Which type of policy incentive including financial incentives, GHG taxes, R&D subsidies, or redistribution of demand subsidies, is most effective in reducing greenhouse gas emissions while simultaneously driving supply and demand in the EV market?

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In Canada, the subsidy standards for electric vehicles (EVs) vary significantly between small and large vehicles, reflecting the government's emphasis on energy efficiency and emission reduction. For larger vehicles, subsidies are primarily limited to zero-emission models such as Battery Electric Vehicles (BEVs) and Fuel Cell Electric Vehicles (FCEVs), with incentives reaching up to CAD 5,000 under the Federal iZEV program.[1] Smaller vehicles, however, have access to a broader range of subsidies, including those for Plug-in Hybrid Electric Vehicles (PHEVs), depending on their electric range and emissions.

Small and large automobiles in Canada receive substantially different levels of subsidies for electric vehicles, which affects the government's financial efficiency and ability to reduce emissions. Despite the fact that their emissions are reduced more than those of fuel-powered vehicles, larger vehicles still produce more pollution than smaller electric vehicles, which is why they are given preference for subsidies. According to this research, a unique strategy should be adopted to encourage the use of smaller, more energy-efficient vehicles while still fostering technological improvements in bigger electric vehicles. However, financing electric cars also presents a problem in attempting to strike a balance between environmental concerns and financial incentives. For example, investments are made to improve accessibility to public transportation and to build infrastructure, but the regulations that are now in place are opaque. Acknowledging investments in public transportation infrastructure increases local economic growth and lessens dependency on private automobiles to boost local economy.

While subsidies are currently the primary policy the Canadian government uses to encourage EV adoption, their cost-effectiveness, impact on greenhouse gas (GHG) reduction, social equity issues, and overall effectiveness in combating global warming while maximizing social welfare are being questioned.[2] Several challenges exist in Canada's current EV subsidy policy. These include the free-rider issues in which subsidies are provided to individuals who will buy the EV without subsidies and the incentivizing effect on companies producing large EVs and consumers purchasing large EVs.[3] The policy also involves problems in shifting the impact of climate change toward the low-income neighbourhood. Several solutions to these challenges are suggested by studies and literature, including targeting the subsidies to different consumer groups based on their sensitivities to EV price and gasoline usage, combining subsidies to other financial and non-financial incentives to maximize its cost-effectiveness, and focusing on the low-income group to balance the benefit among every member of society.[4] Nevertheless, each solution involves limitations, and a comprehensive understanding of their cost and benefits is critical for applying them to Canada's current EV market.

Other countries, including China, Japan, Germany, and closest to us, the U.S., have implemented subsidy policies to encourage the production and purchase of EVs among other

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[1] Environment and Climate Change Canada. (2023, December). Canada's Electric Vehicle Availability Standard: Regulated Targets for Zero-Emission Vehicles. Government of Canada. Retrieved from https://www.canada.ca/en/environment-climate-change/news/2023/12/canadas-electric-vehicle-availability-standard-regulated-targets-for-zero-emission-vehicles.html

[2] Government of Canada. (2024, July). *Program overview.* Transport Canada. https://tc.canada.ca/en/road-transportation/innovative-technologies/zero-emission-vehicles/incentives-zero-emission-vehicles/program-overview#:~:text=There%20are%20two%20levels%20of%20incentives%3A%20Battery%20electric%2C,electric%20vehicles%20are%20eligible%20for%20up%20to%20%242%2C500%3B

[3] Sheldon, T. L. (2022). Evaluating Electric Vehicle Policy Effectiveness and Equity. Annual Review of Resource Economics, 14(1), 669–688. https://doi.org/10.1146/annurev-resource-111820-022834 and Harvey L. D. D. (2020). Rethinking electric vehicle subsidies, rediscovering energy efficiency. Energy policy, 146, 111760. https://doi.org/10.1016/j.enpol.2020.111760

