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CALIFORNIA NATURAL RESOURCES AGENCY

Clean Transportation Program

FINAL PROJECT REPORT

North Coast Plug-In Electric Vehicle Readiness Project

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Project Partners:

- California State Department of Transportation District 1
- City of Arcata
- City of Eureka
- Humboldt County Association of Governments
- Humboldt State University
- North Coast Unified Air Quality Management District
- Pacific Gas & Electric Company

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PREFACE

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007) created the Clean Transportation Program. The statute authorizes the California Energy Commission (CEC) to develop and deploy alternative and renewable fuels and advanced transportation technologies to help attain the state's climate change policies. Assembly Bill 8 (Perea, Chapter 401, Statutes of 2013) reauthorizes the Clean Transportation Program through January 1, 2024, and specifies that the CEC allocate up to $20 million per year (or up to 20 percent of each fiscal year's funds) in funding for hydrogen station development until at least 100 stations are operational.

The Clean Transportation Program has an annual budget of about $100 million and provides financial support for projects that:

- Reduce California's use and dependence on petroleum transportation fuels and increase the use of alternative and renewable fuels and advanced vehicle technologies.
- Produce sustainable alternative and renewable low-carbon fuels in California.
- Expand alternative fueling infrastructure and fueling stations.
- Improve the efficiency, performance, and market viability of alternative light-, medium-, and heavy-duty vehicle technologies.
- Retrofit medium- and heavy-duty on-road and nonroad vehicle fleets to alternative technologies or fuel use.
- Expand the alternative fueling infrastructure available to existing fleets, public transit, and transportation corridors.
- Establish workforce-training programs and conduct public outreach on the benefits of alternative transportation fuels and vehicle technologies.

To be eligible for funding under the Clean Transportation Program, a project must be consistent with the CEC's annual Clean Transportation Program Investment Plan Update. The CEC issued PON-10-602 to provide funding opportunities under the Clean Transportation Program for California's diverse regions to develop regional plug-in electric vehicle strategic plans to guide the deployment of plug-in electric vehicle supply equipment, establish best practices for "plug-in electric vehicle ready" building and public works guidelines, and help to streamline plug-in electric vehicle supply equipment permitting, installation, and inspection process. In response to PON-10-602, the recipient submitted an application which was proposed for funding in the CEC's notice of proposed awards September 26, 2011 and the agreement was executed as ARV-11-006 on April 4, 2012.

ABSTRACT

The goal of the North Coast Plug-in Electric Vehicle Readiness Project was to develop a readiness plan to support the successful introduction of plug-in electric vehicles and the strategic development of electric vehicle charging infrastructure in the region. Key tasks included the creation of a coordinating council, the development of a methodology for planning and siting electric vehicle charging stations, the development of an infrastructure deployment plan, the development of guidelines to streamline the permitting of electric vehicle charging stations, the development of a plan to promote the adoption of plug-in electric vehicles in fleets, and the development of an education and outreach plan.

It was found that a relatively small number of public charging stations are required to adequately support reasonable penetrations of electric vehicles expected in the next ten years, and this infrastructure can be installed for a modest cost. A unique data-driven methodology was developed for planning and siting a regional charging station network, and this methodology can be effectively applied in other regions. In addition, a unique public ownership model was developed for a regional charging station network, and this model can be used to minimize costs and optimize the electric vehicle charging infrastructure services provided to the public.

Keywords: Plug-in electric vehicles, electric vehicle supply equipment, greenhouse gas reduction, on-peak, permitting, fleet vehicles, incentives, education, outreach, readiness plan, infrastructure, planning, deployment

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EXECUTIVE SUMMARY

The goal of this project was to develop a coordinated effort throughout the North Coast region of California to support the successful introduction of plug-in electric vehicles (PEVs) and the strategic development of charging infrastructure to support PEVs. This was facilitated by creating a Plug-in Electric Vehicle Coordinating Council, developing a regional infrastructure deployment plan, developing guidelines to streamline the permitting of electric vehicle charging stations, developing a plan to accelerate the adoption of PEVs in fleets, and developing an education and outreach program to promote PEV adoption. All this information was ultimately summarized in a North Coast Plug-in Electric Vehicle Readiness Plan.

The Plug-in Electric Vehicle Coordinating Council was composed of a group of community stakeholders who met periodically to provide input and feedback on project activities. One of the key tasks they provided input on was the development of an electric vehicle charging infrastructure deployment plan.

The approach used to develop the infrastructure deployment plan included both a macro-level and a micro-level analysis. The macro-level analysis included the development and use of a computer simulation model to determine the number and type of electric vehicle chargers needed. The micro-level analysis included a rubric to assist municipal planners in siting electric vehicle supply equipment in their communities at the spatial level of a parking lot. These tools were used to develop guidelines for the North Coast region, and the results from this exercise lead directly to the funding and eventual installation of nine new electric vehicle charging stations in the region.

Because PEVs and electric vehicle supply equipment are relatively new to the mass market, planning and building department staff are often unfamiliar with the technology. This can lead to delays and increased costs for permitting of electric vehicle supply equipment installations. To address this, the project team assessed the status of electric vehicle supply equipment permitting within the region, provided a summary of model electric vehicle supply equipment permitting practices outside the region, and developed a plan to streamline electric vehicle supply equipment permitting. This effort included involvement of local permitting officials in an electric vehicle supply equipment permitting workshop.

The project team also worked to promote the adoption of PEVs in local vehicle fleets. A fleet evaluation tool was developed and used to assess opportunities in two municipal fleets. In addition, PEV resources were compiled and made available to fleet operators, and a plan was developed to continue to promote PEVs in fleet applications.

Additional project tasks included the estimation of greenhouse gas emission reductions that could be attributed to the deployment of plug-in electric vehicles in the region and the development of a plan to collect electric vehicle charging data. This latter task will allow the region to assess the success of their charging infrastructure deployment efforts and use this information to inform future activities.

Finally, a wide range of education and outreach materials were developed. This included a PEV promotional brochure, a PEV promotional presentation, a PEV Readiness Plan, a webpage, and

a newsletter. These materials were used during the project term to further education and outreach efforts, and it is expected they will continue to be used in the future.
Key lessons learned during the project included:

- The unique data-driven methodology for planning and siting a regional electric vehicle supply equipment network was effective and can be applied in other regions.
- A relatively small number of public charging stations are needed to support a 2 percent penetration of PEVs in the North Coast Region. This penetration level is expected to be reached in approximately 10 years. This infrastructure can be installed for a modest investment.
- We developed a unique public ownership model for an electric vehicle supply equipment network. In this model local site hosts enter into an agreement with the public entity. The public entity owns, operates, and maintains the electric vehicle supply equipment, and sets the cost of vehicle charging so that it can cover its operating costs. The site host pays nothing and gains marketing and public image benefits. This allows for a network of stations to be installed in an orderly, cost-effective fashion. Station designs and the collection of operating data can 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 and will be used less but are critical to providing required regional connectivity. This ownership model can be used to minimize costs and optimize the electric vehicle supply equipment services provided to the public.
- We estimated that a duty factor for the electric vehicle supply equipment network as low as 10 percent 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.

CHAPTER 1: Introduction

In May of 2011 the California Energy Commission's Alternative and Renewable Fuel and Vehicle Technology Program released a solicitation (PON-10-602) to fund the development of regional plans to help prepare California communities for the rollout of PEVs. The plans were intended to prepare communities for the deployment of PEV charging infrastructure, also known as electric vehicle supply equipment (EVSE), establish best practices for "PEV-ready" building and public works guidelines, and help to streamline PEV EVSE permitting, installation, and inspection processes. In the spring of 2012, the Redwood Coast Energy Authority (RCEA) was awarded a grant to prepare a PEV readiness plan for the North Coast region of California.

Problem Statement

The commercial introduction of PEVs into California communities is just now beginning. The state is poised to be a market leader, and successful development of a robust PEV market will bring numerous environmental, energy security and economic benefits to state residents. 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. Humboldt County is a rural community that is anticipating the rollout of PEVs and is poised to become a rural model for successful PEV market development. What was needed was a coordinated and collaborative effort to plan for and promote PEV market development in Humboldt County and the greater North Coast region. This need was met through the development of a PEV readiness plan for the region.

Goals and Objectives

The goal of this project was to develop a coordinated effort throughout the North Coast region to support the successful introduction of PEVs and the strategic development of charging infrastructure to support PEVs. This was facilitated by meeting the following regional objectives:

- Creation of a Plug-in Electric Vehicle Coordinating Council
- Development of an infrastructure deployment plan
- Streamlining of the permitting and installation process for EVSE
- Efforts to accelerate PEV adoption in vehicle fleets
- Development of an education and outreach program to promote PEV adoption.

Project Metrics

The success of this project was measured based on the degree to which the stated project objectives were fulfilled. A successful project was to demonstrate a high level of involvement from community stakeholders, as well as successful development, adoption and deployment of project plans and activities. In addition, a successful project should result in on-going and expanding efforts to prepare the region for the successful introduction of PEVs. The following specific task-based metrics were used to evaluate project success.

1. The Plug-In Electric Vehicle Coordinating Council will exhibit strong participation amongst its members. Members will attend project meetings and provide input on important project activities. Members will assist with the identification of optimal sites in the community for the deployment of EVSE. Members will help the project team engage key stakeholders in the community, such as planning and building officials, elected officials, auto dealers, business and community leaders, electric utility representatives, and fleet vehicle operators.

2. An infrastructure deployment plan will be developed that identifies the number and location of public PEV charging stations needed throughout the region to efficiently and effectively serve PEV drivers. This effort will lead to the identification of a short list of stations to be deployed in a "phase-one" effort. Preliminary designs and cost estimates will be developed, and willing project hosts will be secured, thereby placing the region in a very favorable position to seek grant funding for station deployment. Ultimate success will include firm commitments for EVSE station deployment.

3. Planning and building officials from local jurisdictions will be engaged in a dialog about ways to streamline the permitting, installation, and inspection of EVSE. Information will be collected and shared to illustrate existing procedures, as well as suggested guidelines for expediting the process.

4. A fleet evaluation tool will be developed and used to examine PEV fleet opportunities for at least two municipal fleets. A fleet adoption plan will be developed and made available to local fleet operators to support them in the evaluation of PEV adoption opportunities.

5. Education and outreach materials will be developed, and activities will be conducted to engage local stakeholders and the public, teach them about PEV opportunities and benefits, and to encourage them to consider adopting PEVs.

Geographic Scope

Three neighboring counties compose the North Coast region: Humboldt (population 134,493), Del Norte (27,873), and Trinity (13,448). These counties are in the far northwest section of California (Figure 1). The North Coast PEV Readiness Project focused its efforts on the Humboldt Bay area of Humboldt County (yellow highlighted area in Figure 1). Most of the North Coast region's population, about 100,000 residents, is centered in the Humboldt

Bay area. The 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 PEV travel on the North Coast will be within this more populated region. In addition, the study examined the level of infrastructure needed to serve the more rural areas of Humboldt County (outside of the Humboldt Bay region), as well as the adjacent counties of Del Norte and Trinity.

Figure 1: The North Coast Region

Source: Adapted from Google Maps by Schatz Energy Research Center, 2014.

Project Team

The core project team was comprised of three local entities with strong credentials in the areas of energy and transportation planning, research, and analysis. This included RCEA as the prime applicant. RCEA 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. RCEA is a public joint powers authority, representing all incorporated cities in Humboldt County, the County of Humboldt, and the Humboldt Bay Municipal Water District. As a joint powers authority, RCEA is governed by a board composed of representatives from each of the jurisdictions and is authorized to plan and implement a sustainable energy vision for the county.

The technical lead for the project was the Schatz Energy Research Center at Humboldt State University. The Schatz Energy Research Center was founded in 1989 with a mission to promote the use of clean and renewable energy resources. The Schatz Energy Research Center has provided local energy planning, analysis, training, and public outreach services for many years. This included working with RCEA to develop both the Energy Element for Humboldt County's General Plan Update and the *RePower Humboldt* strategic plan for renewable energy development in Humboldt County (the latter funded by California Energy Commission Public Interest Energy Research grant PON-08-004).

Gutteridge Haskins & Davey is an international engineering consulting firm with a regional office located Eureka, California.[1] Gutteridge Haskins & Davey provided technical consulting services, with a special focus on EVSE permitting, installation and inspection, engineering, and cost estimating, as well as contributions to the PEV infrastructure deployment plan.

