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Evaluating the Impact of High Occupancy Vehicle Lane Access on Plug-in Vehicles in California

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Issue

Allowing single-occupant advanced clean vehicles to use carpool or high occupancy vehicle (HOV) lanes can be an important non-monetary sales incentive. This incentive needs to be balanced against the potential cost of increased congestion on those lanes and reduced revenue of high occupancy toll (HOT) lanes, especially during peak travel periods.

In California, there are two ways a single-occupant vehicle can access the HOV lane: 1) White stickers are available to an unlimited number of qualifying federal inherently-low-emission vehicles, mostly 100% battery electric and fuel cell electric vehicles (BEVs and FCVs). 2) Green stickers are available to the first 40,000 applicants that purchase or lease cars meeting California's transitional zero emission vehicle (TZEV) requirement, mostly plug-in hybrid electric vehicles (PHEVs). The expiration date for both the green and white stickers is 2019.

The green sticker quota is expected to run out before May 2014 with more than 36,000 issued between 2011 and March 2014. Current discussion focuses on whether to expand the green sticker limit beyond 40,000. More stickers will sell more PHEVs but will also increase the number of single-occupant vehicles in HOV lanes and may reduce the lane performance and the revenue of high occupancy toll lanes.

Policy Implications

By developing a better understanding of the costs and benefits of HOV stickers as an incentive for purchase and use of clean vehicles, the state can better tailor the policy for maximum benefit. Our analysis shows that PHEVs with greater all-electric range provide much higher levels of zero-emission travel per HOV mile. Policy makers can take this factor into account when determining the level and duration of the HOV incentive.

Research Findings

We surveyed more than 3,500 plug-in electric vehicle (PEV) owners in coordination with the California Center

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for Sustainable Energy, which administers the state's Clean Vehicle Rebate Program on behalf of the California Air Resources Board. All of the respondents had received the state rebate for purchasing or leasing a PEV. Of those customers, about 3,000 have a white or green sticker on their vehicle and 500 did not apply for any sticker.

The percentage of those that applied for the sticker includes 95% of Prius Plug-ins, 89% of Volts and 79% of LEAFs. When asked about their primary motivation to buy the car, 57% of Prius Plug-in, 34% of Volt, and 38% of LEAF owners identified the sticker as the most important factor (a more recent 4Q 2013 survey shows somewhat lower percentages, 34%, 20%, and 15% respectively) [1].

We observed a significantly higher household income among owners with stickers than among those without stickers (\$173,000 with a sticker vs. \$145,000 without a sticker). This difference may reflect the higher value of time of PEV owners who obtained the sticker and also the higher relative value of the state rebate to PEV owners who did not obtain the sticker.

The amount of zero emission usage of both BEVs and PHEVs can be measured in electric vehicle miles traveled or eVMT. The incentive performance of the HOV stickers can be measured in terms of eVMT per mile of HOV usage. The vehicle usage is measured both by odometer reading and by computer modeling of the fastest route from home to work. We estimated what share of the daily commute was electric and what share was gasoline-powered based on reported home/work charging [3].

Drivers with either white or green stickers drive more and create more VMT and eVMT for each commute day than those without stickers. Prius Plug-in drivers show significant change in the total VMT but no significant change in eVMT (Figure 1). The total daily VMT of drivers with stickers is also correlated with daily HOV miles and range from 11 miles on average for LEAF drivers, 16 miles for Volt drivers, and 21 miles for Prius Plug-in drivers. Overall, Prius Plug-in drivers have a

larger share of their daily miles on HOV lanes and are more popular in regions with HOV lanes.

