Electric Vehicles and State Funds

Current Contributions in Massachusetts and Long-Term Solutions to Transportation Funding

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Acadia Center
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Overview

Electric vehicles are a practical, commercially available option that allow consumers to reduce their carbon footprint and lower their driving costs. In Massachusetts, electric vehicles ("EVs") are about 70 cents cheaper to drive on a per-gallon equivalent basis at current fuel prices, have lower maintenance costs, and cut greenhouse gas (GHG) emissions 75% compared to conventional vehicles. EVs also produce no hazardous tailpipe emissions, such as nitrogen oxides, reducing the public health impacts of transportation. Massachusetts has begun to embrace EVs and their myriad benefits: by providing rebates for EVs, recently expanded to include a low income pilot program; by developing a fast charging corridor along the Mass Pike; and by joining with other Northeast states in the zero-emission vehicle ("ZEV") memorandum of understanding that set the goal of growing ZEVs in the Commonwealth, including EVs, to 300,000 cars by 2025.[1]

In the last legislative session, Massachusetts passed a law requiring the state's Department of Transportation ("MassDOT") to study whether it is advisable to levy surcharges on ZEVs to offset their limited contributions to the state gasoline tax.[2] Some lawmakers are concerned that the gas tax doesn't facilitate equitable contributions to transportation funding from all vehicle types, which will be necessary as EV sales continue to increase—although EVs only made up about 1% of sales in 2017, sales of EVs increased about 41% every year from 2013 to 2016.[3]

Looking only at the gas tax gives too narrow a view, however, as vehicle ownership and operation contribute to multiple state revenue streams. To address the concerns raised by the Legislature and provide a more complete analysis, Acadia Center examined current payments made by EVs to the most relevant categories of taxes. **The results demonstrate that fully electric consumer EVs currently pay about 20% more to state programs than average conventional sedans over their lifetime through higher sales and excise taxes.** This analysis also shows that the higher sales taxes paid by electric vehicles help compensate for their lack of gas tax payments, since vehicle sales tax is pooled in the Commonwealth Transportation Fund (CTF) with the gas tax for infrastructure maintenance. **All vehicle types considered made similar lifetime contributions to the CTF, within 6%, for models under $60,000.**

This new analysis demonstrates that it is not necessary or fair to assess higher fees on EVs in the short term. These fees will not significantly impact transportation funding in the state, given the currently low EV market penetration; however, additional EV fees could significantly hinder growth of the EV market that is critical for the state to meet its requirements under the Global Warming Solutions Act. In the near-term, transportation funding shortfalls will be most fairly addressed through transportation-climate policy, such as a regional cap-and-invest program. In the longer term, when EVs are closer to purchase-price parity with conventional vehicles and make up a greater share of registered vehicles, a consumption-based energy-equivalent surcharge on all alternative fuels, including electricity and hydrogen, could be considered to ensure equitable contributions to transportation funding from all Massachusetts drivers.

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[1] ZEVs include fully electric vehicles, plug-in hybrid electric vehicles (PHEVs) that can also run on gasoline, and hydrogen fuel cell vehicles.

[2] Section 5 of Ch. 448 of the Acts of 2016.

[3] Massachusetts: Pathway to 2030, available here: http://2030.acadiacenter.org/wp-content/uploads/2018/02/Acadia-Center_EnergyVision2030_MA-Target-Summary_20180130-1.pdf

Current EV Contributions

The Commonwealth Transportation Fund

The Commonwealth Transportation Fund ("CTF") is a critical component of transportation funding in Massachusetts. The CTF is used to fund operations of MassDOT and debt service on highway maintenance and construction projects.[4] Motor fuels taxes, including the gasoline tax, diesel tax, and aviation fuel tax, account for about 40% of the revenue of the CTF. The motor vehicle sales tax and other fees collected by the Registry of Motor Vehicles, such as driver's license fees, registration fees, and vehicle title fees, comprise another 50% of revenues.[5]

Municipal Excise Taxes and Tolls

Beyond the CTF, all vehicles pay annual excise tax to their municipality, which is often used for the maintenance of local roads. Excise taxes are based on the original manufacturer's suggested retail price ("MSRP") of the car, adjusted for depreciation, and are assessed at $25 for every $1000 of value.[6] Tolls are another contribution all drivers pay that fund operations of MassDOT, although they are not deposited into the CTF. Tolls are another important funding source that are excluded here, since they depend on the driving route, not the vehicle type, and can be assumed to be equal between conventional, hybrid, and EV drivers.