[4] Sheldon, T. L., & Dua, R. (2019). Measuring the cost-effectiveness of electric vehicle subsidies. Energy Economics, 84, 104545-. https://doi.org/10.1016/j.eneco.2019.104545 and Shang, W. L., Zhang, J., Wang, K., Yang, H., & Ochieng, W. (2024). Can financial subsidy increase electric vehicle (EV) penetration—evidence from a quasi-natural experiment. Renewable & Sustainable Energy Reviews, 190, 114021-. https://doi.org/10.1016/j.rser.2023.114021 and Sheldon, T. L. (2022). Evaluating Electric Vehicle Policy Effectiveness and Equity. Annual Review of Resource Economics, 14(1), 669–688. https://doi.org/10.1146/annurev-resource-111820-022834

eco-friendly alternative products. These economies' unique challenges and varying levels of success might remind Canadian policymakers that allocating much money to subsidize EVs will not necessarily improve the quality and quantity of EV offerings from and in Canadian markets. The choice of comparison is important because these four are known as the world's dominant economies.[5] China, Japan, and Germany in particular are often lauded for their manufacturing quality. However, the quality of their EVs, perceived and objective, is not necessarily so perfect.[6] These gaps have much to do with differing national subsidy strategies. For instance, the current economic cycle phase and consumer and business confidence levels can influence the effectiveness of subsidies, with recessions demonstrating more transaction benefits than expansionary periods, for which tax cuts are more effective.[7]

Efficiency matters as much as effectiveness. While subsidies have been generally accepted as effective for promoting EV adoption, there are ongoing debates about their relative cost-effectiveness, relative impact on innovation (depending on subsidy type), and long-term sustainability (i.e. concerns of over-production's adverse environmental effects). We will explore differences between subsidies aimed at fostering technological innovation, such as research and development (R&D) subsidies, and those targeting the final product, such as subsidies that reduce the retail price of EVs.[8] We will consequently argue that innovation subsidies are preferable in almost every case. This analysis will also address the impact of firm size on subsidy effectiveness, concluding that firm size's relevance is null without taking into account growth potential.[9]

Given the current circumstances that Canada is in, it is unlikely that we will be able to reach the goal of 100% zero-emissions sales for light-duty vehicles by 2035.[10] To motivate a faster conversion from internal combustion engine vehicle (ICEVs) to electric vehicles, Canada has obtained and invested a total of CAD 98.6 billion towards building manufacturing plants for vehicle companies including Honda, Ford, Northvolt, Stellantis, Volkswagen, and POSCO.[11] Although the main purpose of these investments is to ensure a faster adoption through the reduced upfront cost of ownership through having local manufacturing plants, it is uncertain whether these new manufacturing plants will be established in time for them to be effective for the mandate of 2035. Perhaps a better option is by having different options for consumers to contribute to the mandate. Taking a look at the model the United States is using, they have various options for consumers to choose from for example the hybrid models before fully committing to an EV, which helps with the phase out of ICEVS, and allowing companies to not loose as much money as they try to sell off their cars in order to meet the

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[5] Kageyama, Yuri. (2024, February 14). *Japan slips to the world's fourth-largest economy, behind the U.S., China and now Germany.* CTV News. https://www.ctvnews.ca/business/japan-slips-to-the-world-s-fourth-largest-economy-behind-the-u-s-china-and-now-germany-1.6769631

[6] The Yomiuri Shimbun. (2023, November 24). *Japan EV Subsidy Program to Evaluate Measures by Manufacturers; Charging Point Numbers, Response to Issues to Impact Subsidies*. The Japan News. https://japannews.yomiuri.co.jp/politics/politics-government/20231124-151544/

[7] Kang, F., Yu, Q., & Wan, M. (2023). Corporate Innovation Incentive Policy During Business Cycles: Fiscal Subsidies or Tax Incentives? Emerging Markets Finance & Trade, 59(7), 2190–2203, *p.g 2191*. https://doi.org/10.1080/1540496X.2023.2167488

[8] Li, Y., Tong, Y., Ye, F., & Song, J. (2020). The choice of the government green subsidy scheme: innovation subsidy vs. product subsidy. International Journal of Production Research, 58(16), 4932–4946. https://doi.org/10.1080/00207543.2020.1730466, *p.g 4933*.

