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Exploring the Effects of Federal Incentives on Consumers' Plug-In Electric Vehicle Purchase Decisions

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Issue

In the last five years, the availability of plug-in electric vehicles (PEVs) in the United States has shifted from the early testing and demonstration phase to early commercialization. Today there is a small but growing market for both plug-in hybrid electric vehicles (PHEVs) and battery electric vehicles (BEVs). Federal, state and local policies support PEV market growth by reducing sales taxes and fees, offering rebates, and supporting home and public charging infrastructure needs, among other incentives. The most important direct incentive is the federal tax credit, which ranges from \$2,500 to \$7,500 per PEV based on battery size. The objective of this brief is to empirically quantify the impact of the federal incentive on the PEV market and examine the policy implications of the incentives. The results presented are based on a reflective, stated preference survey of 2,882 PEV buyers located in 13 states.

Research Findings

Table 1 shows the average purchase price, maximum federal rebate in dollars and as a percent of purchase price, battery size, and EPA-rated electric range for the top six vehicles considered in this analysis.

According to the owners survey (Figure 1) we can attribute 28.5% of the PEV sales in our survey to the

Vehicle	Avg. Price Paid (Not including Incentives)	Fed. Incentive Amt.	Fed. Incentive as % of Price	Battery Size (kWh)	EPA-Rated Electric Range (mi)
Toyota Prius Plug-in (PHEV)	\$32,300	\$2,500	8.90%	4	11
Ford Fusion Energi (PHEV)	\$40,000	\$4,007	10.90%	8	20
Ford C-Max Energi (PHEV)	\$34,000	\$4,007	12.80%	8	20
Chevrolet Volt (PHEV)	\$39,400	\$7,500	21.20%	17	35
Tesla Model S (BEV)	\$93,600	\$7,500	9.60%	85	208-265
Nissan Leaf (BEV)	\$34,800	\$7,500	26.40%	24	75-84

Table 1: Key values for top six vehicles in analysis

impact of the federal tax credit. As expected, the impact is highly correlated with the credit value as share of the vehicle price. Almost half of the Leaf buyers and 40% of the Volt buyers said they would not have purchased their cars without the federal tax credit.

The Tesla buyers who also received up to \$7,500 had much lower sensitivity to the incentive; only 13.9% said they would not have purchased their car without the incentive. Only 15.3% of the Prius Plug-In buyers said they would not have purchased their car without the incentive.

We estimated the impact of \$1,000 in PEV incentives in Table 2. The analysis suggests that for approximately every \$14,000 of incentives, one additional Leaf is sold. In contrast, a federal investment of \$52,600 in incentives will result in one additional Tesla Model S sold.

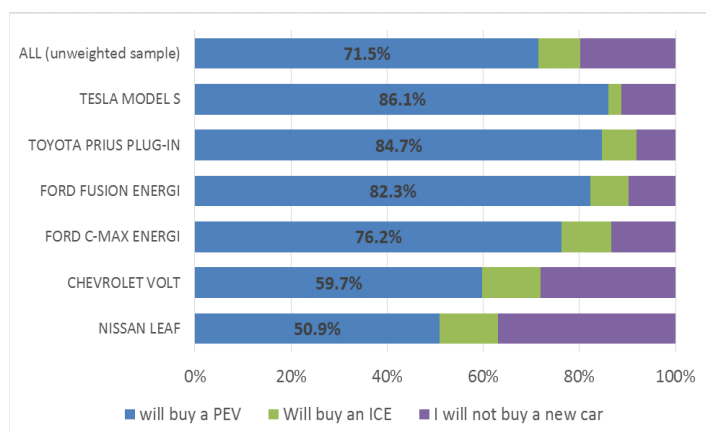


Figure 1: Key values for top six vehicles in analysis

We also estimated the effect of the federal incentive using two different performance metrics: battery kWh on the road and electric vehicle miles traveled (eVMT). We chose these additional metrics because the federal incentive is based on battery size, and the impact of the incentive on kWh is a method to estimate one of the major technological factors important for PEV market growth. Additionally, the impact on eVMT reflects the actual use of the plug-in vehicles as electric cars and is one of the most important metrics for measuring GHG benefits from the incentive. These results are shown on the right side of Table 2.

Policy Implications

This analysis focused on the federal incentive because it is the highest-value monetary incentive and was available to everyone surveyed. Our findings suggest that the federal incentive has a higher impact on sales of vehicles that receive the biggest price reduction from the incentive, such as the Nissan Leaf and the Chevrolet Volt. When weighted for the full market, the results from this study indicate that the federal incentive increased the sales of PEVs by about 32.5% between 2010 and 2014. Volt buyers were less likely to forego a vehicle purchase without an incentive than were Leaf buyers, and Tesla buyers were the least likely to defer their vehicle purchase if there were no federal incentive. We see that the incentive has lower

impact on high-income households that purchase more expensive vehicles, and greater impact on the lower-priced vehicles purchased by all other income groups. The results show that a federal tax credit that focuses on lower-priced vehicles (which are still more expensive than similar conventional vehicles) will improve market growth. Overall sales impacts are higher when the incentive represents a larger share of the vehicle price.

What is the impact of \$1,000 per vehicle federal incentive?			
	Additional PEV Sales	Battery Capacity (kWh)	eVMT per Year (miles)
NISSAN LEAF	0.068	1.6	658
FORD C-MAX ENERGI	0.062	0.5	252
TOYOTA PRIUS PLUG-IN	0.061	0.3	152
CHEVROLET VOLT	0.057	1.0	517
FORD FUSION ENERGI	0.047	0.4	204
TESLA MODEL S	0.019	1.6	240

Table 2: The impact of the federal incentive

When incentive impact is measured in terms of battery capacity, the number of Tesla vehicles sold grows modestly, but in terms of kWh on the road, those additional vehicles account for more battery capacity than any other vehicles except for the Leaf. When the incentive is measured in terms of eVMT, which reflects use of the PEVs as an electric vehicle, our findings suggests that focusing the federal incentive on BEVs with medium range and on long range PHEVs that are within the primary consumer purchase price yield the maximum impact.

Further Reading

This policy brief is drawn from the full paper: Michael Nicholas and Gil Tal (2016), "eVMT in the Household Fleet: Integrating Battery Electric Vehicles into Household Travel." Transportation Research Board, January 2016. Paper #16-6994

¹Uses estimated range in extended mode. EPA sticker values are 92 miles in standard mode. Extended mode is user optional, but available to the driver if he/she would like more range than standard mode.

<http://www.greencarcongress.com/2012/08/rav4ev-20120803.html>