Electric Sector Contributions

Beyond traditional transportation taxes and fees, EVs also contribute to important public policy programs through electricity rates, pay electricity sales taxes in some circumstances, and help lower electricity rates. First, EVs contribute to the renewable energy and energy efficiency programs in the Commonwealth, and electricity generation is covered by the Regional Greenhouse Gas Initiative. Second, Massachusetts exempts residential and small business electric bills from sales and use tax, but EVs charged away from the home at larger commercial and industrial facilities are subject to this additional collection in some cases.[7] In addition, EVs help pay for the costs of the electric system, which lowers the rates paid by all electric customers, regardless of whether they own an EV. This analysis does not include any of these electric sector contributions from electric vehicles.

Analysis

The primary argument supporting higher EV and hybrid vehicle registration fees is that these vehicles do not contribute equitably to the CTF through the gas tax. However, this narrow view does not account for the contribution made to the CTF through the sales tax. Since the purchase price of standard EVs and hybrids is greater than conventional sedans (Table 1), these alternative fuel vehicles pay hundreds of dollars more in sales tax on average. Comparing the lifetime CTF contribution from standard EVs, plug-in hybrids, gasoline-only hybrids, and conventional sedans, all contribute about equally—within 6%.

Examining transportation funding only through contributions to the CTF does not account for payments made by EVs through higher excise tax payments compared to conventional vehicles (Table 1). These payments further increase the annual and lifetime total fiscal contributions of EVs compared to conventional cars, with standard fully electric vehicles paying 20%, or nearly $1,000, more over their lifetimes.

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[4] http://www.mass.gov/bb/h1/fy15h1/bal_15/hfundbal4.htm

[5] https://www.massdot.state.ma.us/Portals/0/docs/infoCenter/financials/FY_2015.pdf#page=10 (see page 10). Vehicle sales tax makes up about 25% of the CTF revenues and RMV fees make up another 25%.

[6] https://www.mass.gov/guides/motor-vehicle-excise

[7] https://www.mass.gov/guides/sales-and-use-tax

Table 1. Annual and Lifetime Contribution of Different Vehicle Types to Taxes and Other Programs[8]

	Average Conventional Sedan	Hybrid Vehicle	Average PHEV <$60k[9]	All-Electric Vehicle <$60k	All-Electric Vehicle >$60k
Average Purchase Price	$20,347[10]	$27,357[11]	$32,304[11]	$34,887[11]	$73,067[11]
Annual Gas Tax Contribution[12]	$93	$54	$33	$0	$0
Annual Average Excise Tax over Lifetime[13]	$142	$191	$225	$243	$510
Total Average Annual Contribution	**$235**	**$245**	**$259**	**$243**	**$510**
Lifetime RMV Fees[14]	$1,035	$1,035	$1,035	$1,035	$1,035
Sales Tax[15]	$1,272	$1,710	$2,019	$2,180	$4,567
Total Lifetime Contribution	**$5,126**	**$5,688**	**$6,160**	**$6,137**	**$11,721**
State Purchase Rebates[16]	$0	$0	-$1,814	-$2,500	-$1,000
Total Lifetime Contribution Less Rebates	**$5,126**	**$5,688**	**$4,346**	**$3,637**	**$10,721**
Total Lifetime Contribution to CTF[17]	$3,422	$3,397	$3,455	$3,215	$5,602

Green rows indicate CTF contributions.

[8] Vehicle lifetime assumed to be 12 years. *See e.g.:* http://www.autonews.com/article/20161122/RETAIL05/161129973/average-age-of-vehicles-on-road-hits-11.6-years. Additional assumptions can be found in Table A-1 in the Appendix.

[9] Massachusetts' EV Rebate program MOR-EV provides different rebates for vehicles above and below $60,000. Weighted average MSRPs are provided for each category of fully electric EVs. For plug-in hybrid EVs, only models less than $60,000 were considered.

[10] Represents the weighted average base-model MSRP for the top ten best-selling conventional sedans from here: http://focus2move.com/usa-best-selling-cars/). MRSPs were obtained from NADA here: http://www.nadaguides.com/Cars/Compare-Cars).

[11] Represents the sales-weighted average base-model MSRP for each vehicle class based on 2017 sales data. Models considered comprised 1% or greater of sales for the vehicle type in 2017 (available here: https://insideevs.com/monthly-plug-in-sales-scorecard/ and here: http://www.hybridcars.com/december-2017-dashboard/). MSRPs were obtained from NADA here: http://www.nadaguides.com/Cars/Compare-Cars).

