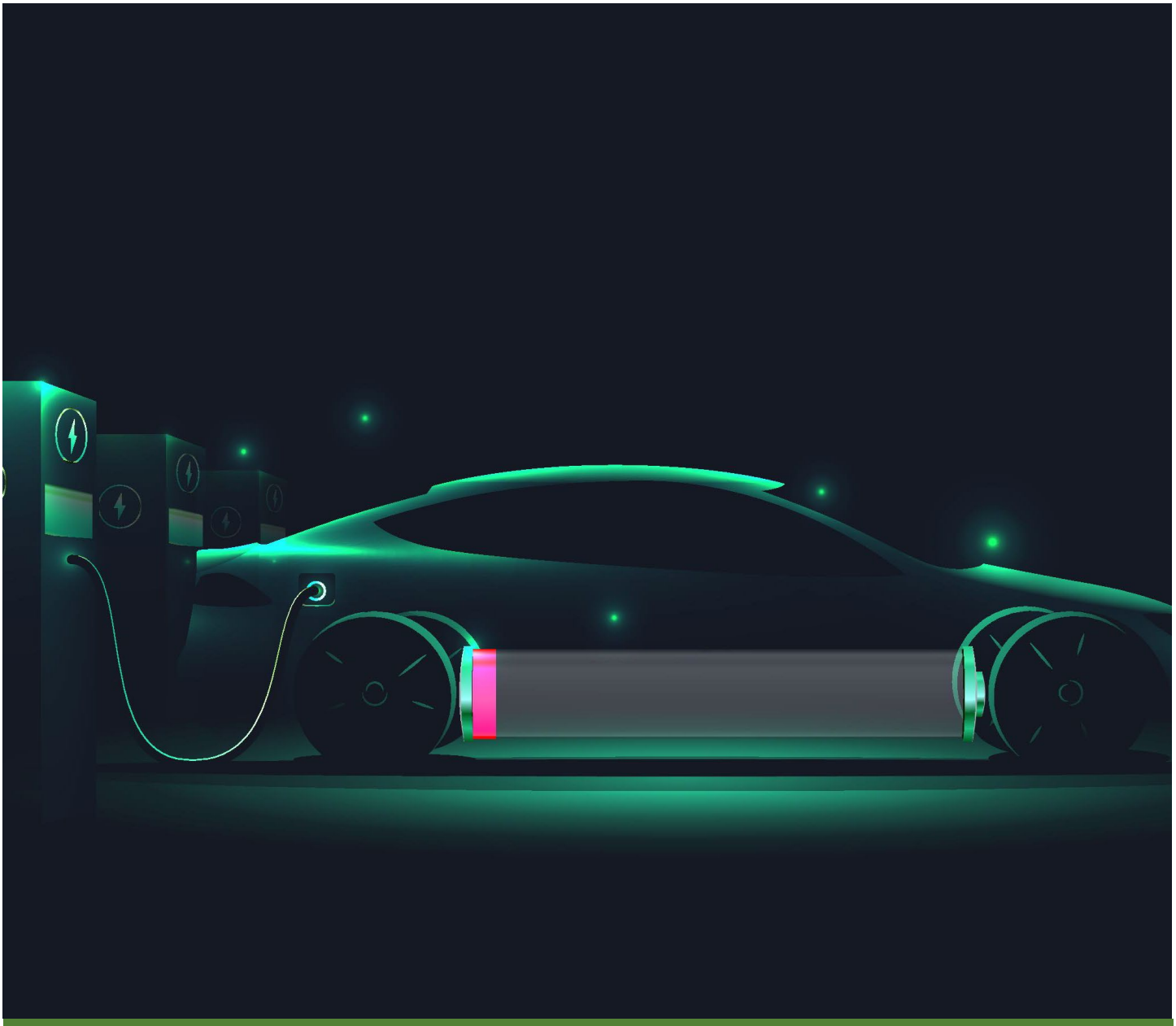

Exposing the EV Fantasy

The Real Cost of Electric Vehicles – Part 1

Robert Lyman

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Contents

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Exposing the Electric Vehicle Fantasy, Part 1 The Real Cost of EV's

Executive Summary

The Canadian federal government has set a series of targets for motor vehicle manufacturers to meet in their sales of light duty vehicles (cars, SUVs, and pickup truck). Zero-emission vehicles, including battery-electric, hydrogen fuel-cell and plug-in hybrid vehicles, must constitute at least 10% of sales by 2025, 30% by 2030 and 100% by 2040.

