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GOOD POLITIC$ BAD POLICY

Why governments should end their subsidies for electric vehicles

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TRUE NORTH IN CANADIAN PUBLIC POLICY

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Contents

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Executive Summary

If one believes that climate change is a serious global threat, it is crucial that any policy introduced results in the greatest possible reduction in greenhouse gas (GHG) emissions per dollar spent. Federal and some provincial governments have embraced the program to offer subsidies for those purchasing electric vehicles (EVs), which do not generate any tail-pipe emissions. Encouraging EV sales over traditional gas and diesel-powered vehicles will significantly reduce emissions.

This paper evaluates Canada's subsidy programs on EV sales and on purchases of electric charging stations. Specifically, it asks how cost effective these subsidies are in reducing GHG emissions and, given that government pays them out of general tax revenue, how equitable they are for all Canadians to access.

Electric vehicles are expensive – in Canada they cost from $12,500 to $25,000 more than equivalent gas models. Therefore, higher-income households buy a large fraction of EVs sold. That government subsidies mostly benefit higher-income households is troubling. The federal government offers a $5000 subsidy for those purchasing an EV and, from the provincial governments, subsidies range from nothing in four provinces, including Ontario, to $8000 in Quebec. Further subsidies are available for those installing household or commercial charging stations.

A review of several studies indicates an expected average lifetime reduction 28.2 tonnes of GHGs for every new EV purchased over an internal combustion engine (ICE) vehicle. In the absence of subsidies, estimates indicate EV sales will drop by half. Marginally, the federal EV subsidy program on its own costs $355 to reduce 1 tonne in GHGs. Adding in the provincial subsidies, the marginal cost rises to between $512 for Newfoundland and $964 for Quebec per tonne of GHG. The federal government uses a price of $50 per tonne of GHG as its social cost of carbon. So, for every $50 per tonne in benefits, the federal/provincial pays between $512 to $964 per tonne; as such, the subsidy programs are very costly and inefficient.

Governments need to rethink the subsidies they offer for purchasing EVs. Electric vehicle and charging station subsidies are an expensive way to reduce greenhouse gases. In addition, since EV sales are made disproportionately to higher-income households, those least needing the subsidies receive money that is paid by tax revenue generated by all taxpayers. Thus, EV and charging station subsidies are a very regressive policy.

The government should let the carbon tax work as intended by refraining from policies like EV subsidies. There are lower cost carbon abatement methods than EV subsidies. They include enhanced methane regulations, large-scale solar power, gasoline taxes, and advanced nuclear. The federal government and those provincial governments that currently subsidize EV sales should end their subsidies and focus on more cost-effective GHG emission abatement policies.

Sommaire

Poser en principe que les changements climatiques constituent une menace mondiale grave nécessite d'établir une politique qui permet la plus grande réduction possible des émissions de gaz à effet de serre (GES) par dollar dépensé. D'ailleurs, un des programmes que le gouvernement fédéral et certains gouvernements provinciaux ont adopté a pour but d'offrir des subventions à l'achat de véhicules électriques (VE), ceux-ci ne générant aucune émission de gaz d'échappement. Les mesures qui favorisent l'achat de VE aux dépens de modèles traditionnels à essence ou au diesel peuvent réduire le émissions de manière appréciable.

Dans le présent document, on évalue les programmes de subventions à l'achat de véhicules et de bornes de recharge électriques au Canada. Plus précisément, on cherche à établir leur efficacité pour réduire les émissions de GES, compte tenu de leurs coûts, ainsi que leur équitabilité sur le plan de l'accès pour tous les Canadiens, puisque les recettes fiscales générales des gouvernements les financent.

Les véhicules électriques sont dispendieux – au Canada, ils coûtent de 12 500 $ à 25 000 $ de plus que les modèles à essence équivalents. Par conséquent, ce sont les ménages à revenu élevé qui les achètent en grande partie. Le fait que les subventions gouvernementales profitent surtout aux ménages à revenu élevé préoccupe. La subvention atteint 5 000 $ au palier fédéral, tandis qu'au palier provincial, elle passe de zéro dans quatre provinces, qui comprennent l'Ontario, à 8 000 $ au Québec. Des subventions sont également proposées pour l'installation de bornes de recharge domestiques ou commerciales.

