



Electric Vehicles at PG&E

Overview of Current Activities

PG&E And Electric Vehicles Overview

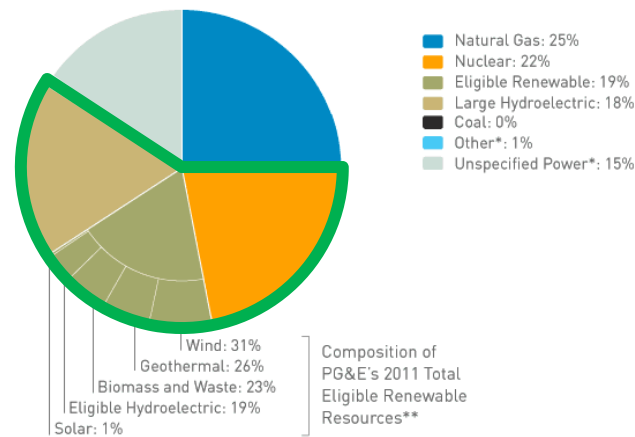
PG&E & Clean Driving

Almost 60% PG&E's electricity comes from greenhouse gas-free resources, which means that driving using PG&E's electricity emits less than half of the greenhouse gases as gasoline and we are getting even cleaner

California & Clean Driving

Even if you do not have PG&E's power, all of California has been cleaning up the grid with 20% renewables now and 33% by 2020

PG&E's 2011 Electric Power Mix Delivered to Retail Customers

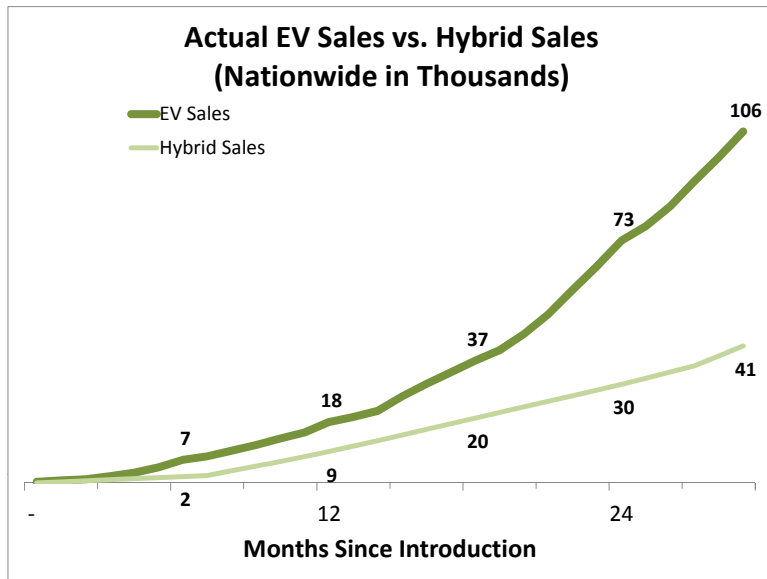


* "Other" includes diesel oil and petroleum coke (a waste byproduct of oil refining) and "Unspecified Power" refers to electricity generated that is not traceable to specific generation sources by any auditable contract trail.

** As defined in Senate Bill 1078, which created California's Renewable Portfolio Standard, an eligible renewable resource includes geothermal facilities, hydroelectric facilities with a capacity rating of 30 MW or less, biomass, selected municipal solid waste facilities, solar facilities and wind facilities. These figures are preliminary and will not be finalized until verified by the California Energy Commission.