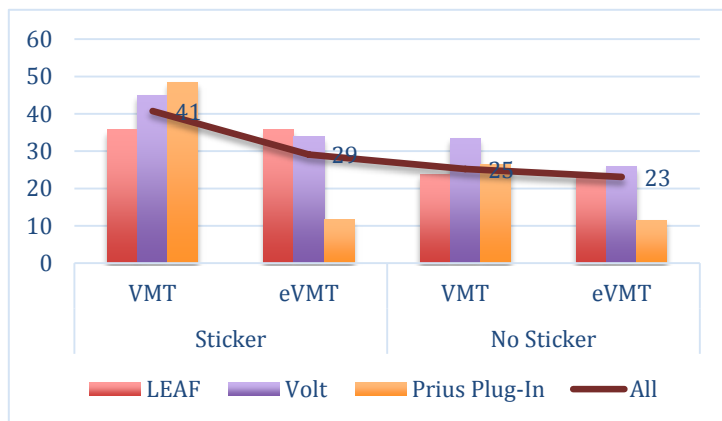


Figure 1: Commute Day VMT and eVMT

On average, for every mile a LEAF is driven in an HOV lane, we estimated more than three electric miles were driven (e.g 30 electric miles on a commute with 10 miles on HOV lanes). This compares to about two electric miles for the Volt and half an electric mile for the Prius Plug-in (Figure 2).

The HOV miles of PEVs are not distributed uniformly on all HOV lanes and are correlated with general traffic trends as shown in Figure 3.

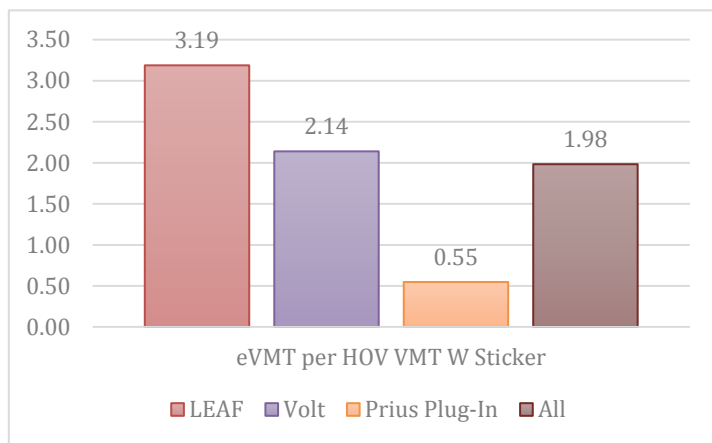


Figure 2: eVMT per HOV mile Traveled

Every additional vehicle that uses HOV lanes may reduce the lanes' performance especially if added to HOV lanes already close to capacity. While more quantitative analysis is needed to determine the amount of increased congestion due to PEVs, comparing areas with a high presence of PEVs to Caltrans HOV lanes designated as close to capacity, we see many overlapping areas both in the Bay Area and in the Los Angeles area [4]. The

reduced HOV lane speed in some areas highlights the potential cost to drivers of providing more HOV stickers versus the benefit to the state of the eVMT.

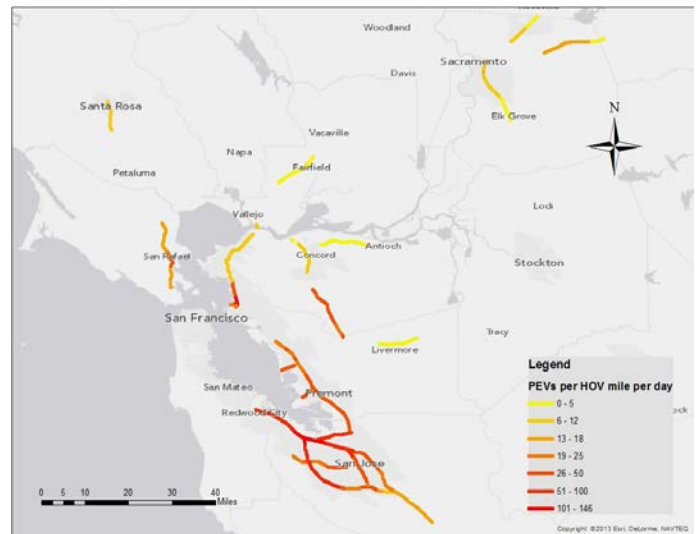


Figure 3: PEVs on HOV lanes per day (not weighted)

Policy Considerations

Using eVMT as a way to evaluate the benefit of HOV stickers, we show the potential to maximize the impact of each additional green sticker by providing them to owners (and vehicle types) that create more eVMT and to owners who might be less likely to purchase the car otherwise. While more research is needed, a fine tuning of the HOV access policy for PHEVs together with the monetary incentives increase the impact and reduce the cost of both policies.

[Click here to read the full working paper.](#)

References

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