Selon plusieurs études examinées, un VE neuf devrait émettre en moyenne au cours de sa vie utile 28,2 tonnes de GES de moins qu'un véhicule à moteur à combustion interne (MCI). En l'absence de subventions, selon les estimations, les ventes de VE diminueraient de moitié. À la marge, en vertu du programme fédéral à lui seul, il en coûte 355 $ pour réduire une tonne de GES. Avec l'ajout des subventions provinciales, ce coût marginal s'élève pour passer à des montants allant de 512 $ (à Terre-Neuve) à 964 $ (au Québec). Ainsi, comme le gouvernement fédéral estime que le coût social du carbone est de 50 $ par tonne de GES, Ottawa et les provinces versent donc entre 512 $ et 964 $ aux ménages pour chaque 50 $ de bénéfice obtenu par tonne de réduction (soit le tarif carbone) –les programmes de subventions sont très coûteux et inefficaces.

Les gouvernements doivent repenser les subventions qu'ils offrent à l'achat de VE. Les subventions à l'achat de véhicules et de bornes de recharge électriques sont un moyen coûteux de réduire les gaz à effet de serre. En outre, comme les VE sont achetés de manière disproportionnée par les ménages à revenus élevés, ce sont les personnes qui ont le moins besoin de ces subventions qui tirent profit des recettes fiscales générées par l'ensemble des contribuables. Les subventions aux VE et aux bornes de recharge sont donc une politique très régressive.

Le gouvernement devrait laisser la taxe carbone fonctionner comme prévu en s'abstenant de mettre en place des politiques telles que les subventions aux VE. Des méthodes de réduction du carbone moins coûteuses que les subventions aux VE existent, notamment : le renforcement de la réglementation sur le méthane, l'énergie solaire à grande échelle, les taxes sur l'essence et le nucléaire évolué. Les subventions offertes par le fédéral et les provinces devraient être remplacées par des politiques de réduction des émissions de GES plus rentables.

Introduction

According to UN Secretary-General António Guterres, "Climate change is, quite simply, an existential threat for most life on the planet – including, and especially, the life of humankind" (UN 2018). Prime Minister Justin Trudeau recently wrote that "climate change is one of the greatest threats we face" (Trudeau 2021).

If one believes these statements to be true, and if every dollar government spends on one climate plan initiative is a dollar they cannot use on another, it is crucial, therefore, that the money spent leads to the greatest benefit possible – in this case, the highest reduction in greenhouse gases (GHGs).

A program the Canadian federal (and some provincial) governments have embraced is to provide subsidies for those purchasing electric vehicles (EVs) as the United States, China, and many of the larger European countries also now do. The idea is straightforward. Electric vehicles do not generate any tail-pipe emissions. Thus, replacing traditional gas- and diesel-powered vehicles with electric ones will significantly reduce emissions. In 2019, gas or diesel cars and light trucks accounted for 87 Mega tonnes or 12 percent of Canada's total greenhouse gas (GHG) emissions (Environment and Climate Change Canada 2021). Therefore, reducing passenger vehicle emissions is considered an important part of meeting our climate goals.

This paper evaluates the subsidy programs Canada offers on fully electric vehicle sales and on purchases of electric charging stations. It does not assess hybrid and plug-in hybrid vehicles, as they have different emission and economic variables, which unnecessarily complicates the process. Two key criteria for EV subsidies are: how cost effective are they in reducing GHG emissions and, given that government pays them out of general tax revenue, how suitable are they to all Canadians? Table 1 shows the primary subsidies available.

