



**CALIFORNIA  
ENERGY COMMISSION**



California Energy Commission  
Clean Transportation Program

## **FINAL PROJECT REPORT**

# **Solano Electric Vehicle Transition Program**

**Prepared for: California Energy Commission**

**Prepared by: Solano Transportation Authority**

**Gavin Newsom, Governor**

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# California Energy Commission

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# PREFACE

Assembly Bill 118 (Núñez, Chapter 750, Statutes of 2007) created the Clean Transportation Program, formerly known as the Alternative and Renewable Fuel and Vehicle Technology 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-14-607 to provide funding to support new and existing planning efforts for plug-in electric vehicles and fuel cell electric vehicles. In response to PON-14-607, the recipient submitted an application which was proposed for funding in the CEC's notice of proposed awards March 17, 2015 and the agreement was executed as ARV-14-059 on June 13, 2015.

# ABSTRACT

The Solano Transportation Authority created the Solano Electric Vehicle Transition Program to implement, identify, and overcome barriers to the deployment of electric vehicles in the Solano County region. Currently, many processes related to the permitting and installation of electric vehicle charging infrastructure are on an ad-hoc basis and there are few coordinated efforts among Solano County's seven cities, and the County of Solano. As electric vehicle use increases in California, this program aims to address these issues and improve the county's readiness to adopt electric vehicles. The Solano Electric Vehicle Transition Program identified five tasks to guide their project: streamline permitting and inspection for electric vehicle charging stations and improve installation process, analyze potential locations for electric vehicle charging infrastructure, install trailblazer signage for plug-in vehicles, conduct electric vehicle awareness activities, and conduct training sessions for city governments.

Several challenges were identified throughout the course of this program, including issues with streamlining permitting and inspection fees related to electric vehicles; pooling resources due to liability issues among individual cities in the Solano County region; adjusting permitting and inspection guidelines to reflect conditions that are specific to certain cities; accounting for site specific commercial installations that make providing permitting checklists and standardized fees more challenging; and general unfamiliarity among some installers and city, county, and utility representatives with electric vehicle supply equipment installations that may lead to delayed projects or misapplied codes.

In response to these challenges, the Solano Transportation Authority generated several recommendations to assist local jurisdictions in Solano County to develop a best practices for electric vehicle supply equipment permitting and inspection, including implementing a method for online submission, review, and modification of project drawings and plans; adopting a "standard" checklist while allowing modifications for city-specific concerns; and creating an online jurisdiction map that installers can easily reference.

**Keywords:** Solano Transportation Authority, Electric Vehicle Readiness, permitting, electric vehicle charging station, direct current fast charge

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# TABLE OF CONTENTS

	Page
Acknowledgements .....	i
Preface.....	ii
Abstract .....	iii
Table of Contents.....	v
List of Figures.....	v
List of Tables.....	vi
Executive Summary.....	1
CHAPTER 1: Introduction .....	3
CHAPTER 2: Permitting & Inspection Streamlining .....	5
2.1 Current Practices .....	5
2.2 Improving EV Charging Station Installation Process .....	5
2.3 Interviewing Charging Station Installers.....	6
2.4 Installation and Permitting Checklist Template .....	6
2.5 Solano EVSE Permitting Roundtable.....	7
2.6 Challenges and Recommendations.....	8
CHAPTER 3: Plug-In Electric Vehicle Awareness Activities .....	10
3.1 EV Ride & Drive Events .....	10
3.2 SolanoEV.org .....	11
CHAPTER 4: Charging Infrastructure Siting Analysis.....	12
4.1 Regional Corridor Network Analysis .....	12
4.2 Local Charging Infrastructure Analysis .....	15
4.3 EV Trailblazing Signage.....	16
CHAPTER 5: Summary of Recommendations and Potential Next Steps .....	18
Glossary .....	20
APPENDIX A: Permitting and Inspection Checklist .....	A-1
APPENDIX B: EV Fact Sheet.....	B-1

## LIST OF FIGURES

	Page
Figure 1: Presenting on the Solano EV Transition Program at the EVSE Permitting Roundtable .....	8
Figure 2: Consumers Test Out EVs at the Ride & Drive Event .....	10
Figure 3: Screenshot of the Home Page for SolanoEV.org.....	11

Figure 4: Estimated Distribution of Impact that EVSE Installations in Fairfield/Suisun Would Have on EV Adoption by Solano Commuters ..... 16

Figure 5: Example EV Trailblazing Sign ..... 17

## **LIST OF TABLES**

	Page
Table 1: Energy (in Kilowatt-Hours) Required to Complete Trips Between Regional Network Locations.....	13
Table 2: Charging Times (in Minutes) to Complete a Trip Between Regional Network Locations, and Networks That Require DC Fast Charger to Complete .....	14



# EXECUTIVE SUMMARY

The California Energy Commission awarded a grant to the Solano Transportation Authority to implement the Solano Electric Vehicle Transition Program. The program's objective is to implement solutions to improve Solano County's readiness to deploy electric vehicles. The project was designed to create a regional guidance tailored to Solano County and implement a variety of steps to improve the county's electric vehicle readiness.

The program had the following high-level goals:

- Streamline permitting and inspection for electric vehicle charging stations and improve installation practice
- Analysis of potential locations for electric vehicle charging infrastructure
- Installation of trailblazer signage for plug-in electric vehicles
- Electric vehicle awareness activities
- Conduct training sessions for city governments

The market growth of electric vehicles is a critical component of California's strategy to mitigate increases in the emissions of greenhouse gas. By taking critical steps to streamline the process of electric vehicle adoption among Solano County residents, the Solano Electric Vehicle Transition Program stands as an example of local and regional governments engaging the community and implementing readiness steps.

On April 11, 2018, the full report for the Solano Electric Vehicle Transition Program was taken to the Solano Transportation Authority's Board for consideration and adoption. This report will support the Solano Transportation Authority in furthering goals to support electric vehicle adoption and implement the associated infrastructure.