In addition to the core team, key project partners who provided in-kind cost share and staff time included Pacific Gas and Electric Company (the local investor-owned utility) and the cities of Arcata and Eureka. Additional partners included the Humboldt County Association of Governments, the North Coast Unified Air Quality Management District, the California Department of Transportation District 1 Office, and Humboldt State University.

Background

Plug-in Electric Vehicles and Associated Charging Equipment

Plug-in electric vehicles include plug-in hybrid electric vehicles and battery all-electric vehicles. Plug-in hybrid electric vehicles can be driven a certain distance on all-electric power (typically 10 to 40 miles), and then can be driven substantially further (e.g., 200 to 300 miles) in gasoline hybrid-electric mode. Plug-in hybrid electric vehicles can be plugged in to recharge their battery banks. Battery all-electric vehicles can be driven a certain range on all-electric power (typically 70 to 100 miles), and then they must be plugged in and recharged. This study addressed both types of PEVs.

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[1] When the project proposal was developed Winzler and Kelly, a California-based engineering consulting firm, was the third core team member. By the start of the project Winzler and Kelly merged with Gutteridge Haskins & Davey.

The equipment needed to charge PEVs is referred to as electric vehicle supply equipment. EVSE are available at three different power levels that support three rates of charging.

- Level 1 charging provides alternating current to the PEV from a 120-Volt, 20-Amp circuit.
- Level 2 charging provides alternating current electricity to the PEV from a 240-Volt circuit with currents up to 80-Amps.[2]
- Level 3 charging, also referred to as direct current fast charging, provides direct current electricity to the PEV. The alternating current feeder capacity for Level 3 EVSE is typically 480-Volt, 3-phase with currents up to 400-Amps.

Regional Characteristics

The North Coast region is rural, with a population density in the bottom third of California counties. However, Humboldt County boasts a relatively large penetration of hybrid electric vehicles. Already, Humboldt has over 90 PEVs on the road, or 0.07 percent of all registered light duty vehicles in the county. Based on these trends, it is expected that the adoption of PEVs in Humboldt will also be among the fastest in the nation. Del Norte and Trinity Counties together have only about ten PEVs currently on the road.

There is one principal north-south transportation corridor – U.S. Route 101 – connecting Humboldt and Del Norte Counties with the rest of the northern California coast to the south and Oregon to the north. There are two east-west corridors connecting Humboldt and Trinity with the northern Central Valley – California State Routes 36 and 299. Finally, U.S. Route 199 connects Del Norte County to Grants Pass, Oregon.

There are currently eight modern, Level 2 public charging stations for electric vehicles in Humboldt County: one in McKinleyville, one in Arcata, five in Eureka, and one in Redway.[3] Four of these stations belong to the Charge Point Network. Most of these stations are available for public charging 24 hours per day. The exception is chargers located at two auto dealerships that only allow charging during regular business hours.

In March of 2013, the *RePower Humboldt* strategic plan was completed.[4] This plan evaluated opportunities for Humboldt County to meet the majority of its energy needs using local renewable energy resources. The study assessed the economic and greenhouse gas emission impacts associated with various options. One key recommendation was to promote the use of

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[2] Typically, Level 2 charging occurs at 30 Amps; however, up to 80 Amps is allowed under the Society of Automotive Engineers J1772 Standard.

[3] EVSE are categorized by their voltage level and, therefore, the rate at which they can deliver charge to a PEV. Level 2 chargers are 240 Volts and can charge a Leaf in about 6-8 hours. There are additional locations that allow charging from standard 120 Volts of alternating current or 240 Volts of alternating current power outlets. However, to charge at these locations modern PEVs need an adapter to connect to the standard Society of Automotive Engineers J1772 connector.

[4] Schatz Energy Research Center and Redwood Coast Energy Authority. 2012. *RePower Humboldt: A Strategic Plan for Renewable Energy Security and Prosperity*, California Energy Commission. Publication Number: CEC-PIR-08-034.

plug-in electric vehicles. The study showed that adoption of PEVs will be critical to cost-effectively reduce greenhouse gas emissions in the region. The North Coast PEV Readiness Project is an important next step toward promoting PEVs in Humboldt County.

CHAPTER 2: Project Activities and Results

Plug-in Electric Vehicle Coordinating Council

Purpose

The North Coast Plug-in Electric Vehicle Coordinating Council 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 Plug-In Electric Vehicle Coordinating Council 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 Plug-In Electric Vehicle Coordinating Council is coordinated by RCEA. Their mission statement follows.

Mission Statement

The members of the North Coast Plug-In Electric Vehicle Coordinating Council 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 stated goals of the North Coast Plug-In Electric Vehicle Coordinating Council are to:

- Develop regionally specific guidelines for PEV infrastructure deployment.
- Identify optimal locations for regional charging infrastructure at sites including public parking areas, commercial properties, highway corridors, and workplaces.
- Determine investment requirements and implementation timelines to meet the local community's needs as PEV adoption increases.
- Utilize regionally specific planning data and studies, as well as locally customized projections of PEV adoption, to support the optimal, phased deployment of charging infrastructure.
- Develop PEV education and promotion plans on the benefits of PEV adoption.
- Develop strategies to facilitate accelerated PEV adoption in private and public fleets.
- Project energy-cost savings and greenhouse gas emissions reductions from regional PEV use.
- Share lessons-learned and best-practices with other regions, particularly rural regions, for PEV infrastructure permitting, installation, deployment, maintenance, and inspection.

Activities and Accomplishments

The North Coast Council is comprised of 14 members representing the following regional entities:

- Redwood Coast Energy Authority
- County of Humboldt
- City of Arcata
- City of Eureka
- City of Fortuna
- Trinity County Public Utilities District
- Humboldt County Association of Governments
- California Department of Transportation
- North Coast Unified Air Quality Management District
- Blue Lake Rancheria
- Schatz Energy Research Center
- Gutteridge Haskins & Davey
- Ourevolution Energy & Engineering

The North Coast Plug-In Electric Vehicle Coordinating Council met four times during the project term. Meetings were scheduled to solicit input from the Committee on key project activities. The Council provided review and feedback on macro-siting, micro-siting, permit streamlining, and fleet adoption in their respective organizations. In addition, they offered ideas about additional key stakeholders that should be involved in the effort, and they helped connect the project management team with key contacts who could help facilitate project activities. Finally, the North Coast Plug-In Electric Vehicle Coordinating Council developed a funding and sustainability plan that will serve to sustain their efforts beyond the completion of this California Energy Commission grant funded project. Key elements of the funding and sustainability plan are presented below.

- The California Energy Commission grant funding could be critical for the first phase of infrastructure planning and community stakeholder engagement and support.
- Initial grant funding would also assist in ramping up implementation of the planned activities beyond infrastructure.
- Advocating that a portion of Cap & Trade revenue be allocated to regional climate action planning efforts, of which PEV plan implementation would be a key part.
- For long term continuity, pursuing an RCEA-ownership model that will be built around a funding model to sustainably maintain, promote, and expand the regional charging network.

Infrastructure Deployment Plan

A key task in the North Coast PEV Readiness Project was the development of an electric vehicle charging infrastructure deployment plan. The plan includes macro-level (i.e. city or neighborhood level) guidelines for the number and type of electric vehicle chargers needed throughout the region to support a given penetration of electric vehicles. An estimate of infrastructure costs and a plan for a phased rollout over time is also provided.

In addition to the macro-level guidelines, a micro-siting analysis was conducted. This work involved the development of a micro-siting rubric to assist municipal planners in siting EVSE in their communities at the spatial level of a parking lot. In consultation with local jurisdictions, the micro-siting rubric was employed to identify optimal sites for EVSE that are consistent with the macro-level guidelines. In addition, a subset of sites was chosen for detailed analysis. The detailed analysis included preliminary design work and preparation of engineering cost estimates for the highest priority EVSE sites.

Macro-Level EVSE Deployment Plan

The macro-level analysis required that the project team answer a key set of questions.

- How many chargers are needed for a giving penetration of PEVs?
- Where should the chargers be located within the region?
- Should Level 2 chargers or Level 3 chargers (also known as direct current fast chargers) be installed?
- How can the deployment be achieved in a cost-effective manner given limited resources for new infrastructure?

The approach taken was to develop a detailed simulation model called the Plug-In Electric Vehicle Infrastructure (PEVI) model. The PEVI model employed an "agent-based" approach and allowed us to simulate individual PEV drivers traveling throughout the region, to model their behaviors, and to assess their charging needs. This report summarizes the PEVI model development and presents resulting macro-level guidelines.

Model Development

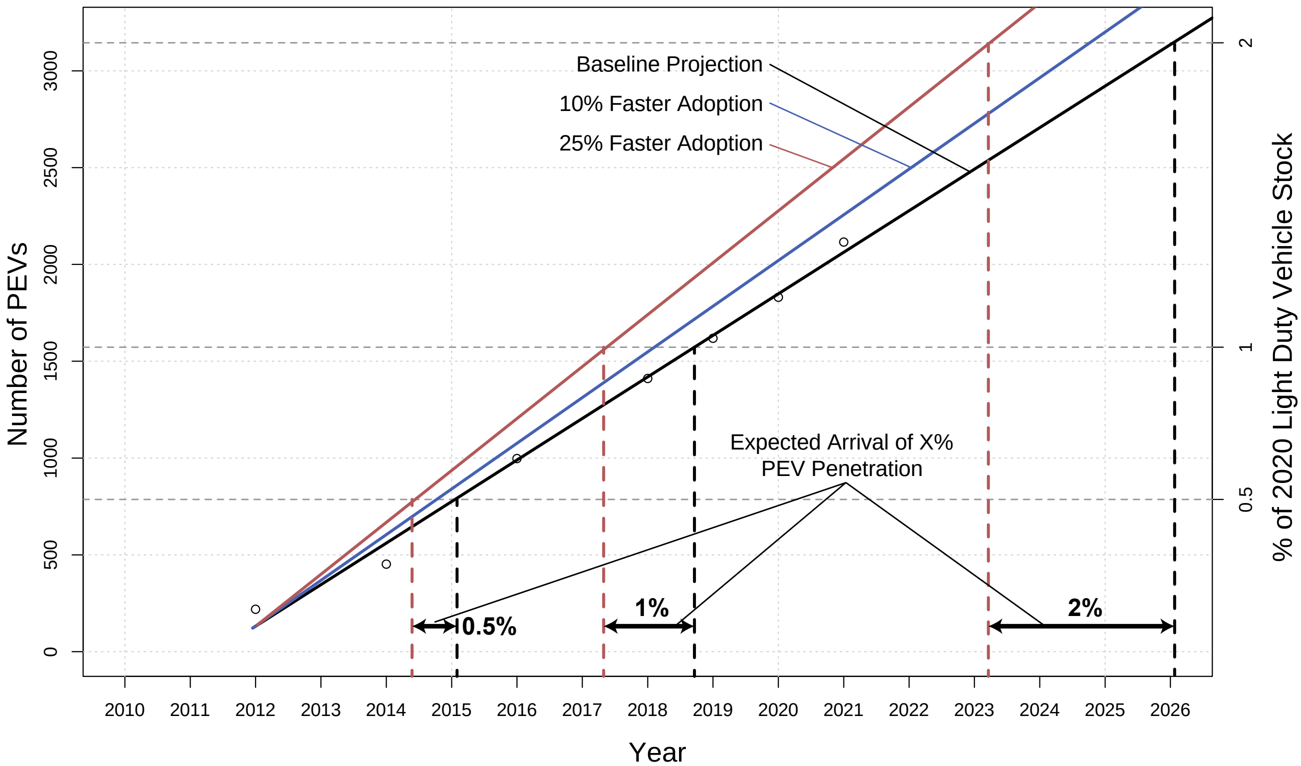
The PEVI model simulates one day of driving and any delays or changes to driver itineraries are tracked. At the end of a model run, the experience of individual drivers can be examined, or the entire run can be summarized by a variety of metrics (e.g., the total number of drivers who experience delay in their itinerary).

PEVI is a stochastic model, meaning that a variety of processes and decisions within the model are based on random chance. The primary purpose of including stochastic processes in PEVI is to avoid reaching conclusions that are overly customized to suit one scenario. Instead, the model is run many times with the same set of initial conditions and the average benefit of a given EVSE infrastructure is calculated.