TABLE 1: FEDERAL AND PROVINCIAL EV SUBSIDIES IN PLACE AS OF DECEMBER 2021

	FEDERAL GOVERNMENT	PROVINCIAL GOVERNMENT
EV purchases	$5000	**QC**: $8000; **NB, PEI**: $5000; **BC, NS**: $3000; **NL**: $2500; **AB, SK, MB, ON**: $0
Household charging station	$0	**QC**: $600; **PEI**: $600[a]; **BC**: $700; **NS**: $500; **all other provinces**: $0
Commercial/municipal infrastructure/ charging stations[c]	Up to $2.5 million[b]	

Sources: Canada Drives 2021; ChargeHub 2021; Canada 2021.

[a] *PEI pays for a level 2 charger, which is estimated at $600.*

[b] *Request for Proposals closed in June 2021 but are expected to reopen in early 2022. Eligibility covers very small to large infrastructure charging projects.*

[c] *Municipalities also offer subsidies related to EV charging, but they are not assessed in this paper.*

Recipients of the subsidies

Electric vehicles are expensive. *TD Economics* estimates new EVs bought in Canada are from $12,500 to $25,000 more costly than equivalent gas models (Feltmate 2020).[1] The large upfront purchase cost makes up a much higher proportion of household earnings for those in low-income than for those with higher incomes. Therefore, a relatively large fraction of EVs can be expected to be bought by high-income households. For example, a TrueCar survey found the average household income of those buying a Ford Focus electric car was $199,000, and $145,000 for those buying a Fiat 500e (also an electric car) (Hayes 2019). A study of the EV market in California (see table 2) shows similar results (Lee and Hardman 2019).

One study estimates that in the absence of government subsidies, only 18 percent of Canadian households would be financially suited to buying an EV.[2] The authors segmented EVs into three categories: Economy/Intermediate, Full/Luxury and Van/SUV/Light trucks. Even if subsidies of up to $15,000 were available, financial suitability would still be less than 20 percent for economy/intermediate EVs and 5 percent for Full/Luxury EVs. The Van/SUV/Light truck EV segment would have the highest financial suitability at somewhere

TABLE 2: PROPORTION OF EVS PURCHASED BY VARIOUS DEMOGRAPHIC GROUPS IN CALIFORNIA

High income families	49%
Middle- to high income families	46%
Middle-income renters	5%

Source: Lee and Hardman 2019.

between 40 to 45 percent (Abotalebi, Scott, and Ferguson 2019). The fact that government subsidies largely benefit high-income households is troubling. The subsidies here are transfers of tax revenue, including taxes paid by lower and middle-income individuals, to high-income earners. Concordia University economist Ian Irvine is even blunter when he writes that "subsidies require taxpayers at large to 'bribe' polluters to reduce their activities" (Irvine 2017). From an equity perspective, EV subsidies are highly regressive.

The fact that government subsidies largely benefit high-income households is troubling.

Charging station and infrastructure development subsidies are also highly regressive. Not only do high-income households benefit from the charging station subsidy, corporations owning residential, commercial, and industrial buildings are also eligible to apply for both.

Cost of subsidies to reduce GHG emissions

Evaluating how cost-effective government EV-related subsidies are in reducing GHG emissions is important. The overall approach for determining cost-effectiveness is to estimate carbon emissions saved when someone purchases a new EV instead of a new internal combustion engine (ICE) vehicle. Assuming a government subsidy helps a consumer purchase the EV over an ICE vehicle, the difference in carbon emissions can be attributed to the government subsidy. We consider emissions from the vehicle manufacturing process through

TABLE 3: ESTIMATES BY VARIOUS AUTHORS OF THE TONNES OF GHGS REDUCED BY SWITCHING FROM AN ICE TO AN EV

	Tonnes of GHGs reduced
Belzile and Milke	28.2
Thorne and Hughes	30.1
Bieker	26.3
AVERAGE	**28.2**

to its expected operating life – that is, the life-cycle approach. Specifically, we look at:

- Emissions produced in manufacturing EV and ICE vehicles. Producing an electric vehicle typically creates more carbon emissions than building a vehicle that has an internal combustion engine. This is mostly due to the battery manufacturing process.
- Emissions produced when operating the vehicles. Electric vehicles have no tail-pipe emissions when they are operating. However, depending upon how a province generates electricity, the EV may (or may not) be responsible for the creation of carbon emissions when it uses electricity produced with fossil fuels.