# CHAPTER 1:

## Introduction

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The Solano Electric Vehicle Transition Program’s purpose is to identify and overcome barriers to the deployment of electric vehicles (EV) in Solano County. Currently, many processes related to the permitting and installation of EV charging infrastructure are on an ad-hoc basis and little coordinated efforts exist among Solano County’s seven cities, and the County of Solano. As EV adoption increases across California, the Solano EV Transition Program seeks to address these issues and improve the county’s readiness to adopt EVs.

Governor Brown recently issued an Executive Order that directs California to work towards a goal of putting over 5 million zero emission vehicles on California’s roads by 2030, in tandem with an eight-year initiative to invest \$2.5 billion in state funding towards clean air vehicles and their associated infrastructure. However, the Governor’s Office also notes in a summary of planned investments for zero emission vehicles that charging infrastructure continues to be one of the greatest barriers to widespread zero emission vehicle adoption.<sup>1</sup> It is the goal of the Solano EV Transition Program that its activities would help to prepare Solano County for widespread zero emission vehicle adoption.

The Solano EV Transition Program has five high level tasks that guided the work of this program.

- **Streamline permitting and inspection for electric vehicle charging stations and improve installation process**

The goal of this task is to harmonize practices in the county related to permitting and inspection of charging equipment installations. A common online resource was prepared for cities in Solano County, including guidance documentation. Case studies of streamlined procedures was investigated. A workshop or similar event on permitting for local permitting officials was conducted.

- **Analyze potential locations for electric vehicle charging infrastructure**

Based on critical factors such as market assessments and vehicle utility, potential locations for charging infrastructure were identified. A local level plan for Level 2 infrastructure and regional level direct current (DC) fast charging infrastructure was prepared.

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<sup>1</sup> [California Budget Summary: Climate Change](http://www.ebudget.ca.gov/2018-19/pdf/BudgetSummary/ClimateChange.pdf). Available at (<http://www.ebudget.ca.gov/2018-19/pdf/BudgetSummary/ClimateChange.pdf>).

- **Install trailblazer signage for plug-in vehicles**

Best practices for the location and installation of street-level signage for plug-in electric vehicles were identified. Installation of the signs is to be carried out by the Solano Transportation Authority in coordination with local cities.

- **Conduct electric vehicle awareness activities**

To build awareness and demand for EVs in Solano County, two electric vehicle showcases were organized, hosted, and completed for audiences of at least 100 people with a ride-and-drive opportunity. A website dedicated to EV for Solano County was tailor-designed and implemented.

- **Conduct training sessions for city governments**

An event was conducted for interested city officials to offer updates on the project, discuss permitting processes, and information about opportunities for investments in the county on charging infrastructure.

Solano Transportation Authority contracted with ICF International and Fehr and Peers to conduct the work on this program. ICF International assisted in all tasks of the program and brought their expertise on zero emission vehicles to the table. Fehr and Peers assisted with the trailblazing signage task by analyzing and proposing potential sign locations, as well as sign and mounting specifications.

# CHAPTER 2:

## Permitting & Inspection Streamlining

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### 2.1 Current Practices

Each Solano County jurisdiction has its own process for permitting EV charging station projects. Jurisdictions require some or all of the following:

- Permit application
- Plan for installation
- Electrical load calculation
- Permit and inspection fee
- Inspection

Requirements vary by jurisdiction and are dependent on the project type. Single family residential installations are less likely to have additional requirements, while commercial or public charging stations may be more complex and require more contact with the permitting office. Additionally, permitting and inspection fees vary widely. Most jurisdictions do not charge a fixed fee for EV charger installation projects, and some fees may depend on the project size or value. For example, the City of Vallejo charges for an electrical inspection the equivalent of 20 percent of the fee of the building inspection that would apply to that building.<sup>2</sup>

The objective of this section is to identify gaps in the process of electric vehicle charging station installation permitting and inspection in Solano County and to identify best practices that could be considered for adoption by local governments in Solano County.

### 2.2 Improving EV Charging Station Installation Process

In order to start developing recommendations for streamlining the process to permit and install an EV charging station, the Solano Transportation Authority and ICF International contacted a diversity of location types – public, workplace, multi-unit dwellings, and cities, that have previously installed EV charging stations to discuss their experiences. Despite some turnover and use of third parties to install the stations among contacted companies and agencies, ICF International talked to several stakeholders, and interviewed a representative from one of them, including the Wiseman Company. This interview serves as a case study of a successful EV charging station installation at a workplace site.

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<sup>2</sup> City of Vallejo, California. [Master Fee Schedule Fiscal Year 2020-2021](http://www.ci.vallejo.ca.us/common/pages/DisplayFile.aspx?itemId=80108). Available at (<http://www.ci.vallejo.ca.us/common/pages/DisplayFile.aspx?itemId=80108>).

## 2.3 Interviewing Charging Station Installers

In order to provide more insight into potential avenues to streamline EV charging station permitting and installation, after contacting stakeholders who have installed EV charging station, the Solano Transportation Authority and ICF International contacted companies which perform EV charging station installations. These companies have firsthand experience in the installation process, including applying for permits and inspections. The following themes and messages resulted from this outreach:

- Inconsistent requirements between jurisdictions – nearly all contractors expressed frustration with the difference of permitting and inspection requirements across all jurisdictions
- Local government staff experience – multiple respondents found that many permitting, and inspection staff did not have experience with EVSE installations
- Inspections – costly in terms of time and resources
- Plans and load calculations – some jurisdictions require plans even though most contractors believe they are not necessary for simple residential installations
- Permitting cost – costs range widely between local governments, and sometimes depend on the value of the project
- Jurisdictional boundaries – sometimes unclear under which jurisdiction a project falls, which can result in confusion as to the applicable requirements
- Utilities – some mentioned that utilities can be a significant holdup in cases where panel upgrades are required