The results of the PEVI model simulations, like with any model, is highly dependent on the quality of the input data. The project team took great care to use the best available regional data to ensure that the PEVI simulations were as realistic as possible. These data included the following:

- **Transportation Demand Data** - Regional travel demand data are available for Humboldt County in the form of the Greater Eureka Area Travel Model. Staff at California Department of Transportation District 1 furnished travel demand counts from this model to the project team.
- **Travel Analysis Zones** - The Greater Eureka Area Travel Model divides Humboldt County into ~750 travel analysis zones and provides a daily trip count between every pair of zones as well as a count for the morning and evening peaks. The project team aggregated the model's travel analysis zones into 52 larger zones for use in the PEVI model.
- **National Household Travel Survey Data** – We used United States Department of Transportation 2009 National Household Travel Survey data to estimate when trips were made, how long drivers spent at their destinations, and what trips drivers were chained together into a daily tour.
- **PEV Adoption Projections** - The historical adoption of hybrid electric vehicles is the best available indicator for the rate of adoption of PEVs over the next decade. We acquired vehicle registration data for Humboldt County over the decade from 2003-2012 and assumed that PEV penetration in 2012 corresponded to hybrid electric vehicle penetration in 2003 (see Figure 2). Also, the vehicle registration data we obtained for Humboldt County was disaggregated by zip code. This allowed us to analyze the spatial variation in hybrid electric vehicle adoption and use this information as a basis for geographically distributing PEV drivers in the PEVI model.
- **Adoption of Battery All-Electric Vehicles vs. Plug-In Hybrid Electric Vehicles** - The project team modeled a 50 percent / 50 percent split between battery all-electric vehicles and plug-in hybrid electric vehicles in the PEVI model for the base scenario and examined other splits in a sensitivity analysis.
- **Cost of Installing and Using EVSE** – The cost of installing EVSE was based on information found in several recent studies. PEVI cost assumptions for the installed cost of EVSE were Level 1 = $2,000, Level 2 = $6,000, and Level 3 = $50,000. To determine the cost of charging we conducted an economic analysis and chose break-even pricing for a charger that is used 10 percent of the time. This resulted in the following charging costs: Level 1 = $0.20/kilowatt-hour, Level 2 = $0.34/kilowatt-hour, and Level 3 = $0.55/kilowatt-hour.

Figure 2: Projection of PEV Adoption in Humboldt County



Source: Schatz Energy Research Center, 2014.

Macro-Siting Results

Macro-level EVSE deployment guidelines were developed for 0.5 percent, 1 percent, and 2 percent PEV penetrations for Humboldt County. Based on the results of the PEVI modeling analysis we offer the following conclusions:

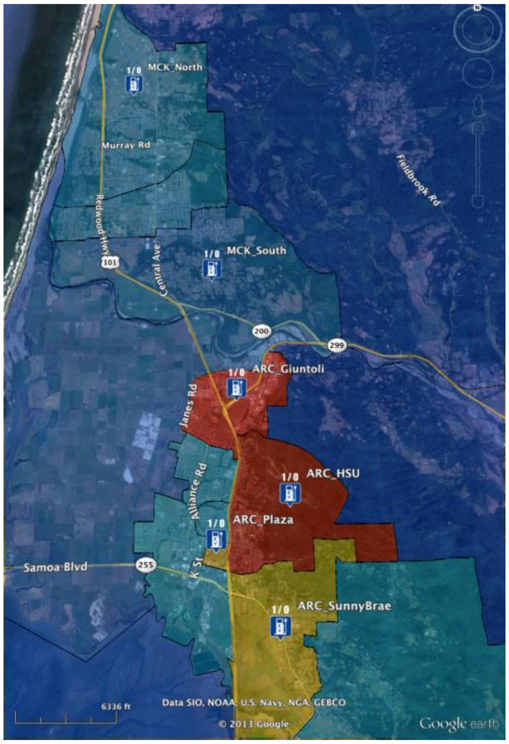
- Overall, relatively few chargers are needed to support many PEV drivers. Approximately 45 chargers are sufficient to support ~3000 drivers in the 2 percent penetration scenario.
- The total cost of the infrastructure needed to support PEV adoption at a 2 percent penetration is reasonable, perhaps as low as about $500,000. This level of capital investment is relatively small compared to the investment required to build a single petrol or hydrogen fueling station. At the same time, the number of drivers that can be serviced in a day by the EVSE infrastructure network is several times higher than a conventional eight-pump service station.
- Level 2 chargers provide a more cost-effective means of supporting PEV drivers than Level 3 chargers. In only one travel analysis zone (Willow Creek) was a Level 3 charger sited. This zone happens to also be ideally situated to promote inter-regional connectivity between Humboldt and Trinity Counties.
- EVSE tends to be sited in and around population centers and major regional corridors.
- Several groups of travel analysis zones show some degree of “substitutability”. In other words, EVSE could be sited in one zone or a neighboring zone and the

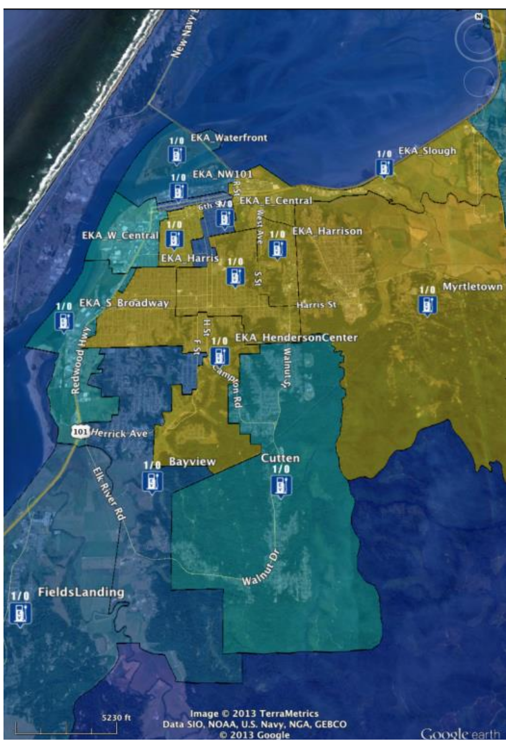
overall impact on PEV drivers will be approximately equivalent if the total need for EVSE in that region is satisfied.

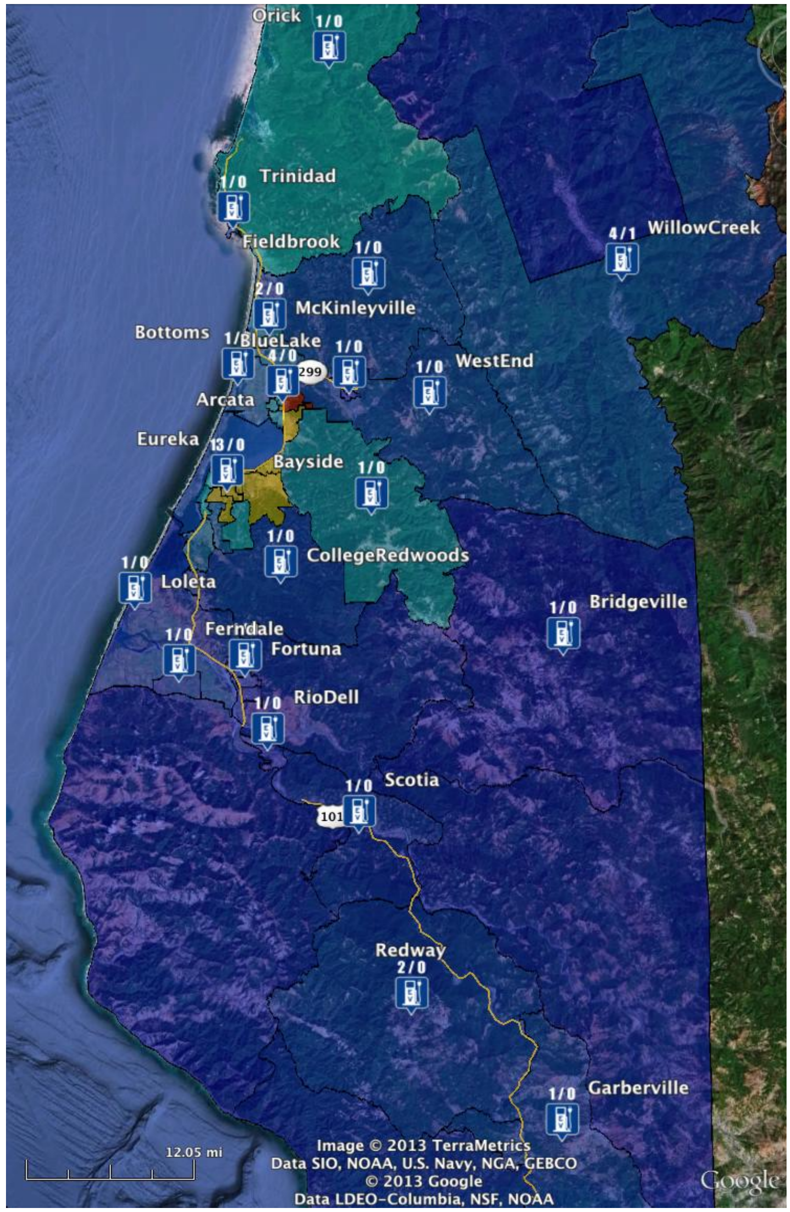
- The first set of installed chargers provides the most benefit to drivers; there are decreasing returns on investment as the infrastructure is built out further.
- As PEV adoption increases, the business case for EVSE owners and operators will become economically viable. Duty factors on average do not fall below ~10 percent and could be as high as ~25 percent as adoption reaches 2 percent. Even a 10 percent duty factor is high enough to warrant a price for electricity that is still competitive with the price of gasoline and diesel fuel for conventional vehicles.

Figure 3 shows the recommended macro-level EVSE deployment guidelines for Humboldt County for a 2 percent PEV penetration targeted for the year 2023. The figure contains three maps: a full map of Humboldt County, a detail of the Cities of Arcata and McKinleyville, and a detail of the City of Eureka. On the maps are icons labeled with the travel analysis name and the number of Level 2 and Level 3 chargers assigned to that zone. The coloring of each zone denotes the intensity of PEV travel demand into and out of that zone over an entire day.

Figure 3: Humboldt County EVSE Deployment Guidelines – 2 Percent Penetration of PEVs







EVSE deployment guidelines for 2% penetration of PEVs (~3000 vehicles) in Humboldt County (top 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 (top left) and Eureka (bottom left).

***EVSE deployment guidelines for 2 percent penetration of PEVs (~3000 vehicles) in Humboldt County (top 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 (top left) and Eureka (bottom left).**

Source: Schatz Energy Research Center, 2014.

EVSE Micro-Siting

The second step of EVSE site identification involved translating the results of the macro-siting analysis into precise on-the-ground locations for charging station installations. The results from the macro-siting analysis were used to set the target number of sites that needed to be identified for each travel analysis zone in Humboldt County and for Del Norte and Trinity Counties in aggregate. With input from the North Coast Plug-In Electric Vehicle Coordinating Council and other stakeholders, a list of candidate sites was developed for each jurisdiction in the study area. A field visit was made to these sites to collect data and then they were evaluated using a micro-siting rubric. Due to the geographic size of the planning area, not all of the candidate sites could be visited and ranked with the rubric. Finally, preliminary designs and cost estimates were developed for a set of high priority sites.

Micro-Siting Rubric

The micro-siting rubric was developed collaboratively by the project team and the North Coast Plug-In Electric Vehicle Coordinating Council and went through multiple revisions before being used for assessing candidate sites. Two pre-screening criteria were first evaluated for each site: 1) is there a willing property owner/host and a willing station operator, and 2) can the site meet Americans with Disabilities Act-accessibility requirements? Following the pre-screening process, each site was evaluated based on a set of weighted criteria. Sites were assigned a weighted score for each criterion, and the scores for all criteria were summed to determine overall site scores. Sites were then ranked according to their scores. Table 1 below shows the criteria and weights that were used in the micro-siting rubric.