[12] Currently $0.240 per gallon. *See:* http://www.mass.gov/dor/all-taxes/fuels/

[13] Excise tax was calculated annually using the Massachusetts depreciation schedule and mil rate of .025. The value presented is the average annual value paid over the 12-year vehicle life. *See:* https://www.sec.state.ma.us/cis/cispdf/Motor_Vehicle_Excise.pdf

[14] Sum of the $60 biannual registration fee, the $75 one-time certificate of title fee, the $35 annual vehicle inspection fee, and the average total driver's license fees of $75 paid every 5 years.

[15] Based on the Massachusetts sales tax of 6.25%.

[16] Purchase rebates of up to $2500 are offered for fully electric and plug-in hybrid electric vehicles in MA. The actual rebate amount is based on battery size and MSRP of the vehicle. The value provided for PHEVs is the sales-weighted average rebate of vehicles sold nationally in 2017.

[17] Includes gas tax contributions, RMV fees, and sales tax.

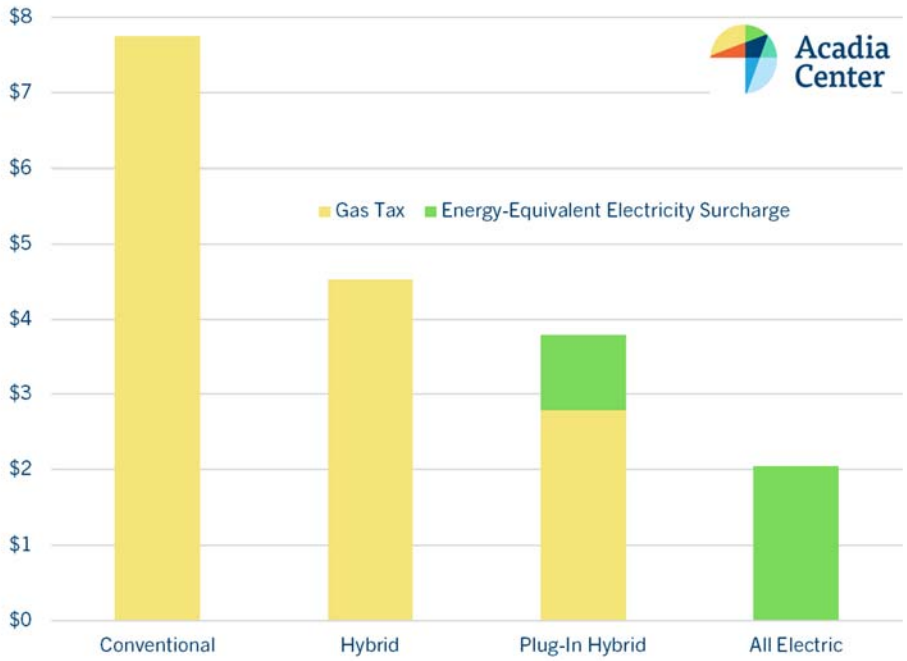
Lastly, it is important to note that Table 1 only calculates tax and other monetary contributions of electric vehicles; public health, environmental, and economic benefits of EVs should also be considered in a comprehensive analysis of transportation funding.

Long-Term Transportation Funding through an Energy-Equivalent Surcharge

In the longer term, EVs will be closer to cost parity with conventional vehicles, reducing the sales and excise tax premiums paid by EV drivers. At this future stage, consumer-friendly mechanisms to ensure equitable and sustainable contributions to transportation funding will need to be developed. One option is to phase in an energy-equivalent surcharge, which would apply across all transportation fuels not currently taxed (e.g., electricity and hydrogen) on a per-energy-unit basis (e.g. per British thermal unit or "BTU"). An energy-equivalent surcharge could operate like the gas tax, with the surcharge assessed when the vehicle refuels. For an EV, the energy-equivalent surcharge could be assessed per kilowatt hour of electricity.

An energy equivalent surcharge can be calculated by determining the current cost per BTU of the gas tax (Equation 1, Appendix) and then converting the cost per BTU to a unit of an alternative fuel—in the case of electricity, the cost per BTU would be converted to cost per kilowatt hour of electricity (Equation 2, Appendix).[18] Applying the energy-equivalent electricity surcharge to the average consumption of a fully electric or plug-in hybrid EV would result in a monthly electricity cost of about $1 to $2 (Figure 1). Electric vehicles use energy more efficiently than conventional vehicles, so the average payment per month can fairly be lower.