To meet these targets, the government has implemented several tax, subsidy, and regulatory measures. The media offer a seemingly endless series of articles claiming that the costs of electric vehicles are declining and sales rising so fast as to make the government's targets attainable. Car buyers, when considering whether to buy an electric vehicle, consider the cost of owning and operating one compared to that of a car powered by an internal combustion engine (ICE). What the consumer cannot see is the economic costs to all of society. In fact, in Canada and other countries, there is virtually no aspect of electric vehicle production, purchase and use that does not receive some form of subsidy. In this article, I will demonstrate this using the information available from Canada and the United States.

The notable subsidies include:

- Taxpayer funding of research and development specifically for EV's: U.S. federal R&D funding for EV's was U.S. $1.3 billion over the 2016-2019 period.
- The federal and Ontario governments have pledged a grant of $590 million to a Ford plant in Oakville to build EV's.
- The federal government gives EV manufacturers $30 million per year in tax breaks.
- The Obama Administration gave U.S. $2.4 billion in grants to support the development of electric vehicles and batteries.
- U.S. states also give large subsidies; Nevada provided subsidies totaling U.S. $1.2 billion to Tesla for the "Gigafactory"
- Taxpayers provide very generous subsidies in the form of rebates and tax credits to purchasers of EVs; the Canadian government provides $5,000 per vehicle and the U.S. government provides a tax credit worth U.S. $7,500 per vehicle. Additional subsidies are provided for the installation of recharging stations in homes, apartment buildings and places of work.
- Regulatory programs dictating the emissions-intensity levels that cars must reach provide that companies can avoid paying large fines for non-compliance by buying

"credits" from EV manufacturers; The total value of these cross-subsidies in the United States were about U.S. $1.1 billion in 2019 alone.

The actual costs that the car purchaser can see are higher for EVs than for cars with internal combustion engines, mainly because of the large capital cost of the initial purchase. In California, the difference is about U.S. $13,000 for a mid-range Tesla Model 3. The costs of EV batteries are now between U.S. $175 and U.S. $300 per kilowatt-hour. At $175 per kWh, the price of oil would have to triple from today's levels before the unsubsidized electric vehicle was cheaper to purchase and operate.

Who benefits from the taxpayer subsidies? According to studies in Canada and the United States, between 50% and 75% of the people who buy EVs would have done so without the subsidy. In the U.S., the vast majority of the subsidy provided by the federal Plug-in Electric Drive Motor Vehicle credit goes to the highest income earners, with the top 20% of income earners receiving 90% of the credit.

Proponents of electric vehicles sometimes claim that converting the entire light duty vehicle fleet to run on electricity will not increase the electricity generation and transportation costs to society. In fact, according to a study done by electrical engineer Kent Zehr, to provide the energy for complete conversion of the Canadian vehicle fleet would require more than 10,000 megawatts of additional electrical generation capacity, over five times the capacity that will be added by the Site C dam in British Columbia and the Muskrat Falls hydroelectric in Newfoundland combined. The costs of the additional generation capacity and transmission lines would be in the hundreds of billions of dollars if they could be built by 2040, which they cannot.

In sum, the thesis that electric vehicles are beneficial and affordable is based on misleading Canadians about their real economic costs. The federal government's 2040 target is neither desirable nor attainable on the grounds of cost alone. The other parts of this series will examine the environmental implications of seeking to electrify all vehicles and the probable trends in Canadian and global EV sales.