[9] Gale, W., & Brown, S. (2013). Small Business, Innovation, And Tax Policy: A Review. National Tax Journal, 66(4), 871–892. https://doi.org/10.17310/ntj.2013.4.05*, p.g. 891*.

[10] Canada can't meet goal of 100% EV sales by 2035, automakers say. (2024, June 19). Financialpost. https://financialpost.com/commodities/energy/electric-vehicles/canada-cant-meet-goal-of-100-ev-sales-by-2035-automakers-say#:~:text=Just%2011%20per%20cent%20of,of%20new%20passenger%20vehicle%20sales.

[11] Tallying government support for EV investment in Canada. (n.d.). https://www.pbo-dpb.ca/en/additional-analyses--analyses-complementaires/BLOG-2425-004--tallying-government-support-ev-investment-in-canada--bilan-aide-gouvernementale-investissement-dans-ve-canada#:~:text=For%20the%20%2446.1%20billion%20in,cent)%20higher%20than%20announced%20investments.

mandates.[12] Yet a lot of EVs are highly priced, and many are still worried about the range, the battery, and the speed. We can motivate more technological improvements by having more specific subsidies for EVs that have better range.[13] Overall we hope to drive demand through the reduction of cost, encouraging more options, and subsidies for vehicles that people actually want.

In this paper, we conduct a comprehensive literature review of over 20 articles on EV policy in Canada. We identify key challenges, evaluate proposed solutions, and assess the policy's applicability to Canada's EV market. Additionally, we analyze case studies from China, Japan, Germany, and the US to evaluate their approaches to EV policy. The following sections provide an overview of the literature, highlight of the main issues, and our evaluation of proposed policies. Finally, we conclude with recommendations for how the Canadian government can effectively utilize its resources to combat climate change.

Literature Review

The main priority of governments has been expanding subsidies for EVs in order to reduce GHG emissions. However, academic research mentions that this may not be well targeted and does not take into account cost-efficiency enough. Professor Harvey L. D. D. evaluates the cost-effectiveness of various electric vehicles and suggests the government should lower subsidy scales and prioritize smaller EVs manufacturing through subsidies. He advocates for aligning subsidies across internal combustion engine vehicles, hybrid electric vehicles (HEVs), and plug-in hybrid electric vehicles. It provides a detailed comparison of vehicle types, assessing fuel consumption and countries economic level as a reference to provide clear market trends using historical data and predict the future models. However, it contains a lack of precise analysis of optimal subsidy levels and insights of future policies are suggested to be detailed. As a conclusion, it provides recommendations to government regulation to avoid spillover effects and inefficient government expenditure. Redirecting investments toward energy efficiency improvements may yield better overall results for emission reductions. Harvey's research advocates for a balanced approach in climate policies, suggesting that while EV subsidies play a role in reducing emissions, a greater focus on energy efficiency measures might offer more substantial and cost-effective benefits in the fight against climate change.

The effectiveness of Canada’s EV subsidies has been criticized in many academic papers, while research papers from countries like China and the US show that there is large space for improvement in Canada’s EV policy. Many scholars have thus researched the cost effectiveness of EV subsidy policy. One such article comes from Sheldon and Dua, who have provided a comprehensive analysis of the US’s EV subsidy policy in their article, evaluating the cost-effectiveness of the subsidies in promoting EV adoption.[14] They criticized the current EV subsidy policy as expensive and involved significant free-rider problems in its distribution.[15] They suggested that the cost-effectiveness of the policy could be improved significantly by targeting the subsidies to factors such as specific consumer groups, geography, vehicle types, and distance travelled.[16] Nevertheless, as the study is conducted in the US, the applicability of its conclusion on Canada’s EV market is under question. Therefore, more studies are required to evaluate the usefulness of such targeting subsidy policy in promoting EV adoption in Canada. On the other hand, Thorne and Hughes have conducted a study on the effectiveness of subsidizing EVs in reducing GHG emissions in Canada.[17] They discussed

[12] Biden administration rolls out new tailpipe rules that will boost EVs and hybrids. (2024, March 20). CTVNews. https://www.ctvnews.ca/autos/biden-administration-rolls-out-new-tailpipe-rules-that-will-boost-evs-and-hybrids-1.6815084

[13] Policies to promote electric vehicle deployment – Global EV Outlook 2021 – Analysis - IEA. (n.d.). IEA. https://www.iea.org/reports/global-ev-outlook-2021/policies-to-promote-electric-vehicle-deployment

[14] Sheldon, T. L., & Dua, R. (2019). Measuring the cost-effectiveness of electric vehicle subsidies.