Figure 1. Monthly Gas Tax and Energy-Equivalent Electricity Surcharge Payments



An energy-equivalent surcharge has many benefits as a long-term solution to transportation funding. First, it is assessed on consumed fuel, in the same manner as the existing gas tax, and the level of the surcharge can be explicitly linked to the level of the gas tax. This type of variable assessment maintains a driver's ability to decrease transportation costs by driving less or by purchasing a more efficient vehicle, unlike an annual fixed registration

[18] *See:* D. L. Greene, Transportation Research Part D, 16, 2001, 451-458.

fee. The energy-equivalent surcharge also reflects that electric vehicles use energy more efficiently than conventional vehicles, with the energy-equivalent surcharge resulting in about $24 annually for fully electric EVs compared to $93 of gas tax paid annually for a conventional vehicle. This is no different than the current gas tax, where a gas guzzler pays more gas tax per mile than a fuel-efficient vehicle. This difference in annual cost also highlights that EV registration fees of $150-$250, as proposed in other states,[19] would overburden EVs compared to conventional vehicles, especially when considering current sales tax contributions to the CTF and the other significant fiscal contributions of EVs.

In addition to EV registration fees, another option that has been proposed for collecting revenue for electric vehicles is a tax per mile traveled, or a vehicle mile traveled (VMT) fee. While this option would allow a driver to lower costs by driving less, it would not necessarily allow a driver to lower costs by purchasing a higher efficiency vehicle. An energy-equivalent surcharge also has the benefit of being similar to the current gas tax, and it would avoid the consumer privacy concerns expressed by some because it tracks only fuel consumption, not travel.

While an energy-equivalent surcharge might be the most equitable solution for long-term transportation funding, there are still implementation challenges that must be addressed. By applying the energy equivalent surcharge to electricity for EVs, this electric consumption would have to be measured separately from other uses. Because a designated utility-grade meter would likely be cost-prohibitive for wide-scale deployment in the near future, lower cost options for metering such as using an EV's on-board systems or an electric sub-meter are viable but would need official approval. Beyond metering, the initial collector of the energy-equivalent surcharge, before it is transferred to the CTF, will also need to be determined. One candidate is electric utilities, which have an advantage given their management of electric billing but would be new to administering transportation funding. Other entities such as the Department of Transportation, charging station operators, or auto manufacturers could also be considered as initial collectors. Determining an implementation strategy in the near-term would enable timely deployment of an energy-equivalent surcharge when EVs reach market maturity.

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[19] *See, e.g.,* An Act To Ensure Equity in the Funding of Maine's Transportation Infrastructure by Imposing an Annual Fee on Hybrid and Electric Vehicles, available here: http://legislature.maine.gov/bills/display_ps.asp?snum=128&paper=HP1252&PID=1456

Appendix

Table A-1. Underlying Assumptions for Annual and Lifetime Contributions

	Average Conventional Sedan	Hybrid Vehicle	Plug-In Hybrid Vehicle	All Electric Vehicle
Fuel Efficiency (Miles per Gallon)[20]	31	53	44	n/a
Percent Travel Using Gasoline	100%	100%	51%	0
Average Annual Gasoline Mileage	12,000	12,000	6,120	-
Annual Gasoline Consumption (Gallons)	324	226	139	-
Average Annual Electric Mileage	-	-	5,880	12,000
Annual Electric Consumption (kWh)[21]	-	-	1,764	3,600

Energy Equivalent Surcharge Calculations

Gas tax per BTU: $0.24/gallon ÷ 120,476 BTU/gallon of gas = $2x10^{-6}/BTU [1]

Per-BTU tax applied to electricity: $2x10^{-6}/BTU × 3412 BTU/kWh = $0.00680/kWh [2]

[20] Conventional sedan efficiency considers the sales-weighted average of the top ten best-selling 2017 sedan models. Hybrid vehicle efficiency and plug-in hybrid efficiency considers the 2017 sales-weighted average of vehicles with greater than 1% of total sales and an MSRP less than $60,000 for gasoline-only efficiency from EPA's fueleconomy.gov.

[21] Based on the 2017 average EV efficiency of 0.3 kWh/mi. *See:* https://www.fueleconomy.gov/feg/pdfs/guides/FEG2017.pdf