The EV Market is Growing Relatively Quickly, but Policy Makers Would Like to Drive Growth Higher

Policy makers have created many initiatives to stimulate the market such as:



EV adoption is tracking at 2x to 3x the rate of initial Prius and Insight adoption

- **President Obama’s “EV Everywhere” Grand Challenge** which is a top priority for Energy Secretary Chu. The goal of EV Everywhere is to enable U.S. companies to produce EVs that are as affordable and convenient for the average American family as today’s gas-powered vehicles within the next 10 years
- **Governor Brown’s “ZEV Executive Order”** which ordered all state agencies (10 are currently participating in a direct manner) to ensure that 1M EVs are in California by 2020.
- The creation of **cross-industry collaborations**, such as the California Plug In Electric Vehicle Collaborative, the Electric Drive Transportation Association, and the Electrification Coalition

A Few Key Obstacles Appear to be Standing in the Way of Faster Progress



Economics

- **High upfront costs** relative to traditional vehicles
- **Incentives are fragmented** and can be complicated to obtain
- Mismatched dealer incentives



Information

- **Limited public awareness and understanding** of EVs
 - Basic vehicle functionality
 - Total cost of ownership
 - Limitations / risks of EV ownership
 - Lifestyle compatibility
 - Vehicle capability



Infrastructure

- Limited **access to charging stations away from home**
- Challenging to enable at-home charging in certain situations (e.g., multi-family and rental properties)
- Fragmented EV services market

PG&E is Addressing the Economic Obstacles with a Wide Range of Current or Planned Activities



Economics

Current activities

- Introducing the **lowest EV rates in the State**
- **Not charging the distribution upgrade costs to EV owners** for any upgrades that are caused by additional EVs
- Participating in the Low Carbon Fuel Standard program and generating credits for our customers

Planned activities

- **Piloting EV incentive and rebate programs** for smart-charging and second-life EV batteries that provide grid services
- **Demonstration of EV subtractive billing** to provide billing flexibility to customers

PG&E is Addressing the Customer Information Obstacles with a Wide Range of Current or Planned Activities

Current activities

Planned activities



Information

- **New EV rates were deliberately simplified** to increase customer understanding of electricity costs
 - Grassroots education effort for customers to learn about the new EV rates and the process to install a new charging station with PG&E
 - Serving as members on national bodies such as the EDTA, EEI, and National Academy, and regional bodies such as the PEV Collaborative and the Bay Area EV Strategic Council to facilitate EV adoption
- Sponsor EV outreach events that have ride-and-drives
 - Building rate comparison tools

PG&E is Addressing the Infrastructure Obstacles with a Wide Range of Current or Planned Activities

Current activities

Planned activities

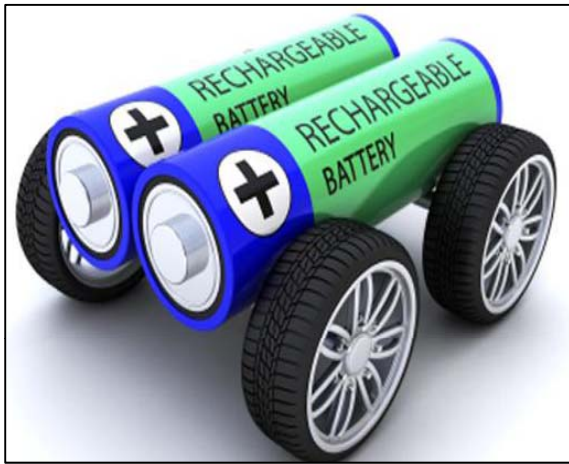
- **Streamlined and consistent service planning** for EV charging infrastructure (e.g., Tesla Superchargers, DGS)
- Promotion of open Smart Grid standards
- Serving on the PEV Collaborative working groups to address the issues of workplace charging and multi-unit dwellings.

- Identifying optimal sites for public charging infrastructure



Infrastructure

Second Life Batteries: Market Uncertainty and Barriers



Key Questions

- When is a battery no longer useful for transportation?
- What is the value of a used vehicle battery in a storage application? How much capacity will be left? How will it degrade?
- What about future battery and energy costs?
- What are the refurbishment costs at scale?

PG&E Pilot Plan

Pilot Goals

- Evaluate the value of DR from PEVs
- Understand technical/communication functionality requirements
- Evaluate performance of PEVs as a DR resources
- Cost and Benefits of Second Life Batteries on the grid

Planned Method

- Develop resource/operational requirements for vehicle batteries used to provide grid services
- Create solicitation for third parties to provide grid services from vehicle batteries, before and after their transportation life
- Enter into contracts with third parties to provide grid services from PEV batteries