Table 1: Micro-Siting Rubric Criteria and Weights

Objective	Final Weighted Score
Close proximity to apparently suitable point of electrical connection	5
Minimal trenching required through paved areas	4.5
Site is highly visible to the public	3.5
Within 0.5 mile of at least 10 Basic Services as per Leadership in Energy and Environmental Design 2009	4
Within 0.5 mile of connection points to other modes of transportation	1.5
Suitable for block of multiple chargers	3
Low risk of public backlash from converting conventional parking spaces	2
Site is well lit without additional dedicated lighting	3
Potential for long duration charge (2 hours or more)	3
Site appears to support workplace & public commerce charging	2
Site appears to be suitable for use by multi-family housing residents	1
Site has the potential to accommodate a safe design that is user friendly	5
Long term control/ownership of site is unlikely to change in next 10 years	3

Source: Gutteridge Haskins & Davey, 2014.

Micro-Siting Results

A total of 100 candidate sites for EVSE were identified in the planning area. Of those 100 sites, 70 were assessed on the ground using the rubric and site owner consultations were initiated on 44. Subsequently, a list of nine highly ranked sites with owners who committed to hosting an EVSE were selected for further evaluation, including development of preliminary site plans and cost estimates. These nine sites, which are shown in Table 2 below, will be shovel-ready upon completion of site-specific project permitting and final engineering work.

Level 2 EVSE is proposed for the nine sites listed in Table 2 as part of the first phase of implementing the North Coast Plug-In Electric Vehicle Charging Network, for which RCEA will act as the non-profit network administrator.

To put these results into context, the macro-siting analysis indicated that for the 2 percent PEV penetration rate, approximately 45 Level 2 EVSE would be needed for Humboldt County, 10 for Del Norte County, and 5 for Trinity County. The macro-siting analysis also indicated that a single Level 3 charger located in Willow Creek, California appeared to be sufficient to meet fast charge needs to support travel within Humboldt County.

A potential Level 3 charging site with a willing owner and an inactive 480 Volt, 3 phase 800-Amp industrial power source was located approximately 0.1 miles from downtown Willow Creek and a preliminary site plan for this location was prepared. For inter-regional travel, additional Level 3 chargers along U.S. Highway 101 and State Route 299 east of Willow Creek would enable connectivity to existing and planned EVSE networks in neighboring rural communities in northern California and southern Oregon. Sites for additional Level 3 chargers were not identified under this Plan.

Note that follow-on grant funding has been secured from the California Energy Commission to install the nine Phase 1 stations shown in Table 2. These stations will be installed in 2014/2015.

Table 2: Nine Stations Recommended for Phase 1 PEV Charging Network

	Location	**Description**
1	Arcata- Creamery District	The Link
2	Eureka- Medical District	St. Joseph Hospital
3	Eureka- Downtown	North Coast Unified Air Quality Management District
4	Fortuna	Parking lot across from City Hall
5	McKinleyville	McKinleyville Shopping Center
6	Ferndale	City Parking on 4th Street
7	Rio Dell	Rio Dell City Hall
8	Trinidad	Trinidad Library/Museum
9	Willow Creek	Bigfoot Museum

Source: Gutteridge Haskins & Davey, 2014.

Plan to Collect Data on Consumer Charging Behavior

Plug-in electric vehicles and their associated charging infrastructure are in their nascent stages of deployment. Consequently, there is uncertainty about how to best deploy EVSE infrastructure, how to best promote PEV adoption, and how to minimize stranded assets. One way to reduce this uncertainty is to collect consumer charge data. Charging network administrators, transportation planners, and State officials can use these data to better understand the need for and use of EVSE by PEV drivers. These data can help planners optimally site new EVSE and help charging network administrators develop better strategies for installing, operating, and maintaining publicly accessible charging infrastructure.

The purpose of this task was to compile information about currently available EVSE and its ability to collect consumer charge data. This information was then used to develop a plan for collecting consumer charging data in the North Coast region.

Review of Available Data Collection Technology

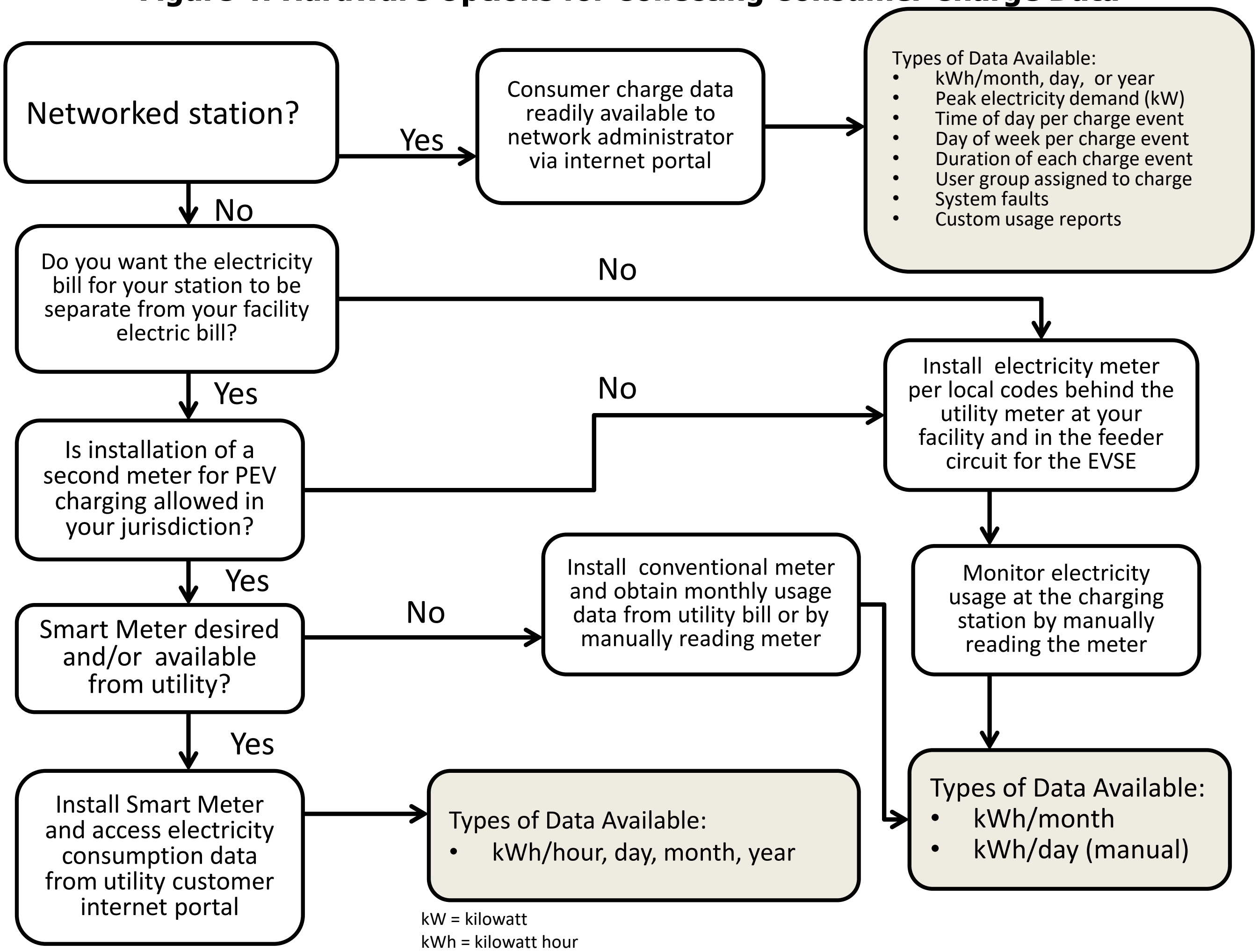
Networked Versus Non-Networked Systems

The technology for collecting consumer charge data is built in too many mass-produced EVSE. A wide range of manufacturers offer *networked* systems that are capable of transmitting and receiving data to and from the internet via cell phone signal. Networked EVSE provide the most convenient means of collecting consumer charge behavior. Networked EVSE allows PEV drivers to readily access charging stations via a service plan, credit card, or a smart phone. Networked systems allow station administrators to manage chargers over the Internet, including set charging costs, monitoring usage, downloading custom reports, and detecting system faults. Networked EVSE facilitates collection and reporting of consumer charge data.

Non-networked EVSE are also available, with the most basic type being a smart relay box, a cord, and a plug configured to charge vehicles for free following safety and communication protocols contained in the Society of Automotive Engineers Standard J1772. In order to monitor usage from this basic type of station, additional metering hardware would need to be installed.

Figure 4 provides an overview of consumer charge data collection options associated with modern EVSE. As can be seen, the most convenient method for collecting consumer charge data is to use networked EVSE. Networked EVSE also provide the highest level of detail about consumer charge behavior because these systems are specially designed for the purpose of remotely monitoring and administering charging station networks.

Figure 4: Hardware Options for Collecting Consumer Charge Data



Source: Gutteridge Haskins & Davey, 2014.

Networked EVSE and Open Charge Point Protocol

Open Charge Point Protocol is a standard that applies to data transfer and communications for EVSE. The Protocol was implemented to address the challenge of interoperability of PEV charging across the diverse landscape of EVSE. EVSE that are Protocol compliant can be accessed by any PEV driver regardless of what charging networks they belong to and what network the EVSE is associated with. The Open Charge Point Protocol 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 Open Charge Point Protocol compliant.

To collect consumer charging behavior data, the EVSE must be supported by a management network. Many manufacturers pair their EVSE with a web-based network for management, monitoring, and control of their charging stations. Charging stations that currently use, or have the option to use, a web-based management network includes AeroVironment, Blink, ChargePoint, ChargePro, ClipperCreek, and Eaton. These EVSE can all be equipped with Open Charge Point Protocol compliant networking features. The network associated with each charging station is listed in Table 3.

Table 3: Charging Station and Associated Management Network

EVSE	**Management Network/Software**
AeroVironment	AeroVironment, Liberty PlugIns
Blink	Blink
ChargePoint	ChargePoint
ChargePro	SemaCharge
Clipper Creek	PowerDash, Liberty PlugIns
Eaton	Sky Network (Greenlots), Liberty PlugIns,
General Electric WattStation	WattStation Connect

Source: Gutteridge Haskins & Davey, 2014.

Networked EVSE allows the owner, host, or even in some cases the local utility company to manage their charging stations. The network is primarily accessible via internet access, but some networks also include smart phone access. On most EVSE networks, access to the web-based network allows an operator to set pricing, manage PEV driver accounts/subscription plans, monitor the station, notify drivers of charge status, troubleshoot problems remotely, produce environmental reports (e.g., greenhouse gas reduction, fossil fuel displacement, etc.), track usage, and export data as available. When a utility company has access to the network, additional management may include assigning shedding groups, demand response, and blackout response.

EVSE Data Access

For public agencies to obtain consumer charge data from independent EVSE owners, it is recommended that the owners sign a Disclosure Agreement with the agency. The agreement would permit the agency, such as RCEA, to periodically access the networked EVSE from a web-terminal and export consumer charge data that does not violate consumer privacy rights.

Other Sources of Relevant Data

Data exported from charging stations represents only a subset of data available for use in analyzing consumer charge behavior. Another set of behavior data could come from consumer outreach. Consumer outreach, in the form of a survey, could complement the data exported from charging stations and could provide added value. For example, a survey might indicate that a majority of consumers want a charging station at a nearby recreation area. This information wouldn't be gleaned from charge data alone. Furthermore, a survey could indicate whether or not a direct current fast charger should be implemented instead of additional Level 2 chargers at a particular location.

Additional charging behavior can also be obtained through vehicle telemetry. Useful telemetry data from a vehicle may include:

- Global Positioning System route information including start and stop times and locations
- Number of trips per day
- Battery state of charge at the beginning and end of trip

These data can provide important insights into how PEVs are used, what their range constraints are, and where additional EVSE infrastructure might be needed. A major hindrance in obtaining telemetry from consumers is that it requires a PEV driver to allow the installation of a telemetry module in his or her electric vehicle, and to allow the release of the driver's data to a third-party. Drivers may be resistant to letting third parties obtain knowledge of their whereabouts. Thus, drivers would need an incentive to be willing to release this information. Also, a Disclosure Agreement would be required to permit the agency to periodically export the driver's vehicle travel data.

Note that some electric vehicle manufacturers have already set up telemetry web-interface systems as optional purchasing features. The telemetry systems allow drivers to monitor their energy usage, check their state of charge, remotely start and stop vehicle charging, track greenhouse gas reductions, and produce usage reports. One example is that Nissan offers an optional telematics service called CARWINGS.