## 2.4 Installation and Permitting Checklist Template

Reaching out to stakeholders who have installed electric vehicle supply equipment (EVSEs) at their property or are involved in installing EVSEs allowed the Solano Transportation Authority to better understand the challenges the permitting and installation process brings. These conversations are what would form the basis for the next step; developing a recommended permitting checklist. Prior to completing this task, however, ICF researched best practices within the industry and noted recommendations that could apply to Solano County. One of note is the passage of Assembly Bill 1236, which requires jurisdictions to adopt ordinances that expedite the permitting process for EV charging stations.<sup>3</sup> Jurisdictions with populations over 200,000 were required to comply by September 13, 2016, while all others were given a deadline of September 30, 2017. One of the requirements of the bill, among others, is the requirement to provide a permitting checklist that clearly outlines the steps that must be taken to acquire a permit for installing an EVSE. Many organizations, such as California Building Officials, have provided sample checklists for jurisdictions. Building off of this idea, and incorporating feedback from Solano County's jurisdictions, the Solano Transportation Authority

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<sup>3</sup> Full text of [California Assembly Bill 1236](https://leginfo.ca.gov/faces/billTextClient.xhtml?bill_id=201520160AB1236) is available at (https://leginfo.ca.gov/faces/billTextClient.xhtml?bill\_id=201520160AB1236).

and ICF International developed an installation and permitting checklist template for local jurisdictions to tailor and adopt. It also builds off the experiences of the County of Solano, which as the only jurisdiction in Solano County over 200,000, was the first to comply with Assembly Bill 1236. The checklist can be found in Appendix A and serves as an example to assist Solano County's jurisdictions in adopting streamlined approaches to permitting and inspecting EVSE installation. The guidelines can be adapted to fit local needs. This checklist also addresses many of the concerns raised during the outreach portion of this effort in which the Solano Transportation Authority and ICF International talked to site hosts and EVSE installers. A copy of the permitting checklist can also be found at the [Solano Electric Vehicle](http://www.solanoev.org) website ([www.solanoev.org](http://www.solanoev.org)).

## **2.5 Solano EVSE Permitting Roundtable**

In an effort to engage local jurisdictions and hold conversations about EVSE permitting, the Solano Transportation Authority hosted an EVSE Permitting Roundtable on November 14, 2017 in which all of Solano County's jurisdictions were invited to come and hold inter-jurisdictional conversations related to the installation of EVSE (Figure 1). The purpose of this effort was to increase communication between jurisdictions on the subject of EVSE, share ideas on ways to coordinate, and discuss upcoming opportunities in EVSE deployment. The Solano Transportation Authority and ICF International were able to secure guest speakers from the Sacramento Municipal Utility District, and Pacific Gas and Electric.

The attendance at this roundtable was lower than expected, with four Solano County jurisdictions represented. However, the conversations were fluid and lots of information was shared on current permitting practices, opportunities to fund EV infrastructure, and potential avenues for coordination. The permitting checklist was shared with all attending jurisdictions to be shared with others within their departments.

**Figure 1: Presenting on the Solano EV Transition Program at the EVSE Permitting Roundtable**



Source: Solano Transportation Authority

## **2.6 Challenges and Recommendations**

Based on review of existing local permitting and inspection processes and interviews with site hosts and installers, the Solano Transportation Authority and ICF International identified a number of key challenges that limit or slow the deployment of infrastructure.

- Permitting and inspection fees are set by city councils, and thus establishing a harmonic flat fee across all jurisdictions would be challenging
- Cities are concerned with liabilities from their permitting/inspection processes, and this may hinder to some extent efforts to pooling resources
- Permitting and inspection guidelines need to account for any conditions that are specific to any given city; for example, in Benicia there are concerns about flooding in certain areas
- Commercial (i.e., non-residential) installations are very site and project specific, making some efforts to streamline, such as providing permitting checklists and standardized fees more challenging
- Some installers and city, county, and utility representatives are not familiar with EVSE installations and may misapply codes and/or delay projects; also, some offices are understaffed, slowing the approval process



Based on these challenges, the following recommendations were put forth to assist local jurisdictions in Solano County to develop a set of practicable best practices for EVSE permitting and inspection.

- Implement method for online submission, review, and modification of project drawings and plans
- Adopt a “standard” checklist for all jurisdictions in Solano County while allowing modifications for city-specific concerns
- Implement a program for simple residential installations with city staff conducting sample inspections to ensure compliance; for example, the State of Oregon has administered its Minor Label Program since 2010<sup>4</sup>
- Create an online jurisdiction map that installers can easily reference
- Train permitting and inspection staff to familiarize with EVSE installation
- For single-family residential installations, remove the site plan requirements

Additionally, the following practices can help jurisdictions increase efficiency while meeting standards and state requirements:

- Prepare combined informational materials providing all guidance on the permitting and inspection processes specific for residential, multi-family dwelling, and non-residential charging equipment installations
- Prepare all guidance, include permitting and inspection checklist, and application materials for online submission to meet state law requirements
- Work with other local governments to make permitting and inspection procedures consistent between jurisdictions by using the Trade Union Coordinated Committee proposed guidelines or other agreed upon standards
- Consider streamlining permitting for installations in single-family homes by reducing application material requirements; for example, eliminate site plan requirements and require installer to provide manufacturer specifications and approved equipment testing certification at the time of inspection, limit to one inspection, and set a fixed fee
- Work with local utilities to create a notification protocol for new charging equipment through the permitting process
- Train permitting and inspection officials in EV charging equipment installation

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<sup>4</sup> State of Oregon. [Minor Label Program](http://www.oregon.gov/bcd/minlab/pages/index.aspx). (<http://www.oregon.gov/bcd/minlab/pages/index.aspx>).