About the Author

ROBERT LYMAN *is an economist with 27 years' experience as an analyst, policy advisor and manager in the Canadian federal government, primarily in the areas of energy, transportation, and environmental policy. He was also a diplomat for 10 years. Subsequently he has worked as a private consultant conducting policy research and analysis on energy and transportation issues as a principal for Entrans Policy Research Group. He is a frequent contributor of articles and reports for Friends of Science, a Calgary-based independent organization concerned about climate change-related issues. He resides in Ottawa, Canada.* *Full bio.*

Exposing the Electric Vehicle Fantasy, Part 1

The Real Costs of EV's

> *Whatever your position on subsidies in general, it is hard to make the case that taxpayers should foot the bill to produce luxury cars marketed to the wealthiest Americans.*
>
> - *Dan Eberhart, Forbes*

The Canadian federal government has set ambitious targets for the sales of "zero emission passenger vehicles" in Canada. Zero-emission vehicles include battery-electric, hydrogen fuel-cell and plug-in hybrid vehicles. The goals are to reach 10% of light-duty vehicle sales by 2025, 30% by 2030 and 100% by 2040. This article, and its related ones that follow, will examine the implications of the government's measures intended to achieve these goals.

An important consideration for vehicle purchasers, and indeed for others, is the cost of electric vehicles, and how these costs compare to those of the competing vehicles powered by internal combustion (i.e. gasoline or diesel fuel) engines (ICEs). Most people, when considering which car to buy, look at the actual cost of buying it and operating it over its useful life. This ignores one of the major cost components – the value of the subsidies provided directly and indirectly by taxpayers and others to EV manufacturers. So, let us start there.

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The Range of Subsidies

There is virtually no aspect of electric vehicle production, purchase and use that does not receive some form of government assistance in Canada and in other countries. The following is a partial list based on the information available.

Research and Development

There are no estimates currently available on Canadian R&D expenditures on electric vehicles. The U.S. Department of Energy Office of Energy Efficiency and Renewable Energy receives funding for R&D on vehicle technologies, most of which goes to electric vehicle research. **The total R&D funding allocated for the 2016 to 2019 fiscal years inclusive was U.S. $1.3 billion.**

Production

The government of Canada does not report on the amount of public funding that goes to EV manufacturers. **Recently, the governments of Canada and Ontario pledged a grant of $590 million to the Ford plant in Oakville, Ontario to build EVs.**

https://www.huffingtonpost.ca/entry/ontario-ford-plant-electric-vehicles_ca_5f7f463ac5b6da9ba1ee20ff

The Canadian government provides tax incentives for EV manufacture in the form of the Accelerated Investment Incentive, implemented effective November 20, 2018. This tax incentive allows an accelerated capital cost allowance in the form of a 100% deduction for capital expenditures in the first year (Class 43.1) on specified clean energy equipment, including electric vehicle charging stations and battery storage. According to Finance Canada's 2020 Annual Report on tax expenditures, this tax break is worth about $30 million per year.

The Canadian industry also benefits indirectly from the funding provided by the United States federal government to affiliated companies. In 2011, President Barack Obama set the goal for the U.S. to become the first country to have one million electric vehicles on the road by 2015. **For this purpose, his administration pledged US $2.4 billion in federal grants to support the development of next-generation electric vehicles and batteries. The funds were allocated as follows: $1.5 billion in grants to U.S.-based manufacturers to produce highly efficient batteries and their components; up to $500 million in grants to U.S.-based manufacturers to produce other components needed for electric vehicles, such as electric motors and other components;** and up to $400 million to demonstrate and evaluate plug-in hybrids and other electric infrastructure concepts—like

truck stop charging stations, electric rail, and training for technicians to build and repair electric vehicles.

Other sources provide different estimates of the value of subsidies provided. According to Subsidy Tracker, an online source of information about U.S. federal and state subsidies to companies in different industries, **the total subsidies provided by U.S. governments to Tesla Motors is about $2.4 billion, more than half of which was provided by the state of Nevada to assure the construction of the Tesla Motors "giga-factory".**

https://subsidytracker.goodjobsfirst.org/parent/tesla-inc

Taxpayer-funded Incentives for EV Purchase

There are three grant programs to benefit EV purchasers at the federal and provincial government levels in Canada. These include:

