

How Much Should Hybrids and Electric Vehicles Contribute to Roadway Funding?

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Energy security and environmental concerns have led to a growing emphasis on alternative fuel vehicles. Particularly within the transportation sector, where gasoline consumption accounts for 47% of total U.S. petroleum consumption, there has been a shift to develop, incentivize, and assist in the adoption of vehicles that are not solely fueled by gasoline.¹ However, the decreases in fuel consumption associated with hybrid and electric vehicles result in gas tax revenue losses for states. While hybrid and electric vehicles represent a small percentage of vehicles on the road, several states have opted to impose additional fees on these vehicles in addition to regular registration fees. The additional fees for hybrid or electric vehicles are largely in the spirit of fairness and an attempt to recoup lost gas tax revenues specifically for transportation funding. In this report, we provide a brief overview of how states incorporate hybrid and electric vehicles into their transportation funding structure. Equity impacts, incentive programs, and how the fees compare to estimates of lost revenue are also discussed.

Hybrid and Electric Vehicles

There are variations between makes and models, but hybrid and electric vehicles fall into the following three main categories.

- Hybrid Electric Vehicles (HEVs)
- Plug-in Hybrid Electric Vehicles (PHEVs)
- All-Electric Vehicles (EVs)

Powered by an internal combustion engine, hybrid electric vehicles use gasoline or alternative fuel and an electric motor that uses recaptured energy stored in a battery. Energy that would be lost during breaking or coasting is captured through regenerative braking technologies. This stored energy is then used to assist in acceleration, and for some models, can be the sole power source for traveling short distances or at low speeds. Plug-in hybrid electric vehicles are also powered by an internal combustion engine that uses gasoline or alternative fuel and an electric motor; however, the electric battery can be charged using an outlet or an electric power source. Plug-in hybrids can operate using gasoline only, electricity only, or a combination of the two, and depending on the battery capacity, some plug-in electric vehicles can travel more than 70

¹ Oil consumption data is from the U.S. Energy Information Administration (EIA). For more information, see http://www.eia.gov/energyexplained/index.cfm?page=oil_use.

miles using only electricity. Lastly, all electric vehicles use solely electricity, are charged using an outlet or other electric power source, and can travel up to about 100 miles on a fully charged battery.²

There are several unique benefits and costs related to hybrids, plug-in hybrids, and all-electric vehicles. Vehicles that are propelled in part or solely by electricity are associated with lower tailpipe emissions and reduce oil consumption in the transportation sector. Yet the electricity for plug-in vehicles stems from the power grid, so total environmental benefits depend on the source of electric power used (e.g., coal, natural gas, nuclear, or renewable sources). Energy portfolios and resources vary by states, so well-to-wheel emissions depend on geographic location. For example, a plug-in vehicle in West Virginia, a large coal producing state, will not realize as much emission reduction as a vehicle in Washington state, which utilizes more renewable energy sources. Additionally, wide-spread adoption of hybrid and electric vehicles require investments in infrastructure (i.e., the availability of public charging stations) and depend on vehicle prices which are often higher compared to their conventional counterparts. Thus, at both the federal and state level, various incentives have been implemented to promote and accelerate the adoption of hybrid and electric vehicles. For qualified plug-in hybrids and electric vehicles purchased after 2009, there is a federal tax credit up to \$7,500 that is based on battery capacity and weight. At the state level, examples of incentives include tax credits and exclusions, rebates, HOV lane access, free parking, and exemptions from emissions inspections. However, states are simultaneously faced with a negative side consequence—reduced gasoline tax revenue from hybrid and electric vehicles.

Transportation Funding: Hybrid and Electric Vehicle Fees

Gasoline taxes are the primary revenue source for transportation infrastructure funds. Inflation and fuel economy gains, coupled with stagnant gasoline tax rates, are the primary causes of strained roadway funding. However, the adoption of hybrid and electric vehicles also dampens gas tax revenues through decreased fuel consumption. (Despite the reduced revenue, these vehicles impose inconsequential damage to roads.) Overall, electric vehicles represent a small percentage of vehicles on the road. For example, in 2015, HEVs, PHEVs and EVs accounted for 2.2 and 0.7 percent of light vehicle sales, respectively.³ In Tennessee, electric vehicles represented 0.28 percent of vehicles on the road in 2013.⁴ Long-term market saturation will likely be gradual as well. Hybrids and plug-in electric vehicles are projected to account for just 2.8 and 1.8 percent of the light-duty vehicle stock in 2025.⁵ Currently, ten states have passed legislation that require hybrid or electric vehicle owners to pay annual fees on top of regular

² For further details on hybrid and electric vehicles, see the U.S. Department of Energy, Energy Efficiency and Renewable Energy, Alternative Fuels Data Center (<http://www.afdc.energy.gov/>) and fueleconomy.gov.

