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### Permalink

<https://escholarship.org/uc/item/8wz0c90f>

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### Publication Date

2021-04-01

### DOI

10.7922/G2R20ZNX

# Cost of Vehicle Ownership: Cost Parity Between Plug-in Electric Vehicles and Conventional Vehicles Is at Least a Decade Away

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April 2021

# POLICY BRIEF

## Issue

While plug-in electric vehicle (PEV) adoption has been rising over the past decade, with PEVs making-up about 7.8% of California’s new vehicle sales in 2019, the trend needs to quickly accelerate for the state to reach its goals of 100% zero-emission vehicle sales by 2035 and a zero-carbon economy by 2045. California has various incentive programs to encourage PEV adoption, but policymakers expect to phase these incentives out as PEVs reach cost parity with conventional internal combustion engine vehicles. Comparing the total cost of ownership—purchase price, operational costs, and resale value (Figure 1)—of PEVs or other zero-emission vehicles with that of conventional vehicles can inform policy decisions about incentive programs and inform consumers’ purchase decisions, by accounting for PEVs’ higher purchase prices but lower fuel and maintenance costs.

Recent research has estimated that cost parity between PEVs and conventional vehicles will be achieved over the next decade. However, the timeline depends on each study’s assumptions about technology improvement and travel behavior. These studies often assign a single total cost of ownership to a specific vehicle model, ignoring the fact that costs can vary across households based on the type of vehicle adopted, travel behavior, access to charging and refueling facilities, gasoline and electricity prices, and other factors. Researchers at the University of California, Davis estimated PEVs’ total cost of ownership for the

period of 2020–2030, their cost-competitiveness with conventional vehicles, and consequently the cost of electrification of California’s fleet of more than 30 million light-duty vehicles. The researchers analyzed six market segments, defined by household income and housing type, to account for the heterogeneity in total cost of ownership. The cost of electrification analysis also included fuel cell electric vehicles and was extended out to 2045 to align with California’s emission reduction goals.

## Key Research Findings

**PEVs’ initial purchase price will remain higher than conventional vehicles for all vehicle types for at least the next decade.** This gap will narrow by 2030, due to declining battery costs and economies of scale, paired with increased conventional vehicle purchase costs due to more stringent fuel economy standards. However, the rising demand for longer-range PEVs may keep production costs and, therefore, purchase costs higher.

**On average, the total cost of ownership of PEVs will achieve parity with that of conventional vehicles by 2035 across all six market segments (Figure 2).** While costs will vary at the household level, each market segment on average will benefit from switching to a PEV by 2035 thanks to the narrowing gap in purchase price and PEVs maintaining a lower cost of operation than gasoline vehicles, even as gasoline vehicles become more fuel-efficient.

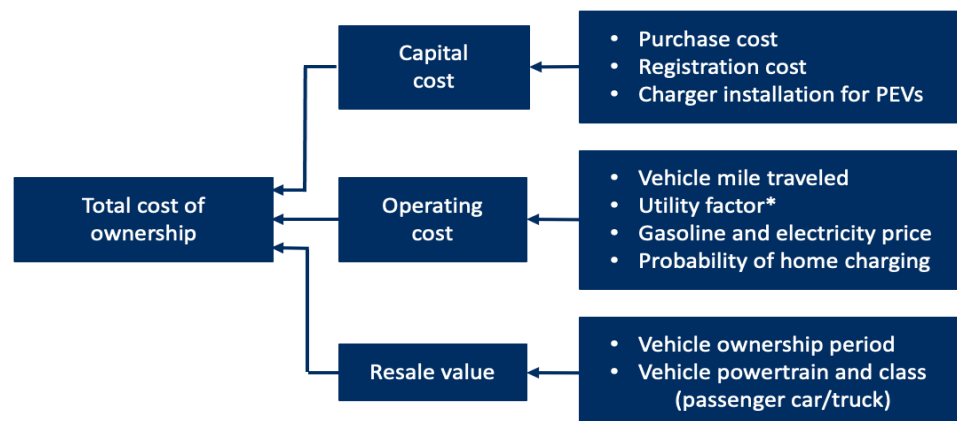


Figure 1. Framework for calculating vehicle total cost of ownership (\*The utility factor is the share of electric vs. gasoline miles that a plug-in hybrid vehicle travels.)