Above are summaries of the findings of three papers that estimated the carbon emissions saved by purchasing an EV rather than an ICE vehicle.

A 2017 Montreal Economic Institute report estimated a net reduction in GHG emissions of 28.2 tonnes from using an EV rather than an ICE vehicle.[3] The authors assumed a 10-year car life and used the provincial subsidies offered for EV and charging station purchases in 2017 for Ontario (up to $14,750) and Quebec (up to $8600). Their calculations showed that in Ontario it cost $523 for every tonne of GHGs eliminated, while in Quebec the cost was $288 per tonne (Belzile and Milke 2017).

A 2019 paper also analysed the effectiveness of EV subsidies in Canada at reducing emissions, but broken down by province. It determined that the overall emission reductions from substituting an EV for an ICE vehicle varied by province due to how each generates electricity. British Columbia, Manitoba, Ontario, Quebec, and Newfoundland rely mostly on hydro dams (as well as nuclear in Ontario), which emit little GHG. Therefore, those provinces showed the greatest reductions in GHGs from switching to a zero-emission vehicle. Provinces such as Alberta, Saskatchewan, and Nova Scotia, which are more reliant on coal to generate electricity, had smaller GHG reductions. The data used to calculate the reduction in GHGs was based on that from Newfoundland, which had the highest overall reduction at 30.1 tonnes.[4] The authors' overall conclusion was that "the cost per tonne of reduced emissions through EV subsidies is much more expensive than other GHG mitigation investments" (Thorne and Hughes, 2019).

Finally, a 2021 paper by Georg Bieker from the International Council on Clean Transportation compared GHG emissions from gas and electric powered vehicles. The author also took a life-cycle approach to capturing emissions. While the study analyzed four market sectors (Europe, United States, India, and China), we use the US figures for comparative purposes. Bieker finds that ICE vehicles will, on average, emit 2.5 times more GHG gases than EVs. The reduction in emissions from switching to an EV is 26.3 tonnes over a 10-year period (Bieker 2021).[5] Table 3 summarizes the results of the three papers.

Using an average lifetime reduction in GHGs of 28.2 tonnes for each ICE vehicle replaced with an EV, we can estimate the average dollar cost per tonne of GHGs saved through the EV subsidy programs. Table 4 shows this estimate by province (row 2), and the cost including personal charging subsidies (row 3).

> *A large fraction of EV sales are to high-income households who would have bought one anyway.*

In fact, row 3 underestimates the marginal per tonne costs of the subsidies since it treats all EV purchases as being due to the subsidy. A large fraction of EV sales are to high-income households who would have bought one anyway. The subsidy can only be said to reduce emissions when it induces an EV purchase in a household that otherwise would have bought an ICE vehicle. When Ontario eliminated its subsidy, sales fell slightly more than half to 45 percent of its previous level (Jones 2019). A study of Quebec's EV sales also assumed that sales would be halved with no subsidy (Mercier, Lanoie, and Leroux 2015). If we assume the marginal EV sales (attributable to subsidies) are only one-half of the total, then we can estimate the marginal cost of emission reductions as double the average amount. This is shown in row 4.