³ Hybrid and plug-in electric vehicle sales data is available at the U.S. Department of Energy, Energy Efficiency and Renewable Energy, Alternative Fuels Data Center (<http://www.afdc.energy.gov/>) and is also reported in the Transportation Energy Data Book: Edition 35 (2016), Table 6.2 which is prepared for the Vehicle Technologies Office, Office of Energy Efficiency and Renewable Energy, U.S. Department of Energy by Oak Ridge National Laboratory (<http://cta.ornl.gov/data/index.shtml>).

⁴ The share of electric vehicles on the road comes from proprietary data collected by IHS Automotive (<https://www.ihs.com/industry/automotive.html>) and presented by Inside EVs (<http://insideevs.com/exclusive-georgia-leads-us-ev-adoption-2014/>).

⁵ U.S. Energy Information Administration, Annual Energy Outlook 2016, Table 40, Light-Duty Vehicle Stock by Technology Type.

vehicle registration fees. Table 1 displays the states and their respective fees for hybrid and electric vehicles.⁶

Table 1. State Fees for Plug-In Hybrid Electric Vehicles and Electric Vehicles

	(1)	(2)
State	PHEV Fee	EV Fee
Colorado	\$50	\$50
Georgia	\$200 ^a	\$200
Idaho	\$75	\$140
Michigan	\$30 ^b	\$100 ^b
Missouri		\$75 ^c
Nebraska		\$75
North Carolina		\$130
Virginia		\$64
Washington	\$150 ^d	\$150
Wyoming		\$50

Source: U.S. Department of Energy’s Alternative Fuels Data Center. All fees are incurred on an annual basis, unless indicated differently, and are in addition to regular vehicle registration fees.

- a. The fee is optional for plug-in hybrid electric vehicles if the owner elects an alternative fuel vehicle license plate.
- b. PHEVs and EVs under 8,000 pounds are subject to this fee. PHEVs and EVs above 8,000 pounds pay \$100 and \$200, respectively.
- c. The fee applies to passenger, school bus, or commercial vehicles with a gross weight of 18,000 pounds or less.
- d. The fee applies to PHEVs with an all-electric range of at least 30 miles.

State fees on PHEVs and EVs range from \$30 to \$200 and \$50 to \$200. Nebraska’s statute for alternative fuel vehicle registration is vague and could apply to both electric vehicles and plug-in hybrid electric vehicles. They state the fee is required for vehicles that “operate on electricity, solar power, or any other source of energy not otherwise taxed under the state motor fuel tax laws.” It does not indicate whether a vehicle that operates on both types of fuel is subject to the fee.⁷ Five states levy a fee on both EVs and PHEVs: Colorado, Georgia, Idaho, Michigan, and Washington. Of these, Idaho and Michigan charge a fee on PHEVs that is lower than that of electric vehicles. Idaho’s fee is \$75 for PHEVs and \$140 for EVs. In Michigan, the fees are \$30 and \$100. Georgia charges the highest registration fee for non-commercial electric vehicles at \$200, which is an optional fee for plug-in hybrid electric vehicles. The benefit to paying the fee

⁶ Although not discussed here, many states also impose taxes on alternative fuels (e.g., compressed natural gas, liquefied natural gas, liquefied petroleum gas, etc.). In Tennessee, there is a \$0.14 per gallon use tax on liquefied gas for motor vehicles, excluding gasoline, diesel fuel, and compressed natural gas. Compressed natural gas (CNG) for motor vehicles is taxed at \$0.13 per gallon.

⁷ Nebraska Revised Statute for alternative fuel and motor vehicle fuel can be found here: <http://nebraskalegislature.gov/laws/statutes.php?statute=60-306> and <http://nebraskalegislature.gov/laws/statutes.php?statute=66-482>.

for hybrids includes access to high occupancy vehicle (HOV) lanes and high occupancy toll lanes, regardless of the number of passengers.

