MEASURING THE COST-EFFECTIVENESS OF CLEAN VEHICLE SUBSIDIES

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Overview

Demand-side policies, including rebates, sales tax exemptions, and tax credits promote clean vehicle adoption, with the goal of reducing local air pollution and greenhouse gas (GHG) emissions. Limited research to date on their cost-effectiveness and efficiency suggests such subsidies are unsustainably expensive, but this may not tell the whole story. Stated-preference research suggests that targeting 'marginal' consumers who are 'on the fence,' or could be nudged to purchase a PEV with a subsidy, can reduce the costs of such demand-side policies (Sheldon, DeShazo, and Carson 2017).

This study assesses the scope for reducing the costs of existing subsidies for PEV sales, through examining the feasibility of a more targeted approach. It also measures the impact of changes in vehicle offerings, specifically the driving range of battery electric vehicles (BEVs), on the potential costs of a fixed subsidy schedule.

Methods

We employed a vehicle choice model using a nationally representative, revealed preference survey data of nearly 275,000 new vehicle buyers in the United States (U.S.) in 2015. The study uses this model to make predictions for the market share of PEVs and fleet gasoline consumption under alternative subsidy policies. The study also used the demographics and attitudinal elements of the survey data to incorporate consumer heterogeneity into the vehicle choice model. We use the latter, which includes income, vehicle disposal type, geography, and vehicle miles traveled, to explore various subsidy policy designs.

Results & Conclusions

The results of this study suggest that the existing federal subsidy structure accounted for only 17 percent of PEV sales in the 2015 model year. This would mean that the cost of existing incentives per additional PEV purchase is very high, at around $35,601, with the cost per gallon of gasoline saved at $8.18 per gallon. A more targeted approach to subsidy policy design would give policymakers the scope to improve the impact and reduce the costs of these subsidies. This research shows that, in every simulation, the most cost-effective scenario is to limit subsidies to lower-income individuals: those with annual incomes under $70k. Such a scenario would mostly restrict subsidies to those consumers who would not have otherwise purchased a PEV (85-95 percent of subsidy dollars) and would account for around 30 percent of PEV sales. The policy cost per additional PEV would be limited to around $16,000, and the cost per gallon of gasoline savings would fall to $3.55 per gallon. Furthermore, the cost reductions from an improvement in the driving range of BEVs by 100 miles could equal those of a targeted subsidy. This study predicts that targeted subsidies, combined with an improvement in vehicle range, would limit the policy cost per additional BEV to $9,712 and the cost per gallon of gasoline to $2.41 per gallon.

A real-world example of targeted subsidy design is California's Replace your Ride pilot program that restricts subsidies to low-income consumers. However, it is important to note that such targeted subsidy designs have the potential to distort the used car market. Appropriate measures would have to be put in place to avoid such unintended consequences.

Targeted subsidy designs will differ depending on their goal. Policymakers could restrict subsidies to low-income individuals if the aim is to maximize PEV market share. Alternatively, if their goal is to minimize gasoline consumption, policymakers might limit subsidies to individuals who dispose of a large conventional vehicle, who reside in rural or farming areas, or who drive more than 2,000 miles per month.

Current U.S. federal policy subsidizes the purchase of PEVs on a sliding scale relative to their battery capacities. This study finds that maintaining this approach for purchases of BEVs would increase their sales. Policies that do not subsidize according to battery capacity would result in greater plug-in hybrid electric vehicle (PHEV) adoption. Thus, given policymakers' goal of encouraging the development of longer-range batteries for BEVs, they are likely to continue assigning larger subsidies to BEVs. However, the level of reduction in gasoline consumption is the same in both the cases, with a slightly lower marginal cost when BEVs and PHEVs are equally subsidized. Thus, if the policy goal is to minimize local air pollution and GHG emissions at lower near-term cost, there is no benefit in prioritizing one technology over the other.

References

1. Sheldon, Tamara L., J.R. DeShazo, and Richard T. Carson (2017), "Demand for Battery-electric and Plug-in Hybrid Vehicles: Policy Lessons for an Emerging Market," Economic Inquiry, 55(2): 695-713.