California Transportation Electrification Assessment

Purpose

The Transportation Electrification Assessment (TEA) quantified the value of transportation electrification to the state, local communities, utility ratepayers, and individuals. The TEA included forecasting electricity consumption and societal benefits (e.g., reductions in criteria pollutant and greenhouse gas emissions and petroleum consumption) in 2020 and 2030 for almost two dozen on- and off-road electrified technologies (including plug-in light-duty electric vehicles, or PEVs) and identifying the market gaps and barriers for increased PEV adoption in California and potential solutions for these gaps and barriers. Grid benefits to utilities and ratepayers were determined through a novel, in-depth cost analysis of increased PEV adoption.

Methodology

The analysis was based on detailed information on the circuits, feeders, and substations of four California utilities' (PG&E, SCE, SDG&E, and SMUD) service territories, including capacity rating, utilization, peak loads, number of residential and commercial accounts, and forecasted load growth. Three PEV penetration rate scenarios were developed based on adoption rates from the California Air Resources Board (CARB) to achieve compliance with the Zero Emission Vehicle (ZEV) Standard: ZEV compliance with 50% fuel cell vehicles (ZEV 50/50), CARB ZEV most likely compliance (ZEV Most Likely), and three times CARB ZEV most likely compliance (ZEV * 3) (Table 1).

Table 1. Cumulative California PEVs

Penetration Scenario	2020	2030
ZEV 50/50	200,000	680,000
ZEV Most Likely	340,000	2,200,000
ZEV * 3	1,000,000	6,700,000

PEV load shapes were based on four different rate scenarios: tiered rate, flat rate, time-of-use (TOU) rate, and mixed rate (50% TOU and 50% flat). PEV clusters were mapped at ZIP+4 detail to circuits and feeders on the utility distribution systems. PEV-related peak load growth at each location on the distribution system for each PEV penetration scenario was calculated based on the combination of the PEV adoption scenario, PEV load shapes, and PEV clusters (Figures 1 and 2).

Figure 1. Distribution System Utilization with PEV Charging for ZEV Most Likely: San Francisco Bay Area

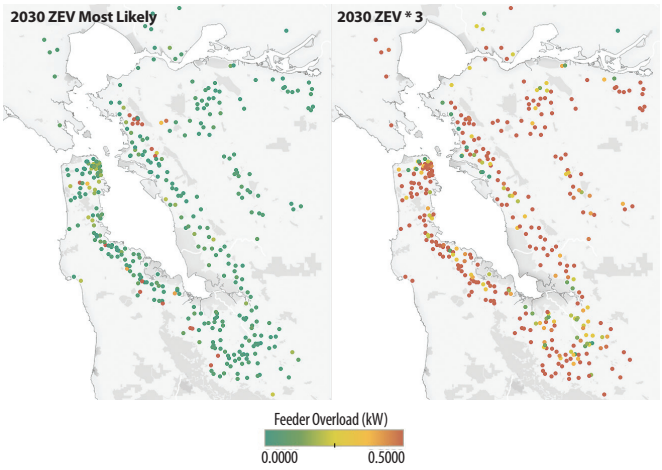
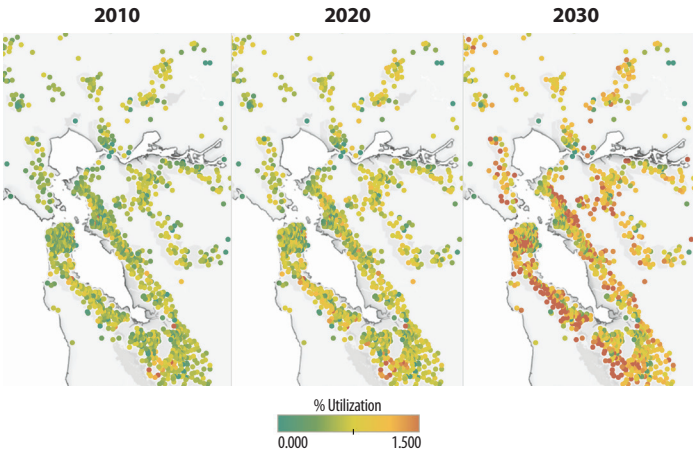


Figure 2. 2030 Distribution System Upgrades Driven by PEV Charging: San Francisco Bay Area



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Key Findings

Distribution System Upgrade Costs

- Managed charging, represented by TOU rates, reduces distribution upgrade costs by 60% (Figure 3).
- Distribution costs are nonlinear with PEV vehicle penetrations, but are manageable under the current trajectory.
- Annual distribution costs under the ZEV * 3 adoption case are about 1% of the 2012 distribution revenue requirement of $9 billion for the four utilities (Figure 4).