Most states with additional registration fees on electric vehicles and plug-in hybrid electric vehicles simultaneously have incentives for such vehicles. Two exceptions are Nebraska and Wyoming. Colorado, Idaho, Michigan, North Carolina, Virginia, and Washington exempt PHEVs and EVs from emissions testing. Tax credits are available for qualifying EVs and PHEVs in Colorado. Georgia also offers an income tax credit for owners who purchase new commercial medium or heavy duty alternative fuel vehicles (including electricity) that use at least 90 percent alternative fuel. Taxpayers must keep their vehicles registered in Georgia for a minimum of five years to qualify. A time-of-use electricity rate for residential customers who own an EV or PHEV is available by individual power providers in Georgia and Michigan. Lansing BWL (Michigan), Indiana Michigan Power, and Puget Sound Energy (Washington) offer a rebate to residential customers who install Level 2 electric vehicle supply equipment used for charging EVs and PHEVs. Colorado, Georgia, North Carolina, and Virginia offer HOV lane exemptions to EVs and PHEVs. In order to use the HOV lanes, owners must have a specific license plate in Georgia and Virginia. Washington exempts new passenger cars, light-duty trucks, and medium-duty passenger vehicles that are dedicated alternative fuel vehicles, including EVs and PHEVs with an all-electric range of 30 miles or more, from motor vehicle sales and use taxes.

Two states offer reduced vehicle registration fees for electric vehicles – Connecticut and Illinois. A biennial fee of \$38 is the total registration fee for an EV in Connecticut. In Illinois, an EV may register for a discounted registration fee of \$35 for a two-year registration or pay \$18 each year. To qualify, an EV must weigh less than 8,000 pounds. Both states offer emissions inspection exemptions. Connecticut offers a rebate for the purchase or lease of EVs and PHEVs that vary depending on battery power capabilities. Illinois Electric Cooperative provides owners of EVs and PHEVs a time-of-use electricity rate and even offers loan financing for EV purchases at a rate of 0.5 percent for 60 months.

States implement these fees primarily as a matter of fairness and to raise modest revenues for roadway funding. Gas taxes have traditionally operated as a user fee system. Drivers pay a tax on fuel consumption (cents per gallon) which roughly corresponds to roadway usage. Drivers of more fuel efficient vehicles pay taxes, albeit less, on their fuel consumption. Yet drivers of all-electric vehicles do not pay any fuel taxes. Light vehicles generally impose little damage on roadbeds. But more drivers do affect congestion costs, including roadway safety.

Some states are exploring alternative ways to raise transportation revenues that would be more equitable. For example, three states (Washington, Oregon, and Iowa) have tried pilot programs that charge drivers based on vehicle miles traveled (VMT). Charging drivers based on VMT would alleviate the disparities in gas tax revenues between drivers of electric vehicles and traditional gasoline-powered vehicles. Yet, there are hurdles in implementing VMT programs state-wide in that they can create new costs compared to the already established collection methods for fuel taxes and vehicle registration fees. Additionally, charging drivers based on VMT may introduce privacy concerns, and using VMT alone does not account for vehicle weight which is the source of roadway damage. Two vehicles may drive the same miles, but a significantly heavier vehicle will impose more wear and tear on the roadway system.

The complexity of such alternatives may be why some states are opting to implement a simpler, annual flat fee for electric vehicle drivers. Comparable fees would be equivalent to the foregone gas taxes that drivers would otherwise pay for an equivalent gasoline-powered vehicle. To illustrate, we use state gasoline tax rates and average fuel consumption for light vehicles to provide an estimate of revenue loss per vehicle (see Table 2). Actual revenues raised will in practice depend on the type of vehicle, fuel efficiency, driver behavior, vehicle miles traveled, etc.