[15] ibid

[16] ibid

[17] Thorne, Z., & Hughes, L. (2019). Evaluating the effectiveness of electric vehicle subsidies in Canada. *Procedia Computer Science*, *155*, 519–526. https://doi.org/10.1016/j.procs.2019.08.072

Canadian-specific factors such as geography, main energy sources, cold weather, and household habits in vehicle usage and questioned whether promoting EV adoption is the best way for Canada to reduce GHG emissions.[18] However, the data utilized in Thorne & Hughes's article focuses only on 3-5 vehicle types and thus might not be as representative of the entire Canadian EV industry.[19] More data and studies are required to validate their conclusion. Finally, a study by Shang et al. in China provided valuable insights into the use of a combination of different EV policies, including financial and non-financial ones, in enhancing EV penetration in China.[20] They concluded in their study that non-financial incentives such as parking benefits, charging discounts, and EV infrastructure development could help boost the effects of subsidies on EV adaptation.[21] Such policies could be valuable for Canada, as they could help it study their usefulness in the Canadian market. Nevertheless, significant demographic, social, and geographic differences between China and Canada could hinder the effectiveness of the policy when it is implemented in Canada.

Li et al. build on previous literature that highlights the growing importance of government subsidies in promoting sustainable development.[22] These earlier studies often treat government subsidies as exogenous variables. Li et al. advance the topic by considering government subsidies as endogenous variables, understanding that competitor market prices and production costs change the differences in effects of different subsidy schemes. Li et al. examine the effectiveness of three government green subsidy schemes—Green Non-Subsidy (GNS), Green Product Subsidy (GPS), and Green Innovation Subsidy (GIS)—with a focus on the EV industry. Their study evaluates how different subsidies impact social welfare and subsidy efficiency as two distinct objectives. The GPS, which subsidizes consumers to reduce retail prices, effectively boosts demand when innovation costs are high and significantly reduces production costs. This approach has been widely used in the EV industry, as seen in the U.S. government's $7,500 subsidy for electric vehicles. However, while GPS can stimulate short-term demand, it may not always maximize social welfare. In contrast, the GIS, which subsidizes manufacturers' innovation efforts, proves to consistently outperform the GPS in terms of efficiency, because it directly encourages green production. This type of subsidy is especially effective when production costs for green and non-green products are similar, as it enables firms to price green products competitively on the market. Evidently, the choice between implementing GPS and GIS should be guided by the specific goals of a subsidy program: maximize social welfare or optimize subsidy efficiency. While GPS may sometimes offer higher immediate social welfare benefits, GIS is generally more efficient and better suited for long-term environmental goals.

Challenges

Cost-Efficiency

While currently there are only two types of consumer subsidies in Canada different by electric range – CAD 2500 for range lower than 50km and CAD 5000 for range greater than 50km, it is questioned whether such a general subsidies policy is cost-effective.[23] Sheldon points out in their article that Canada's current EV subsidies are expensive and not cost-effective, as many people who received the subsidies will buy the EV without it (the free-rider problem), and some who want to buy the EV did not buy it even with the subsidies.[24] The cost-effectiveness problem is also discussed in