Plan for Data Acquisition

The information presented above was used to develop a recommended rollout plan for collecting consumer charge behavior data. The plan consists of the following elements:

1. Select Open Charge Point Protocol compliant, networked EVSE
2. Distribute a PEV Driver Feedback Survey
3. Create database
4. Update database on a quarterly basis
5. Report out to stakeholders on an annual basis

Selecting Open Charge Point Protocol 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 PEV driver to charge
- Availability (percentage of installed time that station is operational)

These data will allow the network administrator to determine:

- Station utilization

- Frequency of PEVs remaining plugged in after their battery has been completely charged and need for policies to address this behavior
- Frequency of overnight charging
- The relationship between charging price and station utilization
- The reliability of various EVSE
- The prevalence of vandalism in particular locations

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. The types of data that can be collected with a survey include the following:

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

Once the type of EVSE to be purchased has been selected and the consumer survey has been finalized, a database that facilitates analysis and reporting should be developed.

Greenhouse Gas Reduction Estimates

One important objective associated with the promotion of PEVs is the opportunity to reduce greenhouse gas emissions associated with the transportation sector. Statewide the transportation sector accounts for 36 percent of gross greenhouse gas emissions, and in some communities the percentage is even higher. Developing estimates and tracking the greenhouse gas emissions reductions associated with PEVs is therefore quite important. As part of the North Coast PEV Readiness Project we developed a methodology for estimating the greenhouse gas reduction potential associated with PEV adoptions.

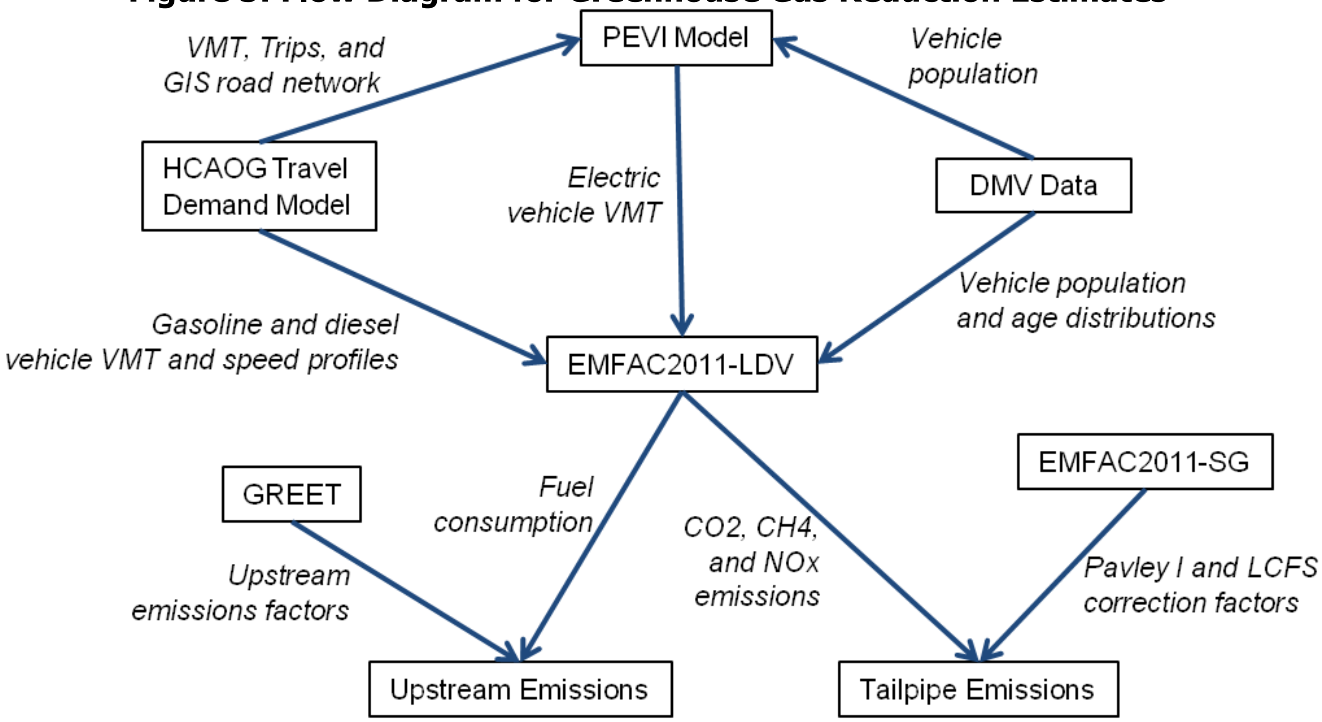
Methodology

Our methodology was to conduct a comprehensive accounting of 2020 baseline light-duty vehicle emissions in Humboldt County using a software tool developed by the California Air Resources Board. We then used the model to simulate the impact of a 1 percent and a 2 percent penetration of PEVs into the overall light-duty vehicle fleet.

A database of County registered vehicles obtained from the Department of Motor Vehicles was used to estimate properties of the total registered vehicle fleet in Humboldt County. These data were combined with data from multiple models to obtain all the required vehicle fleet characteristics. The 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 to obtain vehicle miles traveled estimates. The EMFAC2011-LDV model, part of the EMFAC2011 model suite developed by the California Air Resources Board, 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 California Air Resources Board and part of the same EFCA2011 model suite) 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. Figure 5 outlines the flow of data and the relationship of these different models and data sets.

Figure 5: Flow Diagram for Greenhouse Gas Reduction Estimates



Source: RCEA, 2014.

There were four primary steps in estimating the impact of 1 percent and 2 percent PEV adoption on greenhouse gas emissions. The first step required establishing a baseline vehicle fleet mix for 2020 and the resulting emissions associated with that fleet. The second step involved creating a set of emissions rates from the baseline results to create a new greenhouse gas emission estimate from a different vehicle fleet where a percentage of the baseline fleet is replaced with electric vehicles. The third step involved extracting the emissions estimates of the three primary greenhouse gases from the EMFAC2011-LDV model. The final step looked at upstream fuel emissions for the baseline fleet, as well as the 1 percent and 2 percent PEV adoption fleets.

Results

Table 4 presents the results of the analysis for the baseline case and the two PEV adoption scenarios. All the 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 because the upstream emissions rate, in kilograms of carbon dioxide-per-mile, is essentially the same for gasoline and electric powered vehicles, at least in the Lane Departure Alert 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.

Table 4: Humboldt County Light-Duty Vehicle Greenhouse Gas Emissions for Three PEV Adoption Scenarios

Scenario	Tailpipe Emissions (metric tons of carbon dioxide equivalents/day)	Upstream Emissions (metric tons of carbon dioxide equivalents/day)	Total Emissions (metric tons of carbon dioxide equivalents/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%

Source: RCEA, 2014.

Plan to Mitigate On-Peak PEV Charging

Electric vehicle charging will add load to the electric supply system and, depending on when the charging occurs, could exacerbate peak demand issues. These impacts could affect a utility's system level operations and could also affect customer operations at the site level. Depending on the severity of the impacts, added peak load from PEV charging could require utilities to increase the capacity of particular distribution circuits or otherwise manage peak demands on a constrained system. At the customer level, additional electrical loads during peak periods could result in significant bill impacts or the need for site upgrades. Large bill increases could occur if PEV charging loads were significant and occurred during high priced peak periods or if charging loads were coincident with site peak demands and thereby resulted in increased peak demand charges.

The project team assessed anticipated peak demand impacts associated with PEV charging in the North Coast region. The evaluation included a distribution level peak demand analysis, as well as a site level analysis. The team also examined mitigation measures that could be used to address potential on-peak charging impacts. This section summarizes these project activities.

Distribution Level Peak Demand Analysis

Pacific Gas and Electric Company (PG&E) provided distribution grid infrastructure data and circuit-level load data for 34 circuits in Humboldt County. The period of record for the load data ranged by circuit from two months to five years over the calendar years of 2008 to 2012. Almost all of the data sets contained, at a minimum, the months of November and December of 2012. The load data were analyzed for each circuit and the 20 days with the highest peaks were extracted from the data for subsequent analysis. It is important to note that Humboldt County has little to no cooling load and is a winter peaking region.

The team used the PEVI model to simulate a typical weekday of charging for 3,000 vehicles, or roughly a 2 percent penetration into the Humboldt County light duty vehicle fleet. The PEVI model is spatially distributed, so the PEV charging load was assigned to the appropriate distribution circuit based on the number of customers from a particular circuit (as located by the service-level transformers) who reside within a travel analysis zone from the PEVI model.

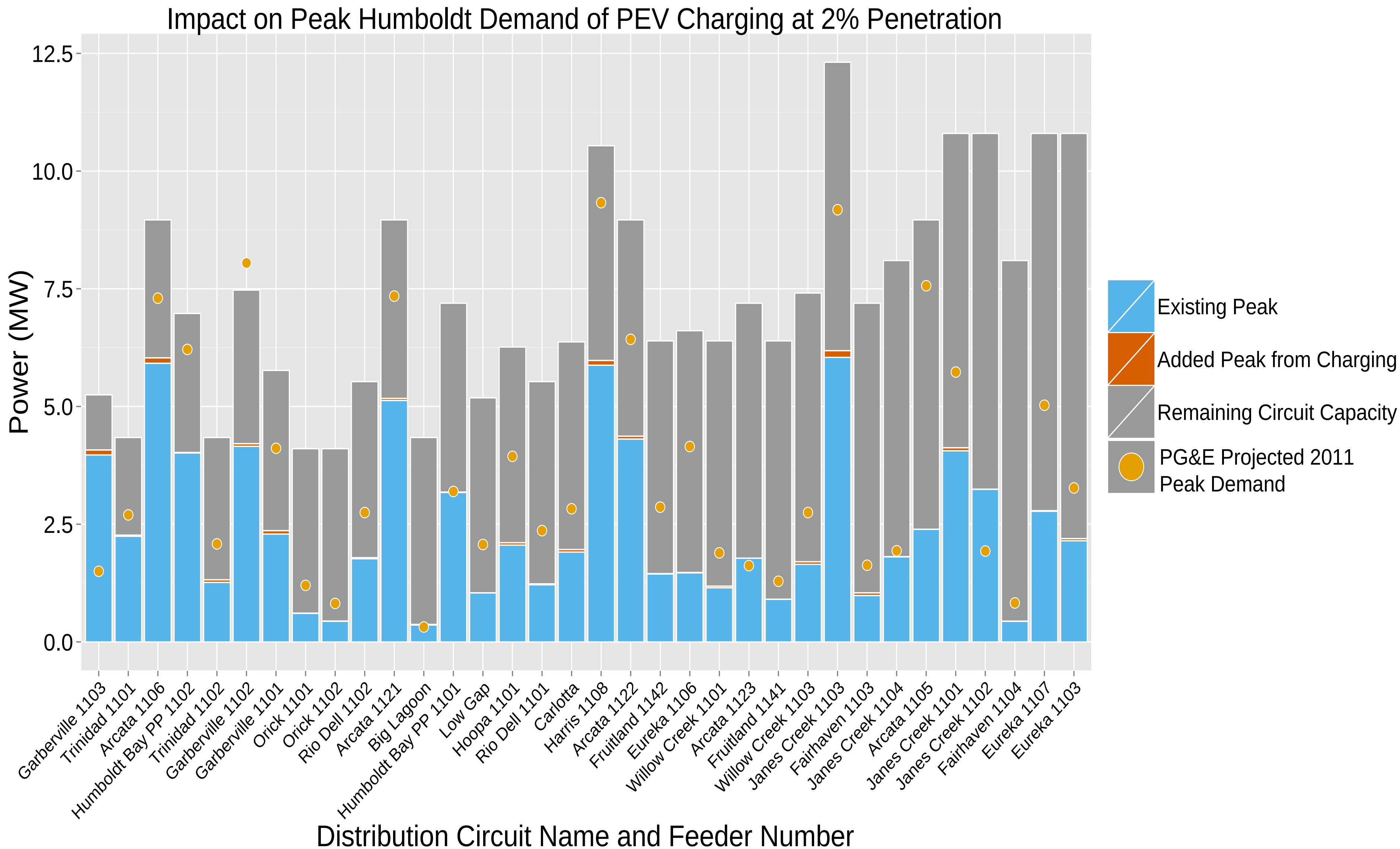
The PEV charging load was resolved to 15-minute intervals to match the load data from PG&E, and the daily load shapes were summed to produce a new load shape that included PEV charging. The distribution level analysis found that even at a 2 percent penetration of PEVs into the light duty vehicle fleet, the increase in peak demand impacts at the distribution level are minor. Table 5 and Figure 6 illustrate the very modest level of impact to PG&E's distribution system. Table 5 shows the mean and maximum impacts to the 34 distribution circuits, and Figure 6 shows the existing peak, added charging peak, and remaining circuit capacity for each circuit.