For states that add an additional fee for hybrid and electric vehicles, state gas tax rates are presented in Column 1 of Table 2. Column 2 lists the total gas tax rates (i.e., the state and federal rates combined). Assuming average consumption of 527 gallons of fuel per vehicle per year, the revenue raised per vehicle from state gas taxes, federal gas taxes, and total gas taxes are shown in Columns 3, 4, and 5 respectively.⁸ Lastly, state fees for electric vehicles are listed in Column 6. Washington, which has the second-to-highest excise tax on gasoline in the U.S., generates the most revenue per vehicle. On the other hand, Missouri, which has the fourth lowest gas tax rate in the U.S., raises the least amount of revenue per vehicle. For the federal government, the average revenue loss is estimated to be about \$97 per vehicle per year. For the states with fees, revenue losses per vehicle range from \$91 to \$261, with an average of about \$154. In comparison, annual fees for electric vehicles range between \$50 and \$200, with an average of about \$103. Tennessee's excise tax on gasoline is 21.4 cents per gallon⁹ which generates an average of \$113 per vehicle in gas tax revenues. Tennessee does not currently impose any additional fees for hybrid or electric vehicles.

When considering state and federal gas tax revenues together, annual fees for electric vehicles in all states are less than what drivers typically pay in gas taxes. When focusing specifically on state gas tax revenues, all states, with the exception of Georgia, have fees that are less than typical revenues per vehicle. On average, fees are \$50 less than state revenues raised from gasoline-powered vehicles. The disparity is the greatest for Washington, which has a \$150 fee for electric vehicles, and average drivers pay \$261 in state gas taxes. Georgia is the only state where the fee exceeds typical revenues raised by the state. Georgia's annual fee for electric vehicles is \$200, \$36 above what drivers typically pay per vehicle (\$164). Therefore, states that have chosen to implement additional fees for hybrid or electric vehicles may not be fully recouping revenue losses, and annual fees are generally less than what drivers typically pay in gas taxes. This could be done for a number of reasons, including environmental concerns and efforts to jump-start the alternative fuel vehicle industry.

⁸ Revenue losses are calculated by multiplying the gas tax rate by the average gallons of fuel consumed per vehicle per year (527 gallons). The federal gasoline tax rate is 18.4 cents per gallon. State gas tax rates are according to the American Petroleum Institute (API) and are effective rates as of 11/1/2016. A weighted average using population is used when tax rates vary across a state. Average annual vehicle miles traveled, miles per gallon, and gallons of fuel consumed are from the U.S. Department of Transportation, Federal Highway Administration, 2014 Highway Statistics, Table VM-1.

⁹ Tennessee's gasoline tax of 21.4 cents per gallon includes a one cent petroleum fee and a 0.4 cent environmental assurance fee.

Table 2. State Gas Tax Rates, Estimate of Revenue per Vehicle, and Electric Vehicle Fees

	(1)	(2)	(3)	(4)	(5)	(6)
State	State Gas Tax Rate	Total Gas Tax Rate (State and Federal)	Revenue Loss for State Gas Taxes (per vehicle)	Revenue Loss for Federal Gas Taxes (per vehicle)	Total Revenue Loss (per vehicle)	Annual Fees for Electric Vehicles
Colorado	\$0.220	\$0.404	\$116	\$97	\$213	\$50
Georgia	\$0.312	\$0.496	\$164	\$97	\$261	\$200
Idaho	\$0.330	\$0.514	\$174	\$97	\$271	\$140
Michigan	\$0.316	\$0.500	\$167	\$97	\$264	\$100
Missouri	\$0.173	\$0.357	\$91	\$97	\$188	\$75
Nebraska	\$0.267	\$0.451	\$141	\$97	\$238	\$75
North Carolina	\$0.343	\$0.527	\$181	\$97	\$278	\$130
Virginia	\$0.224	\$0.408	\$118	\$97	\$215	\$64
Washington	\$0.494	\$0.678	\$261	\$97	\$358	\$150
Wyoming	\$0.240	\$0.424	\$127	\$97	\$224	\$50
<i>U.S. Average</i>	\$0.305	\$0.489				

Concluding Thoughts

Ten states have introduced fees for hybrid or electric vehicles in addition to regular registration fees. Many worry that these additional fees will discourage consumers from purchasing greener vehicles. However, we found that almost all states, with the exception of Georgia, had fees that were less than what typical drivers of fuel-propelled vehicles pay in gas taxes. Moreover, many of these states provide multiple incentives for drivers of hybrid or electric vehicles which outweigh the cost of the additional fees. Even excluding state incentives, the federal tax credit for qualified vehicles of \$7,500 greatly exceeds the cost of the fees. Foregone revenues from electric vehicles are not states' leading issue in transportation funding challenges as the share of hybrid and electric vehicles on the road are minuscule. But collecting such fees strives to establish a more fair and equitable approach to collecting revenues for roadway users.