



Electric Vehicles: Are the Costs Worth the Benefits?

Battery electric vehicles have grown in popularity over the last decade, primarily due to their tax incentives and perceived environmental benefits that steer car buyers away from gas-fueled vehicles. However, as this ConsumerGram shows, the environmental benefits from using electric vehicles are far overstated, which means that incentives designed to encourage electric vehicle ownership may be having adverse consequences on society that outweigh these benefits.

Higher Costs

Cost is an important factor for car buyers. Empirical evidence shows that electric vehicles are costlier to purchase and to insure. According to a study by Arthur D. Little (ADL), the 20-year cost of ownership of an electric vehicle runs \$20,000 to \$32,000 more than a conventional compact and mid-sized vehicle, respectively.¹ Put into perspective, a compact electric vehicle costs 44% more and a mid-size electric vehicle costs 60% more than their gas-fueled counterparts.

Outside of the direct costs of owning a vehicle there are indirect costs to consider. Electric vehicles take a substantially longer time to recharge, sometimes all day, compared to conventional vehicles, which represents lost time and money. In addition, because electric vehicle purchasers receive tax credits, these subsidies represent an opportunity cost to society. The next section discusses more about these subsidies and those who benefit.

¹ "Battery Electric Vehicles vs. Internal Combustion Engine Vehicles: A United States-Based Comprehensive Assessment," Arthur D. Little, November 29, 2016, (this study is referred to herein as ADL), p. 9, figures 10 and 11, http://www.adlittle.us/uploads/tx_extthoughtleadership/ADL_BEVs_vs_ICEVs_FINAL_November_292016.pdf.

Subsidies: Welfare for the Rich

There are a variety of state and federal tax incentives available to electric car buyers and the amount of these tax subsidies has varied over the last decade. As one government report cited, car buyers can qualify for up to \$7,500 in federal tax credits for buying an electric vehicle and, at various times, these car buyers have qualified for an extra \$2,000 for installing their own electric charging stations. Additionally, electric vehicle purchasers may qualify for state tax credits up to \$5,000.² In many cases, taxpayer and ratepayer dollars are being spent to deploy public charging stations.

Who are the electric vehicle owners that benefit from these subsidies? Empirical evidence shows that electric vehicle owners tend to have much higher incomes than other consumers and, among electric car owners, high-income purchasers receive the bulk of the electric car subsidies.³ For example, one study showed that \$6 of every \$10 of electric vehicle subsidies went to households in the top income quintile (top 20%) – specifically, households earning over \$200,000 per year – while only 10% of electric vehicles subsidies went to households earning less than \$75,000 per year.⁴ As a point of comparison, median income for all US households was \$56,516 in 2015.⁵ In other words, most consumers and taxpayers cannot afford to buy an electric vehicle. Among electric vehicles owners, most of the subsidies go to those with the highest incomes.

To recap, various state and federal tax credits advantage those with electric vehicles at the expense of those without electric vehicles, with most of the subsidies going to those with

² James Hamilton, “Green Jobs: Electric Vehicles,” U.S. Bureau of Labor Statistics, Report 4, September 2011, p. 2, https://www.bls.gov/green/electric_vehicles/electric_vehicles.pdf.

³ See Jim Gorzelany, “Electric-Car Buyers Younger and Richer than Hybrid Owners,” *Forbes*, April 22, 2014, <http://www.forbes.com/sites/jimgorzelany/2014/04/22/electric-car-buyers-younger-and-richer-than-hybrid-owners/#7576de63ad32>; Sephen Edelstein, “Most Electric-Car Tax Credits Benefit Highest-Income Households,” *Green Car Reports*, July 8, 2015.

⁴ Severin Borenstein and Lucas W. Davis, “The Distributional Effects of U.S. Clean Energy Tax Credits,” NBER Tax Policy and the Economy, University of Chicago Press, July 2015.

⁵ See Bureau of Census, at <https://www2.census.gov/programs-surveys/cps/tables/time-series/historical-income-households/h17.xls>, data for 2015.

the highest incomes. These explicit and implicit subsidies represent welfare for the rich at the cost of all taxpayers.

Contribution to Greenhouse Gas Emissions

While consumers should feel good by helping the planet, the environmental benefits of electric vehicles are not as clean as often reported for two major reasons. First, to operate battery electric vehicles, they need to be charged and frequently, which means they rely on charging stations powered from the electrical grid – that is, powered most notably using fossil fuel energy. Second, because of the added emissions incurred in producing battery cells and packs, the emissions caused by manufacturing an electric vehicle far exceeds the emissions caused by manufacturing a conventional vehicle of similar size. This fact has been confirmed in several peer-reviewed papers and most recently in the ADL study. That study found that manufacturing a compact and mid-size electric vehicle will discharge 12 thousand and 17 thousand pounds more of CO₂ gases than manufacturing a comparable gas-fueled vehicle.⁶

When accounting for the energy and emissions from the manufacturing of battery cells and packs, as well as for recharging and replacing batteries over the life of a vehicle, electric car ownership is far from green. In fact, these vehicles tend to save on environmental emissions only if they are used intensively over their lifetime. The ADL study found mid-sized electric cars saved only 19% on CO₂ emissions over 20-years of use, and compact and mid-size electric vehicles saved (on average) 23%, assuming usage exceeding 150,000 miles.⁷ This may be an aggressive assumption, considering only 9% of vehicles survive after 20 years of use.⁸ If battery electric vehicles are not used intensively, they can contribute more to greenhouse gas emissions than a conventional gas-fueled vehicle. In fact, if every vehicle in the world were electric, the total reduction in carbon emissions would fall by only 1.8%.⁹

⁶ ADL, p. 12, figure 15.