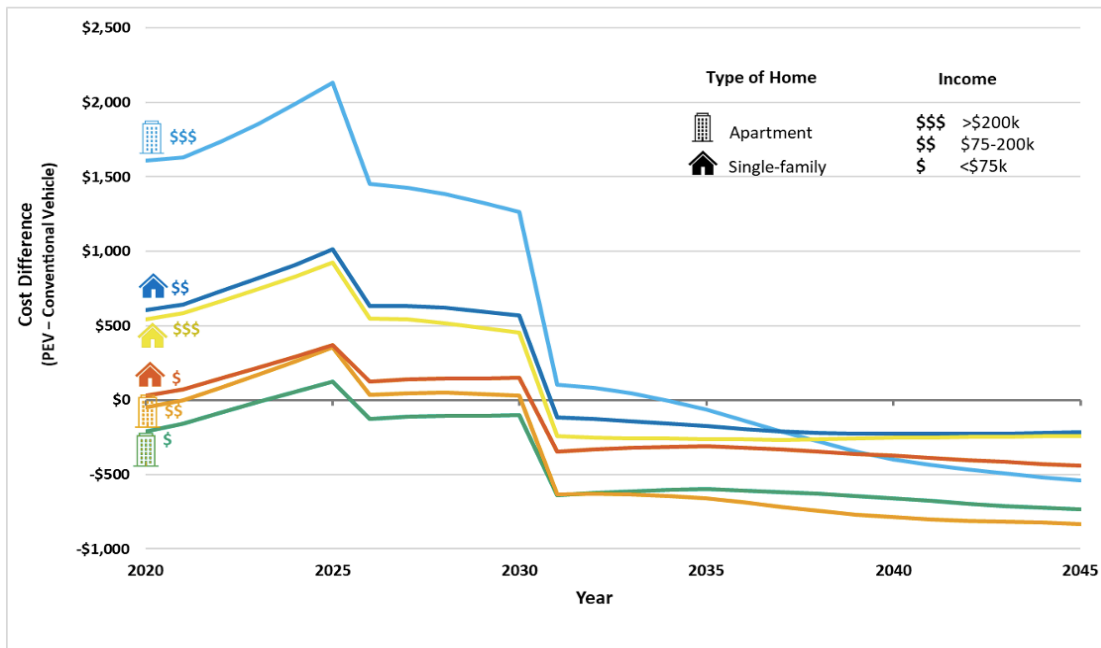


Figure 2. The average total cost of ownership difference between a PEV and a conventional vehicle across six household categories

**Household characteristics have a large influence on total cost of ownership and when cost parity is reached.** For example, living in a single-family home can provide access to a home charger with a low electricity rate, reducing operating costs compared to an apartment dweller relying on more expensive public charging. The number of household vehicles can also influence total cost of ownership. A single-vehicle household purchasing a PEV for all its transportation needs may need an expensive, long-range, large PEV; but, a multi-vehicle household may choose a cheaper, shorter-range, smaller PEV to serve only some of the household transportation needs.

**High-mileage drivers will see the earliest benefits from PEV adoption, particularly in the passenger truck segment.** Because maintenance and fuel costs per-mile are lower for PEVs than conventional vehicles, the overall savings from PEV adoption rise with miles traveled. Since conventional passenger trucks tend to have low fuel efficiency, the fuel cost savings from switching to PEVs in that segment are higher than in the passenger car category.

## Policy Implications

These findings suggest that PEV subsidies may be needed for at least the next decade until cost parity is achieved by most household types. The findings also emphasize the importance of miles traveled and the cost of vehicle charging in determining PEVs' cost competitiveness. As charging

at public infrastructure will likely remain more expensive than home charging, policies that allow more access to overnight/at-home charging, especially for low-income households and apartment dwellers, will be important for achieving parity for total cost of ownership. Finally, the purchase cost of PEVs will remain higher than conventional vehicles for the next decade, serving as a barrier to market entry for low-income households. Establishing a robust used car market for PEVs will be important to bring lower-income households into the market and enable them to benefit from PEVs' operating cost savings.

## More Information

This policy brief is drawn from "Cost of Plug-in Electric Vehicle Ownership: How the cost of ownership impacts the choice between conventional and plug-in electric vehicles," a report from the National Center for Sustainable Transportation, authored by Debapriya Chakraborty, Koral Buch, and Gil Tal of the University of California, Davis. The full report can be found on the NCST website at <https://ncst.ucdavis.edu/project/cost-plug-electric-vehicle-ownership-how-cost-ownership-impacts-choice-between-conventional>.

For more information about findings presented in this brief, contact Debapriya Chakraborty at [dchakraborty@ucdavis.edu](mailto:dchakraborty@ucdavis.edu).

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