TABLE 4: COST PER TONNE OF GHGS SAVED THROUGH EV SUBSIDIES

	Alberta Saskatchewan Manitoba Ontario	Quebec	Prince Edward Island New Brunswick	British Columbia Nova Scotia	Newfoundland
1. Total federal/provincial subsidy	$5000	$13,000	$10,000	$8000	$7500
2. Cost per tonne GHG saved	$177[a]	$461	$355	$284	$266
3. Cost per tonne GHG saved including charging station subsidies	$177	$462	$376 (PEI) $355 (NB)	$309 (BC) $301 (NS)	$266
3. Marginal cost of GHG reductions	$355	$964	$752 (PEI) $710 (NB)	$618 (BC) $602 (NS)	$512

[a] *The $177 per tonne GHG saved would be the total program's cost in Alberta, Saskatchewan, Manitoba, and Ontario, where only the federal subsidy is available*

Comparison to the social cost of carbon

The appropriate comparison point for determining if EV subsidies are efficient is the social cost of carbon, which is an estimate in dollars of the costs incurred to society by generating one tonne of carbon emissions. It is a difficult item to measure, and varying assumptions in its calculation can cause a wide range in its value. The Canadian government uses a price of $50 per tonne of GHG as its social cost of carbon (Environment and Natural Resources 2021). Since the social benefits of reducing carbon emissions total $50 per tonne, it is unproductive to spend more than $50 per tonne on abatement measures. The federal EV subsidy program on its own costs $355 at the margin to reduce $50 in GHG costs. Adding in the provincial subsidies, the cost at the margin rises to between $512 for Newfoundland and $964 for Quebec per tonne (table 4, row 4).

Comparison to the federal carbon tax

Another point of comparison is the federal carbon tax. A carbon tax in effect puts a price on carbon and gives emitters an incentive to find the least costly way of cutting their GHG emissions. For economic efficiency to be realized the carbon tax should not be supplemented by rules or subsidies that cause emitters to adopt abatement options that cost more than the carbon tax. The federal carbon tax in April 2022 will be $50 per tonne, which implies that EV

TABLE 5: LOWER-COST CARBON ABATEMENT METHODS, ($/TGHG)

Methane regulations[a]	20
Land-based wind turbines	34
Natural gas (combined cycle)	37
Large scale solar panels	39
Gasoline tax	44
New natural gas with carbon capture storage	59
Advanced nuclear	80

Source: Martin and Riordan 2020.

[a] *Average value taken from two estimates.*

subsidies violate the economic basis of the carbon tax since they are all far more expensive at the margin. Even if we look ahead to the planned carbon tax level of $170 by 2030, this corresponds to an inflation-adjusted value of $134 in 2022, which is still far below the range of EV subsidy marginal costs.[6]