Figure 3. Present Value Distribution Upgrade Costs Through 2030 by Rate/Load Shape Scenario for ZEV Most Likely

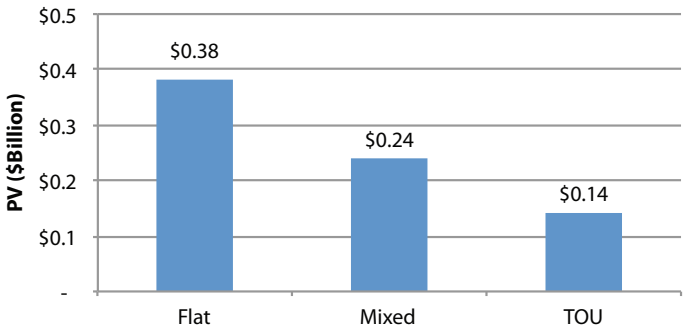
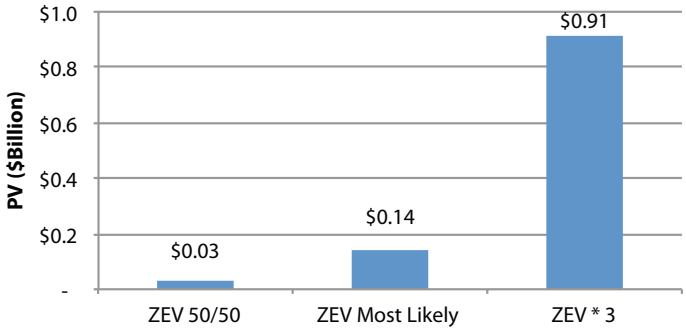


Figure 4. Present Value Distribution Upgrade Costs Through 2030 by Adoption Scenario with TOU Rates



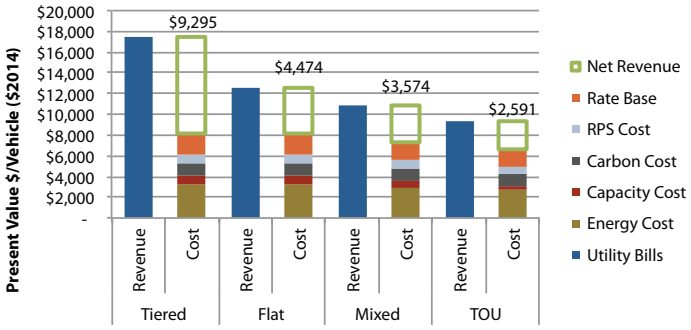
For More Information

For more information and the complete report, please visit the CalETC website: www.caletc.com.

Ratepayer Impacts

- PEV owners pay more than the costs incurred by the utility to deliver the electricity to charge the vehicles, resulting in a downward pressure on rates and a benefit to all ratepayers, not just PEV owners.
- The TOU rate scenario yields lower net revenues for the utility and its ratepayers, but provides lower costs for delivered energy and higher net benefits for PEV owners, which encourages PEV adoption (Figure 5).

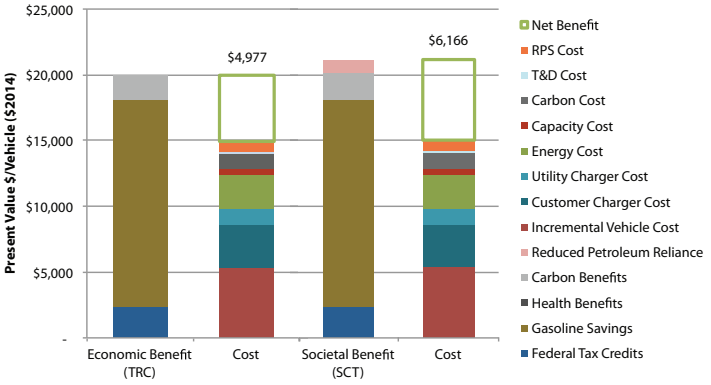
Figure 5. Present Value per Vehicle Ratepayer Costs and Benefits by Rate Scenario (ZEV Most Likely Vehicle Adoption)



Societal Benefits

- The inclusion of monetized societal benefits in the Societal Cost Test (SCT) increases the per vehicle cost-effectiveness by over 20% compared the traditional Total Resource Cost (TRC) test (Figure 6).

Figure 6. Per Vehicle TRC and SCT Costs and Benefits for the TOU Rate Scenario



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