Table 5: Impact of Charging 3,000 PEVs on 34 Distribution Circuits in Humboldt County

Metric of On-Peak Charging Impact	Mean Value of 34 Circuits	Max Value of 34 Circuits
Increase in Circuit Demand	37 kilowatts	143 kilowatts
Increase in Circuit Peak	1.0%	1.1%
Decrease in Spare Capacity on the Circuit	1.0%	8.5%

Source: Schatz Energy Research Center, 2014.

Figure 6: PEV Charging Peak Demand Impact on 34 Distribution Circuits



Source: Schatz Energy Research Center, 2014.

Site Level Peak Demand Analysis

The site level analysis found that on-peak PEV charging is not a cause of significant concern for utility service planners given the relatively low number of publicly accessible EVSE planned for the region. Site level impacts were explored for the top nine ranked EVSE installations sites (see Table 2). PG&E's service planning department was contacted, and preliminary site and electrical plans were discussed. In all cases, PG&E was comfortable with the proposed installation and did not express concerns about adverse effects from on-peak charging.

PG&E provided guidance as to the best point of electrical connection to their system for each of these EVSE installations. In cases where the electrical service for an existing facility would have to be expanded for the EVSE installation, PG&E will cover the cost of the service upgrade upstream of the customer's meter, and the customer will cover the costs of upgrades downstream of the meter. For cases where a new service is required for the EVSE installation, a cost share arrangement is typical between the customer and PG&E for the new service drop from the nearest transformer with appropriate voltage. The specifics of the cost share arrangement depend on the estimated revenue that PG&E can expect from the new service and is evaluated on a case-by-case basis. In general, the cost share requirements in these cases will comprise a significant portion of the overall cost of the EVSE installation.

Methods for Mitigating or Deterring On-Peak Charging

Mitigation measures for on-peak charging consist of a combination of economic and technical measures. Economic measures include peak period pricing structures that will discourage on-peak charging. PG&E rate schedules include peak period energy pricing and demand charges that make electricity consumption during peak periods more costly. These measures can act to discourage on-peak charging when electricity costs are passed through to the PEV drivers.

For this mechanism to work, however, the network administrator must set up the pricing schedule for the EVSE to correspond to the peak energy and demand charge rate schedules for the site. Modern networked EVSE enable pricing to be set up to vary according to a schedule; however, the amount of effort on the part of the administrator to set up the pricing schedule to mirror PG&E's pricing schedule is not insignificant. In addition, demand charges are difficult to pass through to the PEV driver because they are not incurred until the end of the billing period. Finally, determining whether or not demand charges for PEV charging will be triggered depends on what other loads are present at the host facility at the time of the charging event, and on the customer's overall load profile.

Technical measures to address on-peak charging include load-shedding algorithms available in some EVSE, and onsite renewable energy generation and battery storage systems integrated with EVSE. Certain EVSE, such as the Liberty Plug-In System, provide a means for the charging load to be shed if the utility sends out a curtailment signal. In this case, the PEV driver will not notice that a curtailment event has occurred unless they are denied a consequential amount of energy during the event. Using this technology and specific signaling, the utility can limit the extent to which PEV charging occurs during extreme peak periods. It may also be possible to configure this type of system to shed the PEV charging load if the facility load is nearing the point where demand charges would be incurred.

Another technical solution, offered by electric vehicles for Oregon, is a high power EVSE that is integrated with a photovoltaic system and a 30-kilowatt-hour battery pack. This type of system helps mitigate peak demand because the energy for charging can be provided from the battery pack, and the photovoltaic system can provide renewable energy to recharge the battery pack. These devices can allow the PEV charging load experienced by the electricity grid to be shifted to off-peak periods. Similar systems without a photovoltaic system are also available.

Plan for Mitigating or Deterring On-Peak Charging

Mitigation of on-peak charging impacts in the North Coast region is a low priority due to the lack of a regional summer peak demand. In addition, as this analysis showed, on-peak charging in the region at a 2 percent PEV penetration level will not pose any significant impact. This explains why utilities like PG&E are not currently concerned about the impacts of PEV charging on their distribution systems in the region.

While this lack of peak impact makes a plan for mitigating on-peak charging in the North Coast region a low priority, the following recommendations are still offered for PEV stakeholders in the region. Note that PEV and EVSE technologies are still in their early stages, and new features and capabilities will certainly make their way into the marketplace. As the market evolves it will be important for PEV stakeholders to keep themselves informed.

- Stay informed about PG&E's electric rate options and how they relate to peak charging (time-of-use rates, peak demand charges, rules on second meters, etc.).
- Stay informed about EVSE features regarding pricing schedules and demand response features. Examine how the true costs of PEV charging can be passed through to the consumers who are charging their PEVs.
- Examine methods for dealing with demand charges. What impact does PEV charging have on EVSE host site demand charges? How can demand charges be tracked and then passed through to consumers?
- Stay informed about EVSE systems that incorporate battery storage and/or renewable energy generation as a means to mitigate peak charging impacts.

Plan for Streamlining EVSE Permitting, Installation and Inspection

Because PEVs and EVSE are relatively new to the mass market, planning and building department staff are often unfamiliar with the technology. This can lead to delays and increased costs for permitting of EVSE installations. These delays and increased costs can constitute a barrier to PEV adoption.

The scope of this task was to review the current status of EVSE permitting in the major jurisdictions within the North Coast region, provide a summary of model EVSE permitting practices from communities outside the region, and develop a plan to streamline EVSE permitting in the North Coast region.

Description of General EVSE Permitting Process

The general permitting process associated with EVSE installation involves the steps illustrated in the flowchart below (see Figure 7). As shown, the permitting process starts with the applicant notifying the building department and the local electric utility. The building department will guide the applicant through the process and determine to what extent the planning department needs to be involved. For simple installations, the permit may be issued over the counter without involvement of other entities. More complex, larger scale installations may involve other entities. Building in the coastal zone or other sensitive areas can also increase the regulatory burden.

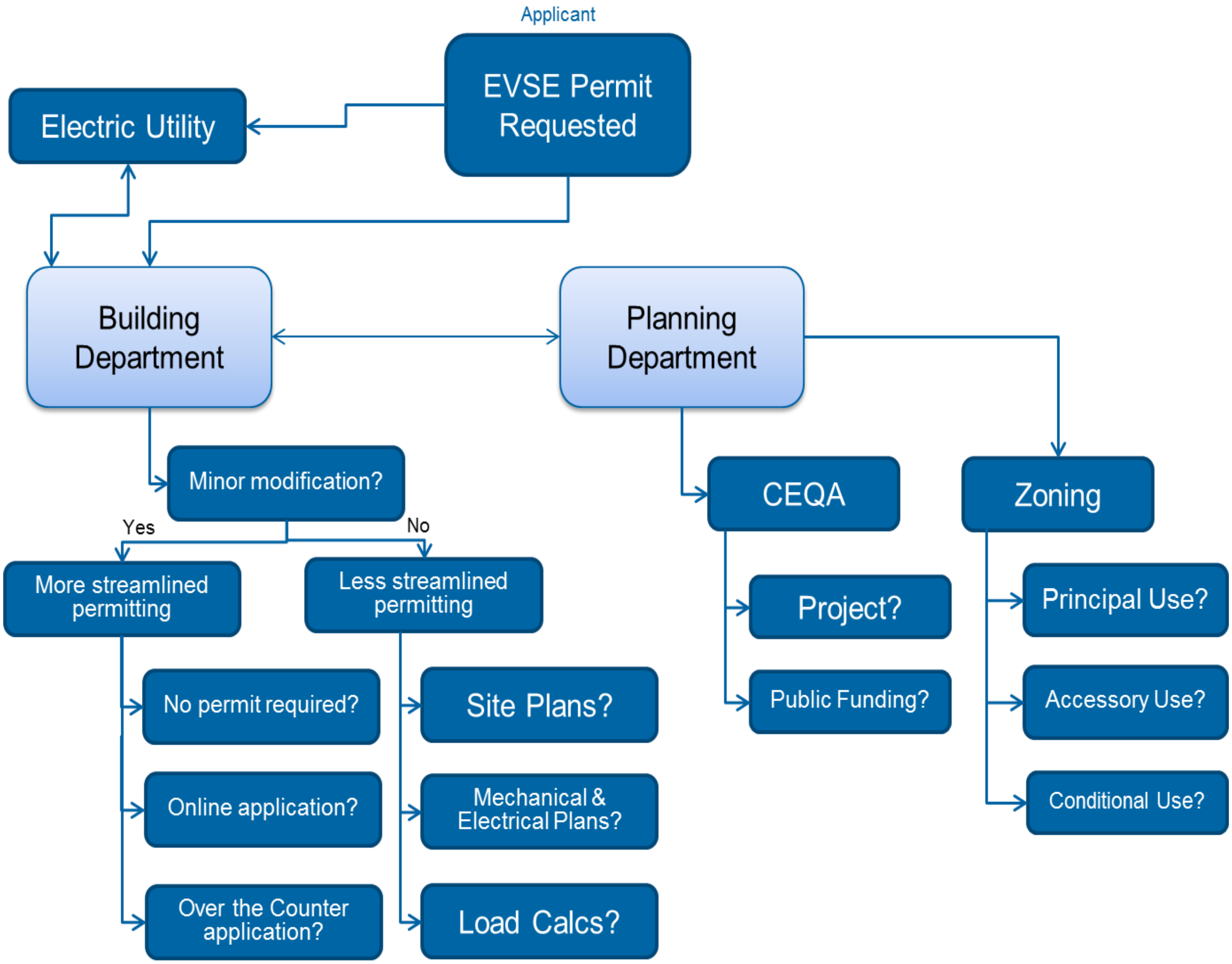
The electric utility will become involved in the permitting process anytime there are modifications required upstream of a given customer's meter to support the EVSE. This can occur when the addition of EVSE at a given facility triggers a need for a service upgrade to accommodate the increased load, or when a new service is requested at a specific location to support the installation of EVSE.

The building department is responsible for issuing a permit for EVSE installation after verification that all applicable requirements have been met. For private commercial and residential installation of Level 1 and Level 2 EVSE, the character of the work is analogous to installing a new electrical outlet. The primary purpose of the permitting process in this case is to verify that the existing electrical service has the capacity to support the additional load.

For publicly accessible Level 2 EVSE, additional considerations can arise, such as land use zoning, environmental impacts of construction, encroachment on required dimensions for sidewalks and parking stalls, accessibility guidelines, and illumination requirements. For Level 3 EVSE, the European Union is typically involved throughout the permitting process due to the intensity and character of the new electrical load.

The planning department will become involved in the EVSE permitting process upon request of the building department. This typically occurs when the proposed installation may cause environmental impacts or conflict with zoning ordinances. The potential for environmental impacts could also trigger a California Environmental Quality Act review.

Figure 7: Permitting Process for EVSE Installation



Source: Gutteridge Haskins & Davey, 2014.

Current Practices for EVSE Permitting in the North Coast Region

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.

Best Practice Examples from Other Communities

There are several communities throughout the United States that have taken steps to streamline their EVSE permitting processes. In some jurisdictions (State of New Jersey, State of Oregon), the installation of EVSE is considered minor work. In other jurisdictions, including Houston, Texas, Los Angeles, California, San Francisco, California, and Charlotte, North Carolina, EVSE installation permits can be obtained over the Internet. In still other communities (Raleigh, North Coast, San Francisco, California, Irvine, California), permits can quickly be obtained over the counter.

In the case where some aspect of the EVSE installation causes the need for a more thorough review, a more involved process involving a plan check is usually required. This process will typically include the following requirements:

- Building permit application
- Site plan
- Electrical plan
- Electrical load calculations
- Inspection

The building permit application is similar to what would be filled out under the online and over the counter permitting scenarios. The site plan will show the property boundary, outlines of structures, locations of existing utilities, dimensions, and location of proposed EVSE and feeder circuit. The electrical plan will include a single line diagram, a panel schedule, load calculations, and a plan showing the circuit layout, conduit and wire size and type, and any details relevant to the installation. Depending on the requirements of a given building department, it may be required to have an appropriately licensed professional prepare the electrical plan for the EVSE installation.