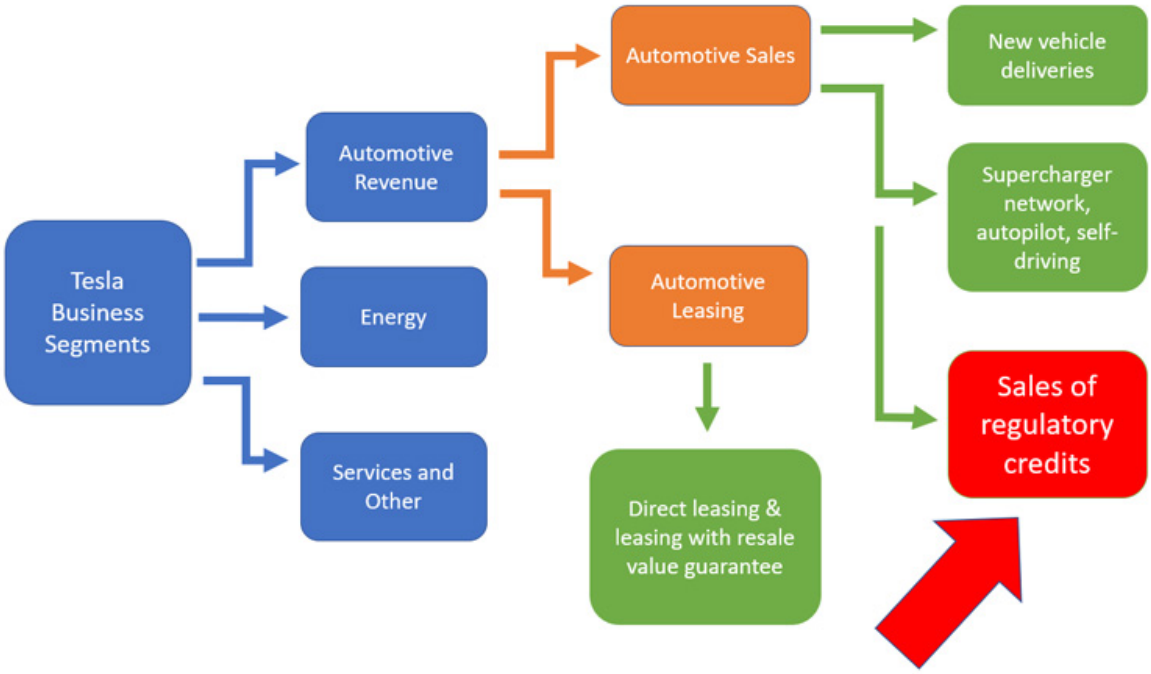
- The Federal Incentive for Electric Cars and Plug-in Hybrids. The subsidy (a rebate) amounts to $2,500 for an EV with a battery of less than 15 kWh and $5,000 for one with a battery of 15 kWh or more. The rebate applies to both purchases and leases.
- Quebec Incentive Program. A resident of Quebec can obtain subsidies of different levels for the purchase or lease of a 100% electric vehicle or plug-in hybrid. If the car is 100% electric, the subsidy is $8,000 if the manufacturers' suggested retail price (MSRP) is below $75,000 and $3,000 if the MSRP is above $75,000.
- British Columbia Incentive Program: A subsidy of $5,000 is available for B.C. residents who purchase a 100% electric vehicle and $2,000 to $5,000 for purchase of a plug-in hybrid.

Thus, purchaser of an EV in Quebec could receive up to $13,000 in subsidies from the federal and Quebec governments for the purchase of an EV.