# CHAPTER 3:

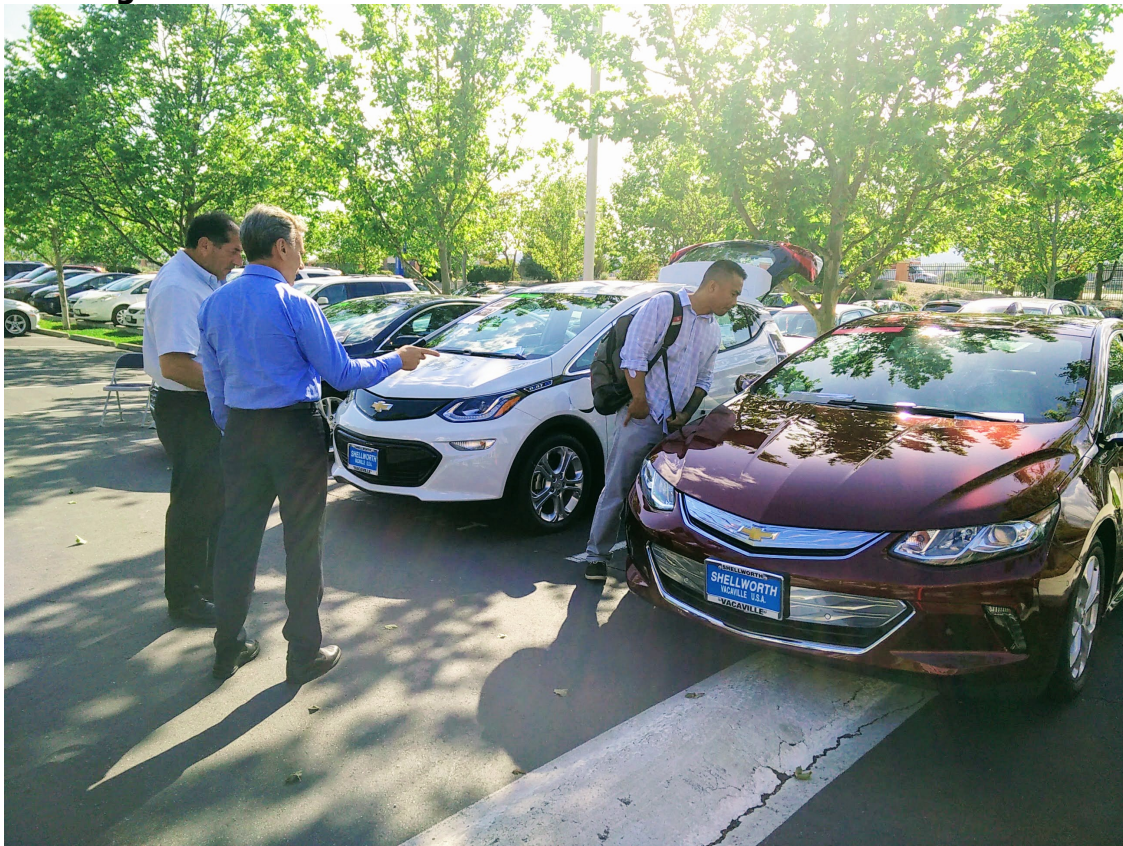
## Plug-In Electric Vehicle Awareness Activities

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### 3.1 EV Ride & Drive Events

In order to expose the public to the benefits of owning an EV, the Solano Transportation Authority hosted two Ride and Drive Events around Earth Day 2017 at two local companies: Genentech and Kaiser Permanente, both in Vacaville (Figure 2). Ride and drive events are considered an important tool to support EV market adoption, as they expose consumers to the technology and increase awareness. At both events, attendees were asked to fill out an “Electric Vehicle Experience Survey” to assess their experience and impressions of electric vehicle prior to and following their interaction with the vehicles at these events. The Solano Transportation Authority developed an electrical vehicle fact sheet for these events as an outreach tool (Appendix B).

**Figure 2: Consumers Test Out EVs at the Ride & Drive Event**



Source: Solano Transportation Authority

The Solano Transportation Authority held its first event on April 19, 2017 at Genentech in Vacaville, California. The event allowed Genentech employees to get firsthand experience with the Nissan LEAF to demonstrate the benefits, address potential concerns, and ultimately lead

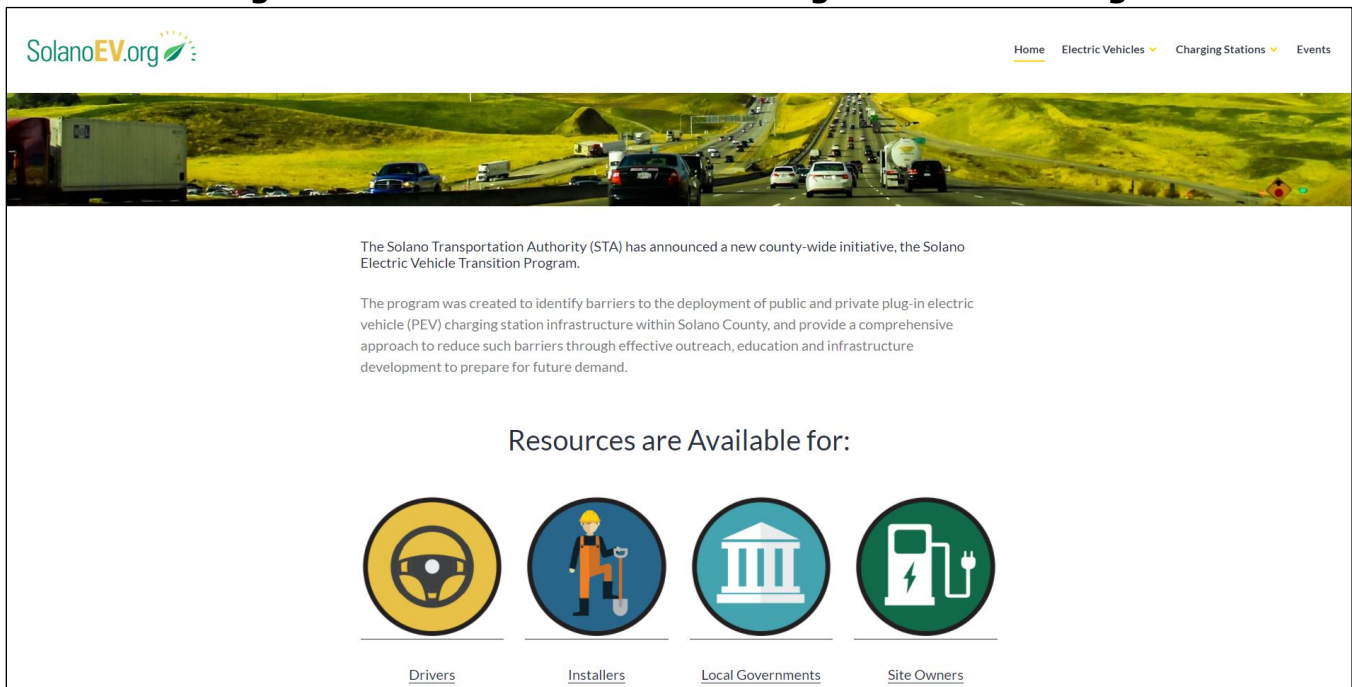
to increased knowledge and familiarity with electric vehicles. Staff spoke with approximately 300 employees at this event. The second event occurred on April 21, 2017 at Kaiser Permanente in Vacaville, California. At this event, the Nissan LEAF and Hyundai IONIQ Hybrid were showcased to Kaiser employees and members of the public. Staff spoke with approximately 100 people at this event.