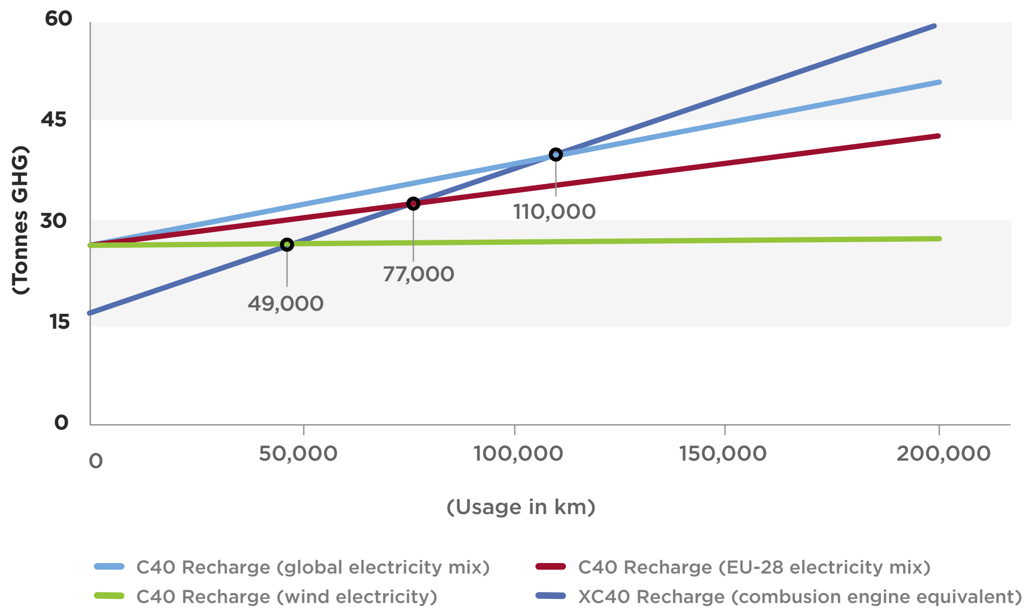
Other carbon abatement methods

Table 5 lists the carbon abatement opportunities whose costs are much more aligned with the social cost of carbon. This list is certainly not exhaustive; rather, it simply shows that there are many initiatives available that can lower GHGs, perhaps doing so much more cost effectively than EV subsidies.

Some additional considerations

Electric vehicles are less costly to operate than traditional ICE vehicles. EVs have fewer moving parts and their maintenance costs are lower. Owners save money on gasoline, of course, but this saving is partially offset by the amount they must spend on electricity. EVs also have higher depreciation rates. The major barrier to EV affordability is their high initial cost. In the future, however, manufacturing scalability and new technologies may lower the price of new EVs relative to their non-electric equivalents. The combination of lower prices for new EVs and higher EV depreciation could lead to cost parity between a used electric vehicle and its non-electric equivalent. One estimate suggests used electric vehicles will reach cost parity with equivalent used ICE vehicles sometime between 2025 and 2030. Price equivalency and lower variable EV operating costs, through traditional market forces, could provide

FIGURE 1: BREAK-EVEN KM NEEDED FOR EVS TO MATCH ICE VEHICLES IN GHG EMISSIONS



Source: Evrard et al. 2021.

a significant incentive for lower-income households to purchase a used EV (Bauer, Hsu, and Lutsey 2021).

Some argue that since a lack of public charging sites inhibits EV demand, charging stations should be subsidized. By building out a network of charging stations, demand for EVs will rapidly increase, leading to significant GHG reductions. This argument assumes that charging stations are a public good that the marketplace cannot provide. But there is no reason for supposing this to be the case. After all, the market provided gas stations for cars in the early years of their adoption because consumers were willing to pay for the service. If EV charging stations are only appearing because governments mandate them or subsidize them, that shows that the costs exceed the consumer benefits, which argues against subsidizing them. Companies such as GM, Mercedes-Benz, BMW, and Volkswagen are all investing in charging stations, while Tesla's Supercharger network is unmatched (Karkaria 2018). Charging station network development should be left to the private sector to avoid further misallocation of government resources.

EV developers are making a significant effort to increase the range of electric vehicles between charging. Many believe overcoming consumers' "range anxiety" is an important step towards greater EV acceptance. Greater battery capacity is key to increasing range. Unfortunately, the greater an EV's battery capacity, the higher are the GHGs emissions during the production process. The batteries are also more expensive and weigh more, which also reduces a car's overall efficiency.

Volvo is one of the legacy auto manufacturers most aggressively pursuing vehicle electrification. The company provides data on life-cycle emissions for the cars it produces. Its C40 Recharge vehicle, with a 360 kilometre range, emits almost 70 percent more GHGs in the production phase (26.4 tonnes of GHG) than its equivalent ICE vehicle (15.7 tonnes of GHG) (Evrard et al. 2021). Depending on how electricity is produced, Volvo estimates it will take between 49,000 and 110,000 kilometres before the C40 Recharge contributes less GHG than its internal combustion engine equivalent.

There is a conflict between the desire for greater range and the higher emissions associated with more intensive battery production. Given that GHG reductions are lower for longer-range EVs, purchase subsidies will be even costlier per tonne of GHG reduced for longer-range electric vehicles.

Recommendations for the future

Based on the above analysis and data, governments need to rethink the subsidies they offer for purchasing EVs. First, electric vehicle and charging station subsidies are an expensive way to reduce greenhouse gases. The marginal cost of GHG reductions ranges from $355 to $964 per tonne in Canada, for every $50 per tonne in estimated benefits. In addition, since EV sales are disproportionately to higher-income households, those least needing the subsidies receive money that is paid by tax revenue generated by all taxpayers. Thus, EV and charging station subsidies are a very regressive policy.