Cross-subsidies Among Auto Companies imposed by Regulation

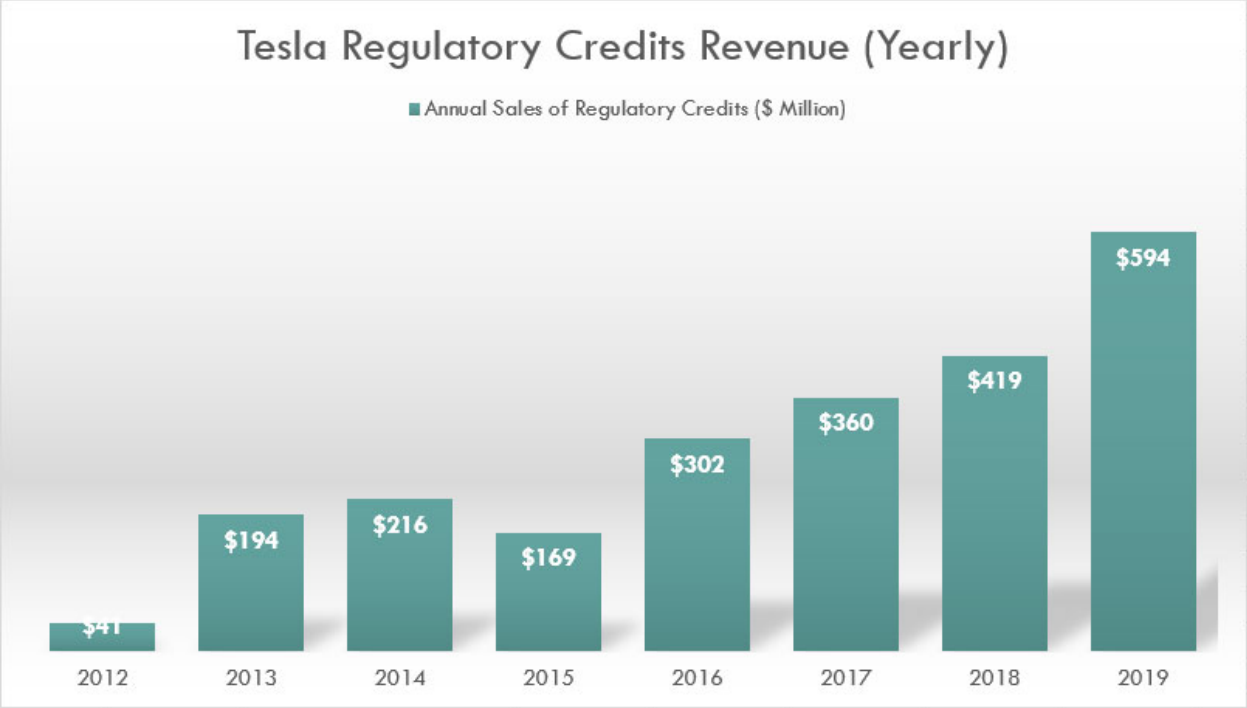
Canada, the United States and many European countries have implemented regulations that prescribe motor vehicle fuel efficiency/ GHG emissions intensity standards that vehicle manufacturers must meet. These standards are based on the averages of the fleets of vehicles sold within specific geographic areas, regardless of the preferences of the vehicle purchasers who live within those areas. When the fleet averages actually sold fall below the regulatory standards, the companies involved can either pay large fines or purchase

"credits" from companies that manufacture and sell "zero-emission vehicles". In addition to the national regulations, some sub-national organizations, like British Columbia in Canada or California in the United States, impose additional regulations that may prescribe the share of each manufacturer's vehicle sales that must be zero-emission vehicles. These regulatory requirements, in effect, force some vehicle manufacturers to pay large amounts, equivalent to cross-subsidies, to the companies that manufacture the zero-emission vehicles.



I could find no published estimates of the amount of money paid in cross subsidies in either Canada or the United States as a result of these requirements. We may gain some insight into their magnitude from reports on the regulatory credits that one company, Tesla Motors, has gained over the recent past. **Based on its 2019 annual report, Tesla Motors made about U.S. $594 million dollars from regulatory credits that year, following credits of U.S. $419 million in 2018 and U.S. $316 in 2017. Over the period 2013 to 2019, Tesla Motors received U.S. $2.25 billion in regulatory credits alone.**

https://stockdividendscreener.com/auto-manufacturers/teslas-regulatory-credits-revenue/#:~:text=ZEV%20and%20GHG%20Regulatory%20Credits&text=Based%20on%20the%202019%20annual,with%20zero%20cost%20to%20produce .



The cross-subsidies have continued to rise at a surprising rate in 2020. Over the first three quarters of 2020, Tesla Motors received a record high of nearly U.S. $1.2 billion in regulatory credits, and this total may rise to U.S. $1.5 billion by the end of the year.

As Tesla Motors sells about 54% of all the EVs sold in the United States, the total value of U.S. cross subsidies to electric vehicle manufacturers in 2019 may have been about U.S. $1.1 billion.