Events like these help the Solano EV Transition Program to forward local, regional, and state goals of improving air quality, reducing greenhouse gas emissions, reducing dependence on petroleum, and raising awareness of emerging technologies in Solano County. In order to replicate these events after the project is over, ICF International developed a template to assist in planning future events, should the need arise. This goes along with the overarching theme of providing the tools to support EV growth in the future.

### 3.2 SolanoEV.org

In order to have a central location for information on EVs in Solano County, the Solano Transportation Authority and ICF International developed the [Solano Electric Vehicle Transition Program website](http://www.solanoev.org) that went live right before the Ride and Drive Events ([www.solanoev.org](http://www.solanoev.org)). This website is meant to be a resource for the public, local governments, installers, and charging site owners. It contains info on the benefits of owning an EV, how to install a charging station, where to find public charging, and permitting and inspection resources for local governments, among other things. The Solano Transportation Authority will continue to host and maintain this website after the project is complete and serve as a Solano County specific resource on electric vehicles. Figure 3 below shows the Solano EV website homepage.

**Figure 3: Screenshot of the Home Page for SolanoEV.org**



Source: Solano Transportation Authority

# CHAPTER 4:

## Charging Infrastructure Siting Analysis

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The Solano Transportation Authority was interested in developing a comprehensive framework for the siting of charging infrastructure in Solano. Earlier sections addressed some of the key institutional questions related to the actual installation. This section addresses questions related to the location of the stations, to create a charging environment that is supportive of current and prospective EV owners.

### 4.1 Regional Corridor Network Analysis

First, ICF International did an analysis of DC fast charging infrastructure needs to support battery electric vehicle travel at the regional level. This analysis involved the collection of Global Positioning Satellite data while driving along regional corridors in Solano County. The data gave information on topography and representative driving conditions, which was then fed into a vehicle dynamics model that evaluates the consumption of energy that a typical EV would experience along these routes. These results led to the evaluation of prospective locations for the installation of DC fast charging infrastructure that would have a high impact on supporting regional longer-distance EV trips.

When conducting this regional level analysis, the question that the Solano Transportation Authority considered was: Can an electric vehicle travel between point A and point B at the regional scale, without recharging along the way? If the answer is no, what are the recommended investments in infrastructure to support such a trip? The analysis sought to show how much energy would be required to travel between two points on the regional scale, and where deployment of DC fast charging infrastructure would have the most impact. To this end, ICF International collected Global Positioning Satellite data along 12 links that connect Solano County cities and a few locations outside the county. Each link was examined to assess how much energy a typical EV would expend to make this trip. The results are compiled into Table 1 and Table 2.

When considering the energy connectivity table below, it is important to note which links would require DC fast charger to complete the trip. Most of the trips above can be served with Level 2 charging and don't need additional charging to complete a one-way trip. For other trips, this is not the case. The following table lists the approximate times (in minutes) that it would take EV drivers to charge using Level 2 chargers to complete a round trip between two nodes. These times will depend on technical factors such as the onboard charger and the size of the onboard energy storage. For the purposes of generating approximate values, the assumption used was an onboard charger of 6.6 kilowatt and an onboard energy storage (battery capacity) of 20 kilowatt-hours. The cells with the text "DC fast charger" indicate links for which on-route charging would be needed.

**Table 1: Energy (in Kilowatt-Hours) Required to Complete Trips Between Regional Network Locations**

	<b>Sacramento</b>	<b>Davis</b>	<b>Dixon</b>	<b>Vacaville</b>	<b>Fairfield</b>	<b>Vallejo</b>	<b>Benicia</b>	<b>Rio Vista</b>	<b>Winters</b>	<b>Lake Berryessa</b>	<b>Napa</b>
<b>Sacramento</b>	0	6.3	10	13.9	19.2	26.3	28.2	18.6	19.2	25.2	27.2
<b>Davis</b>	6.3	0	3.7	7.6	12.9	20	21.9	12.3	12.9	18.9	20.9
<b>Dixon</b>	9.9	3.6	0	3.9	9.2	16.3	18.2	15.9	9.2	15.2	17.2
<b>Vacaville</b>	14.1	7.8	4.2	0	5.3	12.4	14.3	13.1	5.3	11.3	13.3
<b>Fairfield</b>	19.2	12.9	9.3	5.1	0	7.1	9	7.8	10.4	6	8
<b>Vallejo</b>	26.4	20.1	16.5	12.3	7.2	0	3	15	17.6	13.2	15.2
<b>Benicia</b>	27	20.7	17.1	12.9	7.8	2.4	0	15.6	18.2	13.8	15.8
<b>Rio Vista</b>	20.5	14.2	16.1	11.9	6.8	13.9	15.8	0	17.2	12.8	14.8
<b>Winters</b>	19.4	13.1	9.5	5.3	0	17.7	19.6	18.4	0	16.6	18.6
<b>Lake Berryessa</b>	24.1	17.8	14.2	10	4.9	12	13.9	12.7	15.3	0	12.9
<b>Napa</b>	27.8	21.5	17.9	13.7	8.6	15.7	17.6	16.4	19	14.6	0