[18] Sheldon, T. L., & Dua, R. (2019). Measuring the cost-effectiveness of electric vehicle subsidies.
[19] Ibid.
[20] Shang et.al (2024). Can financial subsidy increase electric vehicle (EV) penetration.
[21] Ibid.
[22] Li, Y., Tong, Y., Ye, F., & Song, J. (2020). The choice of the government green subsidy scheme: innovation subsidy vs. product subsidy. International Journal of Production Research, 58(16), 4932–4946. https://doi.org/10.1080/00207543.2020.1730466, *p.g 4933*.
[23] Government of Canada. (2024, July). *Program overview.* Transport Canada. https://tc.canada.ca/en/road-transportation/innovative-technologies/zero-emission-vehicles/incentives-zero-emission-vehicles/program-overview#:~:text=There%20are%20two%20levels%20of%20incentives%3A%20Battery%20electric%2C,electric%20vehicles%20are%20eligible%20for%20up%20to%20%242%2C500%3B
[24] Sheldon, T. L. (2022). Evaluating Electric Vehicle Policy Effectiveness and Equity.

Sheldon & Dua's Articles, when they proposed to improve the subsidies' cost-effectiveness by specifying them based on different consumer groups, vehicle types, and the distance traveled etc.[25]

Effectiveness in Greenhouse Gas Reduction

Harvey discussed in his article about the problem of subsidies in reducing greenhouse gas emission due to its target on producer sales.[26] Canada's current producer EV subsidies mainly take the shape of an investment tax credit and focus on manufacturing and supply chains. It acts as an incentive for producers to increase the size of EV produced, as they generally get more subsidies per unit cost for larger EV. This results in producers promoting larger EV such as SUV and pick-up trucks and a greater proportion of larger vehicles in the EV market.[27] While downsizing is considered as an effective way to reduce GHG emission, the policy reverses the intention by resulting in consumers adopting unnecessary large vehicles. A similar problem is also mentioned in Thorne & Hughes's paper, where they discussed the problem that the household's habit of having multiple vehicles in Canada could lead to households buying additional vehicles as a result of EV subsidies instead of substituting their original gasoline vehicle (GV).[28] They also mention the problem of the sources of electricity in Canada, where for provinces with high carbon-intensive electricity generation, using EV could have the same GHG emission as using GV.[29] Therefore, while EV subsidies did increase EV adoption, it is questioned whether it contributes to GHG emission and whether it is the most efficient way to reduce GHG emission.

Equity Problem

Sheldon mentioned the problem of equity in Canada's EV subsidies policy, as studies have shown that the subsidies unproportionally benefit the middle-to-high income population while leaving the lower-income household behind.[30] The significant upfront cost of EV for the lower-income household and the lack of charging infrastructure in the lower-income neighborhood act as the two main barriers for the lower-income population to adopt EV.[31] While the proportion of EV have increased in the higher-income neighborhood, air quality and noise level improved for the well-off neighborhood while the poor neighborhood continued to suffer from the poor air quality from vehicle emission and the proximity from the coal plants. Therefore, it is worth considering the distribution effects of the EV subsidies and its impacts on social welfare.

Subsidy Standard Among Small and Large Vehicles

With multiple types of electric vehicles existing in the market, including PHEVs, BEVs, and FCEVs. And subsidy standards currently in Canada are more influenced by each regional approach, as a consequence, the variation in standards and criteria created room for improvement in aligning these incentives with broader environmental objectives.

For the Federal iZEV program, vehicles offered must be zero-emission, including all types of vehicles, and rebate amounts up to CAD 5000 for BEVs and FCEVs; for longer-range PHEVs with an electric range of at least 50 km, up to CAD 2500 in subsidies. [32]

Federal iZEV program offered rebates focused on zero-emission vehicles, amounting to CAD 5000 for BEVs and FCEVs. Specially for PHEVs with a longer electric range (less than 50 km), the

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[25] Sheldon, T. L., & Dua, R. (2019). Measuring the cost-effectiveness of electric vehicle subsidies.
[26] Harvey L. D. D. (2020). Rethinking electric vehicle subsidies, rediscovering energy efficiency.
[27] Ibid.
[28] Sheldon, T. L., & Dua, R. (2019). Measuring the cost-effectiveness of electric vehicle subsidies.
[29] Ibid.
[30] Sheldon, T. L. (2022). Evaluating Electric Vehicle Policy Effectiveness and Equity.
[31] Ibid.
[32] Transport Canada. (n.d.). *Eligible vehicles*. Government of Canada. Retrieved August 29, 2024, from https://tc.canada.ca/en/road-transportation/innovative-technologies/zero-emission-vehicles/incentives-zero-emission-vehicles/eligible-vehicles

subsidy is up to CAD 2500. As the standard is straightforward, solely focus on the vehicle's emission type and electric range.