Recommendations for Streamlining EVSE Permitting in the North Coast Region

Based on the information that was collected and reviewed, the follow actions are recommended to streamline the EVSE permitting process in the North Coast region:

1. Include policies to encourage PEV transportation in community planning documents as part of document update cycles.
2. List PEV charging as a permitted use across a broad range of zoning classifications.
3. If a zoning review is triggered, consider the EVSE as an accessory use to another permitted use whenever possible.
4. Develop a standard EVSE permitting process that can be used across the North Coast Region for typical residential installations that meet the following criteria:
    a. EVSE is not accessible to the public
    b. EVSE is located within 25 feet of main electrical panel
    c. Results of load calculation worksheet indicates that the existing main electrical panel for the building is adequate
5. Advertise the standardized process for residential EVSE permits at car dealerships, building department counters, and websites. Allow the standardized process to be completed using an over-the-counter permitting approach.

6. Establish a permit fee structure specifically for EVSE installations, making fees as low as possible for each jurisdiction.
7. Allow second meters for EVSE to enable PEV driver to access lower electric rates for PEV charging.

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

Plan for PEV Adoption in Fleets and Other Incentives

PEV Adoption in Fleets

Vehicle fleets can offer excellent opportunities for the adoption of alternative fuel vehicles, including PEVs. Advantages of fleet applications include fleets are centrally operated and maintained, their usage profiles are typically consistent and well understood, they are housed at and therefore can easily be refueled or recharged at a central location, and their operating costs and total cost of ownership are often tracked and evaluated.

In an effort to promote the adoption of PEVs in local vehicle fleets the project team carried out the following activities: identified fleets in the region, compiled resources for fleet managers, developed a methodology and spreadsheet tool for evaluating PEV fleet opportunities, reached out to local fleet operators, conducted fleet evaluations for two municipal fleets, and prepared a plan to accelerate PEV adoption in fleets.

Fleets in the Region

A list of public and private fleet operators in the region was compiled. Below are the fleet categories that were identified.

- Local government
- Schools / colleges
- State agencies
- Federal agencies
- North Coast tribes
- Private fleets

Resources for Fleet Managers

A listing of resources and tools was compiled that offers important information to fleet operators who are considering adopting PEVs for their fleets. Information compiled includes general information sources, listings of available PEVs, cost and environmental footprint calculators, PEV charging station maps/locators, information on incentives (i.e., tax credits, rebates, grants and California Department of General Services master vehicle contract opportunities), and resources for developing green fleet policies.

Fleet Evaluation Tool

To facilitate the evaluation of PEV adoptions for fleet applications the Plug-In Electric Vehicle Fleet Evaluation Tool was developed. An Excel spreadsheet-based tool, the Plug-In Electric Vehicle Fleet Evaluation Tool 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 lifecycle)
- Avoided downstream tons of carbon dioxide per year

The Plug-In Electric Vehicle Fleet Evaluation Tool can be used to calculate the costs and benefits in a vehicle fleet when replacing conventional internal combustion engine vehicles with PEVs. PEVs can include both battery all-electric vehicles and/or plug-in hybrid electric vehicles. Note that the Plug-In Electric Vehicle Fleet Evaluation Tool model assumes vehicles are being replaced at the end of their useful lives. Therefore, comparisons are between a new conventional internal combustion engine 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.

The Plug-In Electric Vehicle Fleet Evaluation Tool model is initialized with a set of default input data, but users can easily specify their own inputs as desired. Input data for the model includes:

- Average and maximum miles traveled per day
- Average annual mileage
- Percent city driving
- Annual maintenance costs
- Characteristics of the likely conventional replacement vehicle (purchase cost, fuel economy)
- Cost of fuel
- PEV characteristics (range in miles per full charge, efficiency in miles per kilowatt hours)
- PEV purchase cost and expected PEV maintenance costs
- PEV incentives (applicable rebates, tax credits, etc.)

- Estimated installed cost of electric vehicle charging equipment
- Cost of electricity (including time of use aspects and demand charges)

Features of the model 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 utility electric rates for commercial customers, including PG&E, Redding Electric and Pacific Power and Light.
- 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.

Fleet Assessments

Outreach to fleet managers included communications with local municipalities via the North Coast Plug-In Electric Vehicle Coordinating Council. Two municipalities, the Cities of Arcata and Eureka, expressed interest in participating in fleet evaluations. The project team worked with city staff from these two jurisdictions to conduct an evaluation of their fleets and assess opportunities for PEV deployment. Information about PEVs and access to the Plug-In Electric Vehicle Fleet Evaluation Tool was also provided to other local municipalities upon request.

While working with these two municipalities we first helped them assess what vehicle applications might be suitable for PEV adoption. Because the PEV market is in its early stages, there are currently only about 25 light-duty PEVs available, and they are primarily passenger sedans, coupes, and hatchbacks. Because of this limited menu of offerings and because battery all-electric vehicles have limited range, it is important to make sure that available PEVs can meet the requirements of the application being considered. Key pre-screening criteria that should be considered before conducting a full economic analysis include:

- The required vehicle range (miles driven per trip) is compatible with PEV characteristics
- PEVs can meet the needs of the application (i.e., passenger and cargo capacities)
- The vehicle being considered for replacement is to be replaced in the next couple of years
- The vehicle being considered for replacement has relatively high annual miles driven

Following pre-screening efforts, both municipalities identified a set of vehicles to be evaluated. These vehicles were evaluated using the Plug-In Electric Vehicle Fleet Evaluation Tool model, and results showed that in both cases there were multiple cost-effective opportunities for adoption of PEVs.

Plan to Accelerate PEV Adoption in Fleets

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 "North Coast 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 PEV Readiness Project
- Make the Plug-In Electric Vehicle Fleet Evaluation 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

Municipal Activities and Incentives to Promote PEVs

The project team compiled a list of potential incentives that local municipalities, electric utilities and others could offer to individuals, businesses, and organizations in the North Coast region to encourage PEV adoption and retention. These include direct monetary incentives, as well as incentives that can help raise awareness, provide education, deploy community infrastructure, and create community recognition. Local governments and utilities can also lead by example to demonstrate the financial benefits, practicality, and fun associated with driving a PEV. A list of potential incentives follows.

Municipal Incentives

- Provide publicly accessible charging infrastructure
- Provide free charging
- Provide free parking for PEVs
- Encourage PEVs and EVSE as part of a Green Business Certification
- Provide incentives for home and commercial EVSE installation
- Support the continuation of the North Coast Plug-In Electric Vehicle Coordinating Council

Utility Incentives

- Offer rebates for the installation of EVSE
- Provide special rates for PEV charging
- Work to minimize demand charges associated with PEV charging
- Provide customer assistance and support resources
- Provide incentives to include EVSE with solar electric installations

Community Incentives

- Foundations or support groups can offer monetary incentives, install their own EVSE infrastructure, and/or provide expertise, knowledge, support, and experience to other community members.
- Integrate PEV and EVSE promotion policies into community planning (climate action planning, energy committee, historical review, homeowner association, community foundation, business association, etc.).
- Develop economic opportunities around PEVs (like PEV-based travel services, PEV equipment and services, PEV related trainings or events, etc.).

PEV Education and Outreach Activities

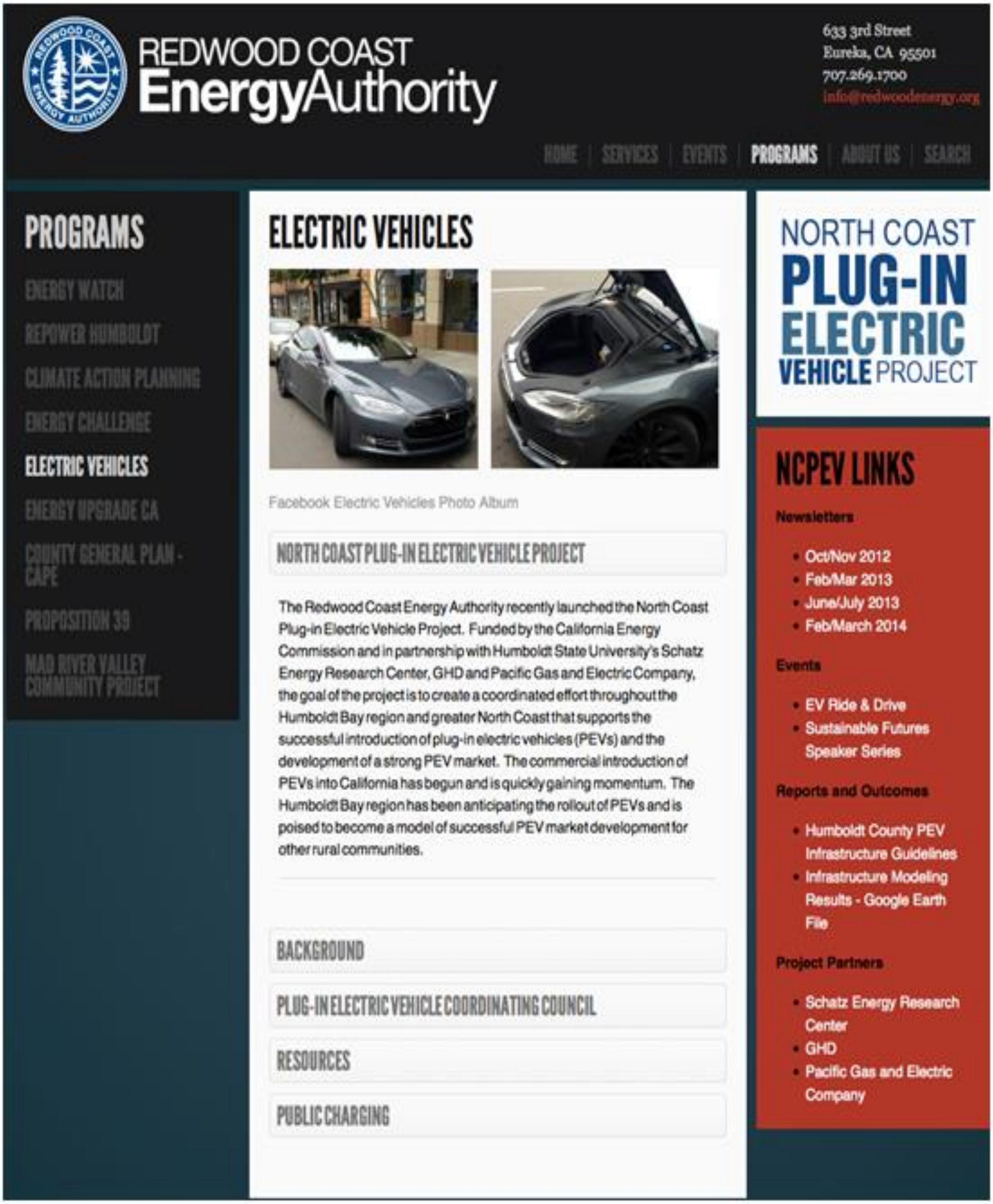
Education and outreach efforts for the North Coast PEV Readiness Project included media-based outreach, such as a newsletter and website, as well as outreach events. In addition, an outreach plan was developed for promoting PEVs in the North Coast region. These activities are briefly described below.

Media-Based Outreach

News and updates about the North Coast PEV project were compiled into a project newsletter, "Powered by Electricity." During the project period four newsletters were produced. The newsletters informed readers about North Coast PEV Readiness Project activities, as well as relevant local, state, and national news related to electric vehicles and associated infrastructure. Newsletters were distributed electronically to the North Coast Plug-In Electric Vehicle Coordinating Council and other citizens and stakeholders who expressed an interest. Newsletters were also made available at the RCEA office and Resource Library, were displayed as take-away collateral at outreach events and were available for download from RCEA's website.

The project team also developed a North Coast PEV Project webpage that was integrated into RCEA's larger website. The webpage provides information about the North Coast PEV Project, information about the Plug-In Electric Vehicle Coordinating Council (including meeting minutes), a list of information resources related to PEVs, and links to charging station locators. Also included on the page are links to project reports and outcomes, as well as updates about current project related events (presentations, PEV ride and drive event, etc.). An image of the web page is shown in Figure 8.