Source: Solano Transportation Authority

**Table 2: Charging Times (in Minutes) to Complete a Trip Between Regional Network Locations, and Networks That Require DC Fast Charger to Complete**

	<b>Sacramento</b>	<b>Davis</b>	<b>Dixon</b>	<b>Vacaville</b>	<b>Fairfield</b>	<b>Vallejo</b>	<b>Benicia</b>	<b>Rio Vista</b>	<b>Winters</b>	<b>Lake Berryessa</b>	<b>Napa</b>
<b>Sacramento</b>	0	0	0	59	139	DC Fast Charger	DC Fast Charger	130	139	DC Fast Charger	DC Fast Charger
<b>Davis</b>	0	0	0	0	44	152	DC Fast Charger	35	44	135	DC Fast Charger
<b>Dixon</b>	0	0	0	0	0	95	124	89	0	79	109
<b>Vacaville</b>	62	0	0	0	0	36	65	47	0	20	50
<b>Fairfield</b>	139	44	0	0	0	0	0	0	6	0	0
<b>Vallejo</b>	DC Fast Charger	DC Fast Charger	98	35	0	0	0	76	115	48	79
<b>Benicia</b>	DC Fast Charger	DC Fast Charger	108	44	0	0	0	85	124	58	88
<b>Rio Vista</b>	DC Fast Charger	64	92	29	0	59	88	0	109	42	73
<b>Winters</b>	142	47	0	0	0	117	145	127	0	100	130
<b>Lake Berryessa</b>	DCFC	118	64	0	0	30	59	41	80	0	44
<b>Napa</b>	DC Fast Charger	DC Fast Charger	120	56	0	86	115	97	136	70	0

Source: Solano Transportation Authority

Based on the analysis conducted and considering each node's degree centrality (number of links each node has with other nodes), Fairfield/Suisun emerged as a central location ideal for a DC fast charger. Its central location is ideal to serve both trips within Solano County, but also trips that occur between regions. "Gateway" locations along the county borders were also identified as ideal for DC fast chargers to serve trips in between Sacramento and the Bay Area (Vallejo/Benicia), as well as trips to and from the Central Valley (Rio Vista). ICF International analyzed potential locations near highways/freeways in each of the cities and proposed four locations for future DC fast charging infrastructure: Solano Shopping Center in Benicia, near Solano Town Center in Fairfield, Gateway Plaza in Vallejo, and Highway 12 in Rio Vista.

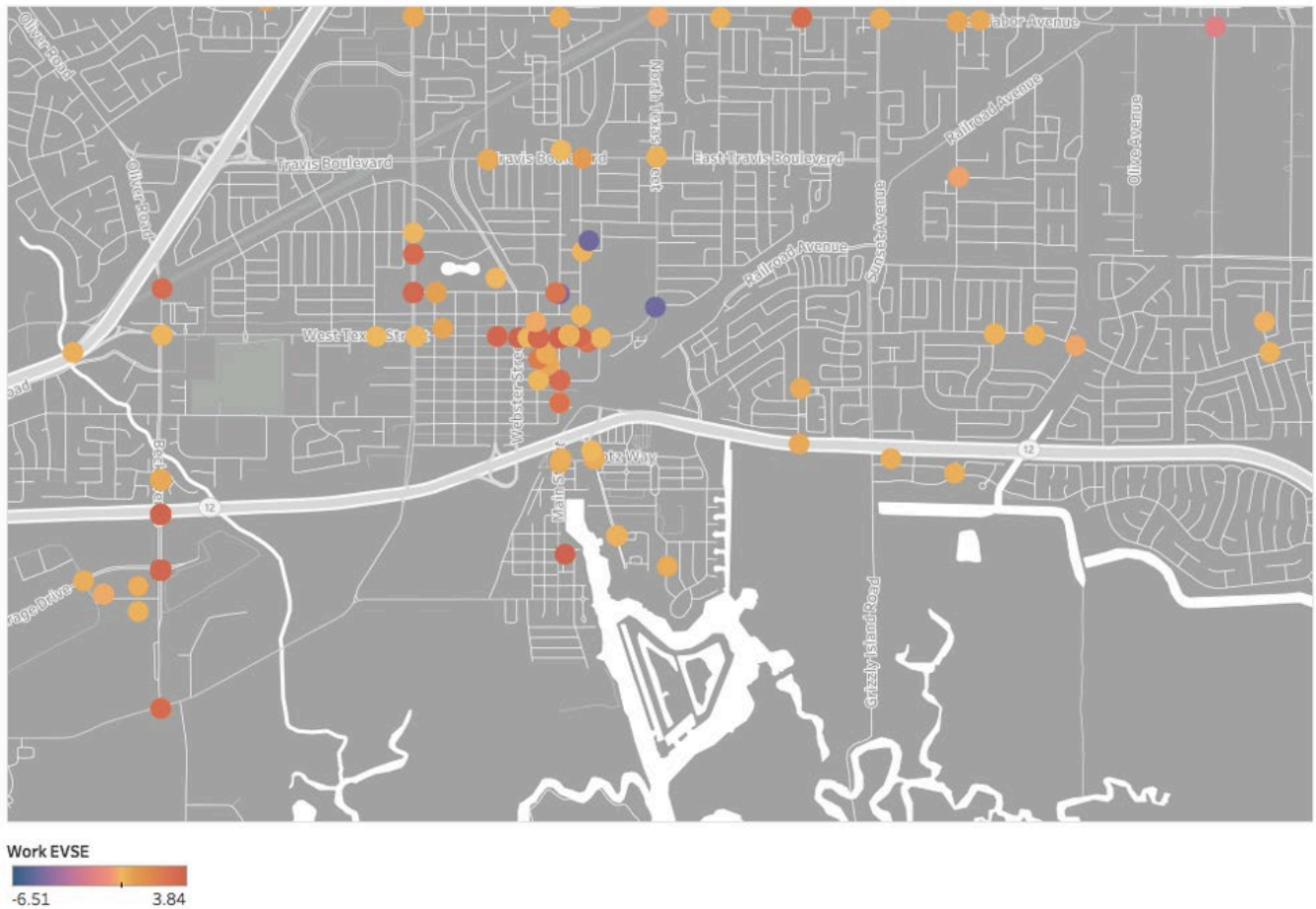
## **4.2 Local Charging Infrastructure Analysis**

