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 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.

Table 1: Key values for top six vehicles in analysis

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<tbody>
<tr>
<td>Toyota Prius Plug-in (PHEV)</td>
<td>$29,200</td>
<td>$2,500</td>
<td>8.50%</td>
<td>4</td>
<td>11</td>
</tr>
<tr>
<td>Ford Fusion Energi (PHEV)</td>
<td>$40,000</td>
<td>$4,600</td>
<td>10.50%</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Ford C-Max Energi (PHEV)</td>
<td>$34,000</td>
<td>$4,600</td>
<td>13.60%</td>
<td>8</td>
<td>20</td>
</tr>
<tr>
<td>Chevrolet Volt (PHEV)</td>
<td>$39,400</td>
<td>$7,500</td>
<td>19.20%</td>
<td>12</td>
<td>35</td>
</tr>
<tr>
<td>Tesla Model S (BEV)</td>
<td>$93,600</td>
<td>$7,500</td>
<td>8.00%</td>
<td>85</td>
<td>208-295</td>
</tr>
<tr>
<td>Nissan Leaf (BEV)</td>
<td>$34,800</td>
<td>$7,500</td>
<td>26.40%</td>
<td>24</td>
<td>75-84</td>
</tr>
</tbody>
</table>

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.
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.

### Further Reading


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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