⁷ Ibid.

⁸ Ibid, p. 4.

⁹ Holman W. Jenkins, Jr., "As Al Gore Told Donald Trump: Forget Climate Change, Green Handouts Have Become a Political End in Themselves," *Wall Street Journal*, December 9, 2016, <https://www.wsj.com/articles/as-al-gore-told-donald-trump-1481326892>.

The bottom line is that battery electric vehicles can be helpful in reducing emissions, but not to the degree commonly thought. Since not every electric vehicle on the road will turn out to be cleaner than its gas-fueled counterpart, policymakers do not know with certainty the full extent to which subsidies encourage less pollution.

Environmental Realities

Data showing emission savings from electric vehicles assume that buying an electric vehicle effectively eliminates a gas-fueled vehicle off the road. However, the reality is that owning an electric car does not always completely replace a conventional car. This can happen because electric vehicles have mileage limitations that require them to be frequently recharged. For example, the Ford Focus Electric's 2017 model has an increased range of 100 miles per charge.¹⁰ Because of this range limitation, electric vehicles are often unsuitable for long distance driving, which means that some consumers will hold onto their gas-fueled vehicles for longer trips. Thus, range limitations lead to an underutilization of electric vehicles and can make environmental benefits unachievable.

Alternatively, battery electric vehicles are well suited for shorter trips. In some localities, these vehicles are exempt of toll payments and high-occupancy restrictions, making them convenient and lower-cost for commuting to work. However, while these commuters may stop using their gas-fueled vehicles, they may also be deterred from using public transportation options and carpooling, which reduces the potential for environmental benefits. Thus, it is safe to assume that not all electric vehicles will benefit the environment, subsidized or not.

Increased Toxicity

The focus on greenhouse gas emissions, noted earlier, ignores how the manufacturing and use of various automobiles can produce other environmental consequences on humans.

¹⁰ John Voelcker, "Updating 2017 Ford Focus Electric: 100-Mile Range, DC Fast Charging," *Green Car Reports*, at http://www.greencarreports.com/news/1101359_updated-2017-ford-focus-electric-100-mile-range-dc-fast-charging.

Because electric batteries expose miners to metals like nickel, graphite and cobalt, and because they require electricity, they generate significantly more environmental toxins than conventional vehicles. Over a twenty-year period of operations, electric vehicles produce 20 days of lost life or disability, compared with only 6 days for conventional vehicles.¹¹ A National Bureau of Economic Research study found three times the level of environmental damage from secondary pollutants.¹²

Besides the negative consequences on human health, the toxicity impacts of electric vehicles on terrestrial animal and plant life are substantially worse than gas-fueled vehicles. In terms of the impact on freshwater plants and animal life, electric vehicles produced twice the toxicity as conventional vehicles. In short, the modest benefits of reduced carbon-dioxide emissions are traded off for adverse secondary environmental impacts.

Summary

At first glance, battery electric vehicles can have some environmental benefits, though empirical evidence suggests that these emission-reduction benefits are overstated in instances where vehicles are not being fully utilized. When compared to conventional vehicles, electric vehicles produce other pollution, including problems associated with increased toxicity on human health, as well as increased toxicity to terrestrial and freshwater life (see Table 1).

**Table 1: ADL Study Highlights
Comparing Electric to Gas-Fueled Vehicles¹³**

Impact Area	Electric Vehicles Have ...
Total Cost of Ownership	44% Higher Costs
Human Health Impacts	3 Times Greater Human Toxicity
Greenhouse Gas Emissions	23% Less Emissions

¹¹ ADL, p. 15, figure 18.

¹² S. Holland, E. T. Mansur, N. Muller and A. Yates, "Environmental Benefits from Driving Electric Vehicles?" National Bureau of Economic Research, NBER Working Paper No. 21291, June 2015.

¹³ ADL, figure 4.

As the table above shows, electric vehicles are substantially costlier to own. Attempts to make battery electric vehicles more affordable by providing subsidies and tax credits tend to benefit higher income consumers at the expense of lower-income consumers who cannot afford these vehicles. Even among electric vehicle owners, most of the subsidy (60%) goes to the income earners at the highest quintile (20%). For policymakers, incentives designed to encourage electric vehicle ownership can have adverse consequences on society that outweigh their benefits.

For consumers in the market for a new car, the negative economic and environmental consequences cast doubt on the value of electric vehicles compared to gasoline-powered vehicles. Consumers should weigh all the costs and benefits before making an informed decision based on what will improve their quality of life.