The need for investments on charging infrastructure can be warranted on two main grounds, namely, to support the displacement of fossil fuel consumption with increased use of plug-in vehicles on the road and/or to support further market uptake of plug-in vehicles. In other words, charging infrastructure can help materialize a latent demand for electric vehicles and electric miles. Therefore, an evaluation of charging infrastructure investments necessitates an assessment of this demand.

In order to analyze potential locations for local charging infrastructure (Level 2), the Solano Transportation Authority conducted an online consumer survey to gauge the attitudes of those who work and/or live in Solano County towards electric vehicles. The survey was designed to answer the question of where market demand for plug-in vehicles exist, and where workplace charging infrastructure would have the greatest impact on this demand. The survey asked respondents about their commute, prior knowledge of EVs, a market analysis "game" (respondents were asked to evaluate hypothetical sets of three vehicles), their current vehicle, and demographic questions. It was sent out to employers across Solano County and resulted in 861 usable responses. In addition to gauging opinions on EVs of workers across the county, the survey also served as an outreach tool to employers and provided information on EVs and their associated infrastructure. Fifty to one hundred employers across the county received this survey.

From this survey, ICF International was able to use the data from the responses and run it through a model. Factors included the locations of respondent's workplaces and home zip codes, and responses to the market analysis game. By examining these figures, ICF International was able to gauge where investments in future EV charging infrastructure would have the most impact on EV adoption; essentially, where there is the most latent demand for EVs across the county. These locations were then placed on a map in two parts: one shows the distribution of probabilities of choosing an electric vehicle, and the other is the estimated distribution of impact that EVSE installations may have on EV adoption by Solano commuters. ICF International produced a total of 14 maps, located in the full Solano EV Transition Program report, that show these results. An example is included as Figure 4 showing areas of Fairfield and Suisun City. Red dots indicate locations that would have a higher impact on EV adoption, while purple dots indicate areas that would have less impact.

**Figure 4: Estimated Distribution of Impact that EVSE Installations in Fairfield/Suisun Would Have on EV Adoption by Solano Commuters**



Source: Solano Transportation Authority

### 4.3 EV Trailblazing Signage

One of the tasks of the Solano EV Transition Program was to site potential locations for trailblazing signs to point drivers towards existing EV charging stations. Many existing charging stations are difficult to locate and not near major thoroughfares. These signs seek to assist EV drivers in better locating available charging. For this task, the Solano Transportation Authority worked with a consultant, Fehr and Peers, to develop the locations for the signs, as well as specifications for the signs themselves and mounting. Fehr and Peers also contacted each Solano County jurisdiction to compile information on required permits, and willingness to deploy these signs. The project included budget to purchase several of these signs and work with local agencies to install them on local streets. Fehr and Peers developed 76 potential locations to deploy trailblazer signs.

They also provided to the Solano Transportation Authority a document that detailed all sign and mounting specifications required for installation. Figure 5 shows the proposed sign. Work on deployment of trailblazing signs continues. The Solano Transportation Authority has been contacting local agencies to gauge interest in installing the signs and will be purchasing them soon. The plan is to have some trailblazing signs installed before the end of May 2018.



**Figure 5: Example EV Trailblazing Sign**



Source: Solano Transportation Authority

# CHAPTER 5:

## Summary of Recommendations and Potential Next Steps

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The Solano EV Transition Program was a multi-faceted program that sought to bring together many Solano based stakeholders to improve the county's EV readiness. It did not come without challenges.

At times, the stakeholders were a little difficult to engage as interest in electric vehicles in Solano County is still emerging. However, the Solano Transportation Authority now has a plan (the results of this program) to carry out to ensure that the work to ready Solano County for widespread EV adoption continues.

These are outlined in the potential next steps to follow the conclusion of the Solano EV Transition Program:

- **Seek funding for EV infrastructure**

Now that this program has conducted a siting analysis for potential locations to deploy EV charging infrastructure, a natural next step is to seek funding for installation. To this end, the Solano Transportation Authority is planning a first phase implementation of this EV Transition Plan to fund new charging stations at the Vallejo Ferry Building, and additional stations at the Amtrak station in Suisun City. Furthermore, the Solano Transportation Authority will be utilizing the maps showing demand for EV charging to inform siting decisions in future phases of implementing EV charging infrastructure.

The Solano Transportation Authority has been monitoring funding opportunities from Pacific Gas and Electric Charge program, the Bay Area Air Quality Management District, the Volkswagen settlement and others.

The Solano Transportation Authority will continue to work with our member agencies to promote more EV charging infrastructure, as outlines in the Solano Transportation Authority's Alternative Fuels and Infrastructure Plan.

- **Continue to work to streamline permitting and installation of EVSE**

The Solano Transportation Authority's Alternative Fuels and Infrastructure Plan also makes mention of increasing EV readiness through expedited permitting processes. This is something that the Solano EV Transition Program made strides in, by working with local stakeholders to develop recommendations to help streamline and expedite EVSE permitting.