Figure 8: Redwood Coast Energy Authority's North Coast Plug-in Electric Vehicle Project Webpage



Source: RCEA, 2014.

Outreach Events

Numerous outreach events were conducted over the duration of the project. These included presentations to local community groups, tabling at community events, and coordination of two PEV ride and drive events. Below is a brief list of several recent outreach events.

Outreach Events

- Humboldt Electric Vehicle Association Annual Electric Vehicle Show and Pancake Breakfast, April 21, 2013 & April 27, 2014: Local electric vehicle owners and enthusiasts showed off their cars, trucks, scooters, bicycles, and tractors at the Bayside Grange. The North Coast PEV project team was on hand to talk about the North Coast PEV Readiness Project.
- Eureka Natural Foods Earth Day, April 26, 2014: RCEA was on-hand to talk about the North Coast PEV project and coordinated the participation of a local PEV dealer who brought a Chevrolet Volt to this gala community event to celebrate Earth Day.
- Electric Vehicle Ride & Drive, March 15, 2014 & June 19, 2014: Several local dealership representatives provided PEVs to test drive around the Redwood Acres Raceway. RCEA was on-hand to answer questions about readiness planning and promote PEVs. There was a spike in state Clean Vehicle Rebates issued for Humboldt County after the March event.
- Sustainable Living Exposition, June 7, 2014: This event featured a Wheels of Change Auto-Rama that showcased cutting edge automobile technologies.
- Drive the Future Now Event at BMW of Humboldt Bay, June 5, 2014: RCEA presented information about the North Coast PEV project and staff had a chance to test drive the all-electric BMW i3.

Presentations

- Humboldt State University Math Colloquium, September 27, 2012
- Humboldt State University Environmental Systems Seminar, October 1, 2012
- Humboldt State University Sustainable Future Speakers Series, March 13, 2014
- Humboldt State University Math Modeling Class, April 8, 2014

Outreach Plan

The Outreach Plan served as a guide for education and outreach in the North Coast region to engage the community and promote the benefits of plug-in electric vehicles. Education and outreach programs targeted the public, as well as key stakeholders in the community who can create policies to support PEV readiness and adoption.

Project education and outreach programs were boosted by reaching out to other communities and organizations with similar goals and compiling existing education and outreach resources. Entities that were contacted or used as a resource include:

- City of Arcata Energy Committee
- City of Eureka Energy Committee
- Humboldt Electric Vehicle Association
- Local car dealerships
- Numerous companies in the EVSE industry
- Rocky Mountain Institute’s Project Get Ready
- United States Department of Energy
- California Plug-in Electric Vehicle Collaborative
- The Electric Vehicle Project

Partnering organizations and local municipalities of the North Coast PEV project included the Humboldt County Association of Governments, North Coast Unified Air Quality Management District, the City of Eureka, the City of Arcata, PG&E, Schatz Energy Research Center, Gutteridge Haskins & Davey Engineering, California Department of Transportation District 1, and Humboldt State University. Ongoing collaboration was coordinated through the Plug-in Electric Vehicle Coordinating Council and smaller work groups discussed in Section 2.1.2.

Through partnerships and collaboration, the core North Coast PEV project team assisted in developing and implementing diverse education programs that addressed the following sectors: public, local government, emergency first responders, mechanics and electricians, and potential fleet vehicle operators.

Sharing Project Results

The North Coast PEV Readiness Project Team participated in several activities outside of the North Coast region where we shared information about our project and learned about the efforts to promote PEVs in other communities. These activities included giving presentations at meetings, participating in workshops, conferences, or meetings, and participating in organized conference calls. In addition, we provided review and input on the California Statewide Plug-In Electric Vehicle Infrastructure Assessment (CEC-600-2014-003). We also worked closely with the Upstate PEV Readiness Project Team to share lessons learned between our two projects.[5]

[5] The Upstate PEV Readiness Project is a sister project that was also funded under CEC-PON-10-602. The Upstate Region includes Siskiyou, Shasta and Tehama Counties.

Presentations to groups outside of the North Coast Region

- North State Super Region Meeting, Weaverville, CA, April 30, 2014

Participation in Workshops, Meetings, and Conferences

- Statewide PEV Infrastructure Plan Stakeholder Workshop, California Energy Commission, January 30, 2013
- PEV Regional Readiness Coordination Meetings, numerous conference calls (February 27, 2013, etc.)
- Plug-in Electric Vehicle Financing Strategies Workshop, hosted by the Governor's Office, California State Treasurer's Office and the California Plug-in Vehicle Collaborative, February 1, 2013
- Governor's Summit on Zero Emission Vehicles, September 28, 2012
- Second Governor's Summit on Zero Emission Vehicles, March 7, 2014

North Coast PEV Readiness Plan

The final deliverable for this project was to prepare a North Coast PEV Readiness Plan. Figure 9 shows the cover page for the Plan. This Plan summarizes the results of the project and presents information in a user-friendly format that makes it easily accessible to community stakeholders. Stakeholders might include planners, code and permitting officials, economic development folks, elected officials, local and regional government staff, climate mitigation advocates, community groups, regulators, businesspeople, and anyone else in the community who has an interest in plug-in electric vehicles. The North Coast PEV Readiness Plan will be available for download on RCEA's website, and paper copies will be distributed to select stakeholder groups.

Figure 9: Cover Page of North Coast PEV Readiness Plan

Source: RCEA, 2014.

CHAPTER 3: Conclusions and Recommendations

Assessment of Project Success

The North Coast Plug-In Electric Vehicle Readiness Project was very successful in meeting the goals and objectives that were laid out at the start of the project. The project demonstrated a strong level of participation from community stakeholders. The project was successful in developing and adopting infrastructure deployment plans, and RCEA has secured follow-on funding (CEC-PON-13-606) to install the first phase of a network of publicly owned and operated PEV charging stations. The efforts that have been initiated through this project to promote PEV adoption and to develop a regional charging infrastructure network in the North Coast region have been very successful, and it is likely that these efforts will be sustained and expanded moving forward.

The set of bulleted points that follow evaluate project success based on the set of five project metrics that were stated in Project Metrics section in Chapter 1 of this report.

1. The North Coast Plug-In Electric Vehicle Coordinating Council exhibited strong participation. The group was composed of 17 members with representation over a diversity of stakeholder groups. Attendance and participation at Council meetings were good. Members provided input on numerous project tasks, especially regarding the criteria for siting EVSE and recommending locations for installing EVSE. The North Coast Plug members also assisted the project team in contacting other stakeholders in the community such as planning and building officials, elected officials, auto dealers, business and community leaders, electric utility representatives, and fleet vehicle operators.
2. An infrastructure deployment plan was developed that identified the number and location of public PEV charging stations needed throughout the region to cost-effectively meet the needs of PEV drivers. The plan was based on a two-part process that included both a macro-level and a micro-level analysis. The macro-level analysis utilized a data-driven, unique "agent-based" modeling technique to determine where charging stations should be located. This was followed by a micro-level analysis that considered specific on-the-ground details and identified optimal sites for PEV charging stations that had willing site hosts and other suitable characteristics. This effort led to the identification of nine "Phase 1" sites for PEV station deployment. The Energy Commission has provided funding for the installation of PEV stations at these sites and the stations are expected to be installed by the end of 2015.
3. Planning and building officials from the local jurisdictions were engaged in a conversation about permitting requirements for EVSE. Information was collected about current local practices, as well as about "best-practices" from other jurisdictions throughout the country. This information was presented at an "Electric Vehicle 101" workshop. The workshop was attended by several local building officials and there was a lot of constructive dialogs. The results from the workshop were then compiled into a set of regional guidelines to help streamline the permitting, installation, and inspection of EVSE throughout the region.

4. A user-friendly fleet evaluation tool was developed and used to assess PEV fleet opportunities for two municipal fleets. Numerous opportunities were identified for cost effective adoption of PEVs. The results of this effort were compiled into a PEV fleet adoption plan and this plan, along with the fleet evaluation tool, were made available to fleet operators in the region. Moving forward, these materials will be used by RCEA and others to help promote the adoption of PEVs in local fleet applications.
5. A wide range of engaging education and outreach materials were developed. This included a PEV promotional brochure, a PEV promotional presentation, a North Coast PEV Readiness Plan, a webpage, and a periodic newsletter. These materials were used significantly during the project term as part of our education and outreach efforts. In addition, these materials will continue to be used moving forward by RCEA and others to continue to promote the adoption of PEVs in the region.

Conclusions and Lessons Learned

The North Coast Plug-In Electric Vehicle Readiness Project was a success. The goals and objectives that were defined at the start of the project were met. More importantly, the work that was accomplished was just the start of substantial efforts to promote PEVs in the region. The community has been engaged in this process and the efforts begun in this project will certainly continue.

Below is a summary of a few lessons learned during the project.

- The community is receptive to the introduction and adoption of PEVs.
- There is a need for greater PEV options for more diverse applications, such as light trucks, vans, and sports utility vehicles.
- There is a need for more charging infrastructure to meet PEV driver’s needs and expectations.
- Planning and building officials are receptive to EVSE installations.
- We developed a unique data-driven methodology for planning and siting a regional EVSE network. This is an effective methodology that can be applied in other regions.
- A relatively small number of public charging stations (approximately 45) are needed to support a 2 percent penetration of PEVs (approximately 3,000 PEVs) in the North Coast region. This penetration level is expected to be reached in approximately 10 years. This infrastructure can be installed for a modest amount of money.
- We developed a unique public ownership model for an EVSE network. In this model local site hosts enter into an agreement with the public entity. The public entity owns, operates, and maintains the EVSE, and sets the cost of vehicle charging so that it can cover its operating costs. The site host pays nothing and gains marketing and public image benefits. This allows for a network of stations to be installed in an orderly, cost-effective fashion. Station designs and the collection of operating data can 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 can be used to minimize costs and optimize EVSE services provided to the public.

- We estimated that a duty factor for the EVSE network as low as 10 percent 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.

Recommendations

The following recommendations are made for promoting PEVs and other alternative fuel options in the North Coast region.

- Continue to promote PEVs throughout the region.
- Continue to install more EVSE throughout the region based on the infrastructure deployment plan that has been developed. Collect data regarding the use of EVSE infrastructure and assess the results. Use this information to guide future actions and future EVSE deployment.
- Expand efforts to include other alternative fuel vehicles, such as hydrogen and biofuels. This effort has already begun as part of the Northwest California Alternative Fuels Readiness Project. This new project has been funded by the CEC under PON-13-603.

GLOSSARY

CALIFORNIA ENERGY COMMISSION (CEC)—The state agency established by the Warren-Alquist State Energy Resources Conservation and Development Act in 1974 (Public Resources Code, Sections 25000 et seq.) responsible for energy policy. The Energy Commission's five major areas of responsibilities are:

1. Forecasting future statewide energy needs
2. Licensing power plants sufficient to meet those needs
3. Promoting energy conservation and efficiency measures
4. Developing renewable and alternative energy resources, including providing assistance to develop clean transportation fuels
5. Planning for and directing state response to energy emergencies.

ELECTRIC VEHICLE SUPPLY EQUIPMENT (EVSE)—Infrastructure designed to supply power to EVs. EVSE can charge a wide variety of EVs, including BEVs and PHEVs.

PACIFIC GAS AND ELECTRIC COMPANY (PG&E)—An electric and natural gas utility serving the central and northern California region.

PLUG-IN ELECTRIC VEHICLE (PEV)—A general term for any car that runs at least partially on battery power and is recharged from the electricity grid. There are two different types of PEVs to choose from—pure battery electric and plug-in hybrid vehicles.

PLUG-IN ELECTRIC VEHICLE INFRASTRUCTURE (PEVI) MODEL—A model that stimulates the interaction between a regional fleet of plug-in electric vehicles with public and private charging infrastructure over any time frame. The model is intended to be used as a tool for analyzing the impacts of alternative electric vehicle supply equipment infrastructure scenarios in addition to plug-in electric vehicle adoption rates, technology advances, market trends, and driver behaviors.

REDWOOD COAST ENERGY AUTHORITY (RCEA)—The Redwood Coast Energy Authority develops and implements sustainable energy initiatives that reduce energy demand, increase energy efficiency, and advance the use of clean, efficient, and renewable resources.