Taxpayer-funded Incentives for EV Chargers

There are provincial and even municipal programs to benefit those who want to install electric vehicle rechargers. These include:

- British Columbia: a grant of up to $350 for a home recharging station in a single-family home; up to $2,000 for a charger in a condominium, apartment building or workplace.
- Manitoba: a loan of up to $3,000 per home recharging station, installation included.
- Quebec: a grant of $600 for purchase of a home recharger

Other Subsidies and Incentives

Some Canadian cities grant EV drivers unfettered access to bus lanes and multiple-passenger lanes on expressways. European countries go further, and there is always the chance (risk?), these privileges will be provided in Canada. Norway, for example, grants EV owners exemption from the 25-per cent value-added tax on new car purchases; exemption from import duties; exemption from emission fees; no fuel taxes; cut-rate insurance; and ultra-cheap or free parking, road tolls and car ferry tickets.

It appears that no amount of taxpayer largesse is too much. The costs of these societal subsidies, of course, are not reflected in the prices that purchasers pay for EVs. They are hidden, and usually not considered when people assess the costs of owning and operating an EV compared to an ICE vehicle.

The Costs that the Consumer Sees

Data on the prices of EVs in Canada are often more difficult to come by than in the United States, so I will use information from there, and specifically from California, which is by far the largest market for EVs in the United States. Edmunds, a prominent source of data on vehicle sales and costs, estimates that the average U.S car price in 2019 was about U.S. $37,000, which is probably correct for California as well. The most common electric vehicle in a moderate price range is the TESLA Model 3. The price for the Basic Model 3 is $39,000, but you cannot buy one today and if you could it would have to be black. For any other colour, the upcharge would range from U.S. $1,500 to $2,500. To add mid-range amenities costs more. Edmunds estimates the present actual average Model 3 price to be about U.S. $50,000. **So, that means that the average California cars buyer would have to pay about U.S. $13,000 more per car to switch from an ICE to an EV. U.S. $50,000 equates to Cdn $64,500 at current exchange rates, a price many Canadians might find "hefty".**

Electric vehicles generally cost less to operate than ICEs, but they come with a nasty surprise. Generally, manufacturers warranty them for eight years or 100,000 miles. That is based on standard operating conditions. In cold weather regions, where more frequent fast-charging will be needed, the lives of the batteries can be shorter. Once the warranty has expired, the cost to replace the battery on a Nissan Leaf is about $15,000, if it can be sourced.

https://new.engineering.com/story/cheap-electric-vehicle-shock-expensive-batteries

Tesla batteries, which last longer, are reported to cost between U.S. $3,000 and U.S. $7,000 to replace.

Ian Irvine, a Professor of Economics at Concordia University in Montreal, wrote an article in 2017[1] in which he examined, among other things, the costs of electric vehicles, the inter-relationship between EV subsidies and regulations, and the distributional effects.

With respect to the prices that consumers face, Irvine noted the work of Covert, Greenstone and Knittel[2] who showed that the cost of battery-powered vehicles should remain substantially higher than the cost of gasoline-powered vehicles for the foreseeable future, even with a higher rate of technological change in the EV sector. A recent MIT analysis[3] noted that the current lithium-ion battery packs are estimated to cost from U.S. $175 to U.S. $300 per kilowatt-hour. (A typical midrange EV has a 60/kWh battery pack.) At U.S. $175 per kWh, the price of oil would have to triple from today's levels before the unsubsidized electric vehicle was cheaper to purchase and operate. The MIT study pointed to the costs of metals mining as the factor likely to inhibit major EV battery cost declines, which it viewed as likely to require shifts from the dominant lithium-ion chemistry today to entirely different technologies like lithium-metal, solid-state and lithium-sulfur batteries.

Distributional (Regressive Income) Effects

Irvine elaborated on the "free rider" problem, the fact many people who purchase EVs would have done so without the subsidy, so it is unneeded.

"All purchasers of EVs receive the subsidy, but many would purchase an EV in the absence of a subsidy; free riders dilute the power of the incentives. Overviews of the operation of these subsidy schemes in Canada (Antweiler and Gulati 2013; Chandra, Gulati and Kandikar 2010) conclude that three-quarters of recipients would have purchased the subsidized vehicle without the inducement…Mercer et al. (2015) propose that the free ridership rate is about one-half. This means that each $8,000 subsidy in Quebec would reduce the purchase of one-half of an EV, bringing the cost of one genuine vehicle switcher to $16,000. "

A related problem concerns the effect of subsidies in transferring income from the general tax-paying population to the recipients of the subsidies. In the Strata report previously referenced, it was noted that most EVs are purchased by people with higher incomes.