The permitting checklist template that resulted from this effort stands as an example of how Solano County's local governments can increase their EV readiness. In the future, the Solano Transportation Authority will look to further engage local agencies and encourage adoption of the recommendations to streamline permitting and inspection processes.

- **Increase EV awareness through outreach**

One of the ways the Solano Transportation Authority can increase EV awareness and adoption is through public outreach. When conducting the SolanoEV.org Earth Day Events, ICF International created a template for the Ride and Drive events that the Solano Transportation

Authority can potentially use to replicate these events in the future. Additionally, the charging infrastructure siting analysis may lead to more outreach to potential site hosts for EVSE, especially in tandem with funding opportunities. As previously mentioned, the Solano Transportation Authority will be looking to these maps to site potential locations for EV infrastructure in future implementation phases and will conduct more site host outreach accordingly.

# 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 California 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.

**DIRECT CURRENT (DC)**—Electricity that flows continuously in the same direction.

**ELECTRIC VEHICLE (EV)**—A broad category that includes all vehicles that are fully powered by electricity or an electric motor.

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

# APPENDIX A:

## Permitting and Inspection Checklist

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Solano Transportation Authority and ICF International staff developed an installation and permitting checklist for local jurisdictions to use as shown below.

ACTION	NOTES
Pre-installation	
Identify electric vehicle model and obtain charging equipment manufacturer specifications	
Verify vehicle will fit completely on property while charging	
Assess electrical system capacity and determine if upgrades (including new dedicated circuits) are needed	
Contact electric utility to notify planned installation, consult on necessary upgrades, and discuss charging level, meter, and rate options	Visit Pacific Gas and Electric’s EVSE installation <a href="#">website</a> or call at 877-743-7782 <sup>5</sup>
Permit Application	
Submit site plan with property lines, garage or parking space dimensions, and clearances of proposed charging system location including location of additional meter, if applicable	
Submit one-line diagram showing (1) location of new and existing meter/sub meter and charger controller; (2) wire sizing and routing	
Provide manufacturer installation details and specifications for the electrical supply charging unit	
Provide information from the manufacturer indicating whether or not ventilation is required, label plans accordingly and provide mechanical ventilation, if required	
Complete the Electrical Load Calculation Worksheet and provide load calculation of	

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<sup>5</sup> [Pacific Gas and Electric’s EVSE installation website](https://www.pge.com/en_US/residential/solar-and-vehicles/options/clean-vehicles/electric/charger-installation.page). (https://www.pge.com/en\_US/residential/solar-and-vehicles/options/clean-vehicles/electric/charger-installation.page).

electrical service; include the electrical load required to charge the vehicle at 125 percent

Note the voltage (120-volt or 240-volt) and ampacities of the vehicle charger

List or label all supply equipment

Pay permit fees

### Installation

Meet all code requirements (Article 625 Electric Vehicle Charging System)

Requirements include:

Coupling means of electric vehicle supply equipment shall be stored or located at a height of not less than 18 inches and not more than 48 inches above the floor level.

Electric vehicle supply equipment rated 125-volt, 15 or 20 amp may be cord and plug connected; all other EV supply equipment shall be permanently connected and fastened in place

If both 120-volt and 240-volt circuits are desired to be monitored by the electric vehicle meter, a meter distribution will be required

### Inspection

Schedule inspection(s)

For standard residential installations, one inspection after installation is typically sufficient; more complex projects may require multiple inspections at points before wiring and final installation

# APPENDIX B: EV Fact Sheet


The electric vehicle fact sheet with contact information shown in figure 6 provides at a glance information for potential EV purchasers.

**Figure B-1: Solano Transportation Authority's Electric Vehicle Fact Sheet**

**STra**  
Solano Transportation Authority

SolanoEV.org

## Electric Vehicle Fact Sheet



### WHAT ARE ELECTRIC VEHICLES?

Electric Vehicles, a.k.a. EVs, are designed to use electricity as fuel. The electricity is stored onboard in advanced batteries that can be recharged from various sources, such as the grid and solar panels.

There are essentially two types of electric vehicles:

**Plug-In Hybrid Electric Vehicles (PHEVs):** They can use both electricity and gasoline as fuels. If the onboard battery is exhausted, they switch to a gasoline engine.

**Battery Electric Vehicles (BEVs):** They are powered exclusively with electricity. They typically can drive longer on electricity than PHEVs thanks to their large-capacity batteries.

### HOW FAR CAN ELECTRIC VEHICLES GO?



It depends. There are models with rated ranges of about 100 miles, others with about 200 miles, and others with even longer range.

### HOW CAN I HELP THE ENVIRONMENT?

EVs driving on electricity have no emissions, helping clean the air. EVs also help reduce emissions of greenhouse gases. In fact, when charged with renewable sources of electricity (like that from solar panels), EVs are all around zero-emission vehicles.

### HOW DO I CHARGE AN ELECTRIC VEHICLE?

All EVs can be charged using regular 120 volt wall outlets, but standardized 220 volt charging equipment significantly accelerates the charge. Most people charge their EV at home at night, benefiting from dedicated lower electricity rates. Public charging stations can be found in many locations across the state, including workplaces, recreation destinations, and more.

During long trips, EVs can be charged at fast-charging stations. These high-power stations can supply 10 kilowatt-hours (about 35 miles worth of electricity) in just about 10 minutes. Fast charging stations can often be found along highway corridors.

In the near future, models with wireless charging capability will become available.

### HOW MUCH CAN I SAVE?

If you purchase a BEV in California, you can claim **\$2,500** in rebates and up to **\$7,500** in federal tax credits.

If gas costs \$3 per gallon, it costs 9 cents per mile to drive an efficient 32 miles-per-gallon conventional car (just in fuel). In contrast, an EV that is charged during off-peak hours costs just 3-4 cents to drive per mile.

BEVs also require no oil changes or emissions testing and need less maintenance.

For more information, visit: [SolanoEV.org](http://SolanoEV.org)  
Contact us: (800) 535-6883

Source: Solano Transportation Authority