Recommendation: End federal and provincial government subsidies for purchasing EVs and charging stations.

Second, market research suggests that barriers to EV sales include lack of knowledge about the technology and uncertainty about the operating savings potential (Abotalebi, Scott, and Ferguson 2019; Singh, Walsh, and Goodfield 2021; and Morris 2018). The auto industry should develop a targeted information campaign for two specific EV submarkets. The first is the 18 percent of Canadian households that are financially suited to purchase an EV. At a current adoption rate of only 4 percent, this submarket is being underserved. The second submarket is for used EVs that may be as affordable as their combustion engine equivalent by 2025. Given EV cost parity and much lower operating costs, used EVs may begin to be financially attractive to lower-income households, especially as a second car.

Recommendation: Encourage auto makers to develop information and marketing campaigns that provide easier access to information on the benefits and suitability of EVs based on different driving patterns and needs. This could include items such as a better understanding of lower EV life-cycle costs and facts on battery life, between-charge range, charging times, and their ability to carry out utility functions.

Third, government should let the carbon tax work as intended by refraining from policies like EV subsidies. As table 5 showed, there are lower cost carbon abatement methods and, if the marginal costs are as shown, the market will adopt them in response to the federal carbon pricing system. In addition, some forms of methane regulation may yield cost-effective GHG abatement. One tonne of methane has the same climate impact as approximately 25 tonnes of CO_2. Methane can escape or leak from oil and natural gas facilities. Possible initiatives include better leak detection and repair (LDAR) or developing more comprehensive regulations covering methane emissions. (Konschnik and Reuland 2020).

Recommendation: The federal government should trust its carbon pricing system and let the market identify the lowest-cost abatement strategies. It could also enhance its regulatory framework to cover facilities that are currently not regulated. Consider offering tax credits to companies that undertake leak detection and repair on facilities not currently covered by regulation.

Conclusion

Government subsidies for EV purchases are a costly and inefficient way to reduce carbon emissions. The subsidies unfairly benefit mostly upper income households. Declining prices for EVs could make them accessible to most Canadians by 2030. Businesses are also building out the charging station infrastructure needed to accommodate the vehicles. Therefore, the federal government and those provincial governments that currently subsidize EV sales should end their subsidies and focus on more cost-effective GHG emission abatement policies.

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Endnotes

1 Canadian dollar figures converted from US dollars based on an average 2021 exchange rate of US$0.7992.

2 Financial suitability is estimated by comparing the total ownership costs of an ICE vehicle and a comparable EV suitable for specific households (e.g., SUV or compact or med/large auto), based on the household's mileage usage, and length of ownership.

3 The Belzie and Milke paper provided data for Ontario and Quebec only. This paper uses the Ontario figure of 9.2 tGHG as it is closer to Canada's overall Electricity Consumption Emissions Intensity.

4 The calculation made for comparative purposes is as follows: ICE vehicle: (163 g GHG/km × 19,182 km/year × 10 years)1,000,000 = 31.27 tGHG. EV: (0.155 kWh/km × 19,182 × 40 g GHG/kWh × 10)/1,000,000 = 1.19 tGHG. Net reduction due to EV = 31.27 tGHG – 1.19 tGHG = 30.1 tGHG.

5 Bieker used an 18-year vehicle life. The results are standardized for comparative purposes.

6 The calculation is done by assuming a 3 percent average inflation rate for eight years.

6 For this cost parity to have meaning, we must assume that the usable life of a used EV is the same as an equivalent ICE vehicle.

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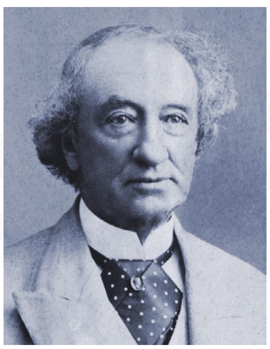

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