"First, because wealthy people are more likely to purchase new vehicles, subsidies for new car purchases (EV or not) will tend to benefit the wealthy. Additionally, electric vehicles tend to

[1] Ian Irvine, *Electric Vehicle Subsidies in the Era of Attribute-Based Regulations*, Canadian Public Policy, March 2017 pp. 50-60

[2] Thomas Covert, Michael Greenstone and Christopher Knittel. *Will We Ever Stop Using Fossil Fuels?* Journal of Economic Perspectives, Winter 2016 pp 117-138

[3] James Temple, *Why the electric-car revolution may take a lot longer than expected*. MIT Technology Review, November 19, 2019

have lower ranges than gasoline vehicles, making them less attractive as a household's first vehicle. Households that purchase electric vehicles are therefore more likely to be able to afford several vehicles, rather than just one. Finally, because many electric vehicles are expensive compared to gasoline vehicles, they tend to be purchased by wealthier individuals. These factors have the combined effect of making policies that subsidize the purchase of electric vehicles particularly regressive even when compared with other clean energy policies in the United States."

Researchers for the U.S. National Bureau of Economic Research, using data from the Internal Revenue Service, found that the vast majority of the subsidy provided by the federal Plug-In Electric Drive Motor Vehicle credit goes to the highest income earners, with the top 20% of earners receiving 90% of the credit.[4]

Other Costs to Society

Electric car proponents sometimes argue that moving to completely electrify the vehicle fleet, as now proposed in Canada and other countries, would not add significantly to the amount of electricity generation required. Kent Zehr, a retired Canadian engineer who spent most of his career in the electric utility industry, examined this thesis in an article published in May, 2019.

https://blog.friendsofscience.org/wp-content/uploads/2019/05/ELECTRIC-VEHICLE-CONSIDERATIONS-4.pdf

Zehr examined current levels of gasoline consumption in Canada, converted this from litres of gasoline per day to electrical energy per year, and compared the impact of adding that electrical energy demand to current electrical generation capacity. Here are some of his most striking conclusions:

- **At perfect efficiency (impossible) and complete conversion of the vehicle fleet, more than 10,000 megawatts of additional electrical generation capacity would be required for Canada to power all-electrical cars by 2040.**
- **At present, there are two large hydro power projects being built in Canada which together will have a generation capacity of 1,924 megawatts. The Site C**

[4] Borenstein, S., Davis, L.W., (July, 2015) *The Distributional Effects of U.S. Energy Tax Credits*. National Bureau of Economic Research Working Paper Series. Pp 1

dam in British Columbia is projected to cost $12 billion; the Muskrat Falls project in Newfoundland will cost more.

- There are no other large power generation projects even being contemplated in Canada now.
- To meet the 2040 stated objective, at least eight more projects of about the same size as those now being built would be needed.
- Large amounts of additional infrastructure would be needed to deliver the newly added power to the locations where it would be needed. None is planned now. ***The costs of the generation and transmission required would be in the hundreds of billions of dollars.***

In short, the societal costs to provide the energy needed for electrification of the entire Canadian vehicle fleet would be immense, and there is not enough time to add these before 2040 (or 2050).

Conclusion

Electric vehicles cost too much, even without considering the benefits that EV manufacturers receive from the many subsidies that the consumer does not see. **The thesis that electric vehicles are beneficial and affordable is based on misleading Canadians about their real economic costs. Moreover, the subsidies consist largely of transfers from lower-income to higher-income people, who probably would have purchased the EVs without the subsidy.**

When the costs of the additional electricity generation and transmission are considered, it becomes clear that the goal of complete electrification of the light duty vehicle fleet is not attainable in the timeframe set by the federal government.

The other parts in this series will examine the environmental implications of seeking to electrify all vehicles and the probable trends in Canadian and global EV sales.

About Friends of Science Society

Friends of Science Society is an independent group of earth, atmospheric and solar scientists, engineers, and citizens that is celebrating its 18th year of offering climate science insights. After a thorough review of a broad spectrum of literature on climate change, Friends of Science Society has concluded that the sun is the main driver of climate change, not carbon dioxide (CO2).

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