For British Columbia, they also offer a subsidy program, also known as the CleanBC Go Electric Passenger Vehicle Rebate Program.[33] The program offers up to CAD 3000 for BEVs and FCEVs but lacks clarity on how much GHG reduction is required for maximum rebates. Using Ford PHEV Escape (2023, 2024) as an example, its range is 60 km electric and 784 km for full range; it offered combined rebates up to CAD 7000. On the other hand, compared with the Mini PHEV Countryman All4 Cooper SE (2023), the original price was similar; the range of electric and full is 29 km and 479 km, respectively. Mini also offered combined rebates up to CAD 7000; even with a big, different range, the rebates are the same. It showed different vehicles with different electric ranges can still receive the same rebate, suggesting a less stringent or possibly inconsistent application of standards.

Compared to Quebec, Quebec's Roulez vert Program[34] offered more detailed requirements for subsidy qualification, including odometer readings, demonstration of vehicle's history, resale intentions, and leasing terms. Quebec offers up to CAD 5000 for PHEVs and CAD 7000 for FCEVs. This represented Quebec as having a more matured set of criteria for eligibility for subsidies, leading to a more efficient use of funds compared to British Columbia.

Along with the inconsistency standards across regions and vehicle types suggested that there could be potential legal issues and inefficient fund usage due to asymmetrical between environmental goal and policy.

Differences in Outcomes Between EV Technology Subsidies and Final Product Subsidies

Subsidy programs vary in cost-benefit ratios (efficiency) and profit turnovers (effectiveness), especially in an industry as complex as the EV industry. Some of this variation can be explained by a subsidy's structure or size.[35] For instance, in China, local subsidy programs concern different risks and possibilities than centralized programs, as each involve different supervision and control levels. A more pressing question for Canada, though, which is relatively new to EV subsidies, is what proposed subsidies should target to begin with. For example, a subsidy may target funding new technology (i.e. innovation, R&D) or new final products (i.e. units produced and sold). Such differences signal challenges in achieving optimal social welfare.

According to economic models, subsidies aimed at technology consistently enhance both social welfare and subsidy efficiency.[36] These subsidies may be referred to interchangeably as green innovation subsidies and research and development subsidies. Intended to be received by firms that develop and patent new discoveries in the industry, these subsidies promote technological advancements without endorsing high consumer prices; R&D investments' impact on overall unit cost and unit price differences is less apparent than investments that reduce overall unit costs directly, like production subsidies. This approach encourages manufacturers to innovate and develop sustainable products. It also indirectly encourages businesses to maintain low retail prices to be competitive; usually higher costs of innovation are used to justify transferring higher prices to consumers, but in

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[33] Government of British Columbia. (n.d.). Explore personal rebate offers. CleanBC Go Electric Passenger Vehicle Rebate Program. https://goelectricbc.gov.bc.ca/rebates-and-programs/for-individuals/explore-personal-rebate-offers/

[34] Gouvernement du Québec. (n.d.). Amount of financial assistance for a new vehicle. Roulez vert Program. https://www.quebec.ca/en/transports/electric-transportation/financial-assistance-electric-vehicle/new-vehicle/amount-financial-assistance

[35] Gao, Y., Hu, Y., Liu, X., & Zhang, H. (2021). Can public R&D subsidy facilitate firms' exploratory innovation? The heterogeneous effects between central and local subsidy programs. Research Policy, 50(4), 104221-. https://doi.org/10.1016/j.respol.2021.104221, *p.g 2*.

[36] Li, Y., Tong, Y., Ye, F., & Song, J. (2020). The choice of the government green subsidy scheme: innovation subsidy vs. product subsidy. International Journal of Production Research, 58(16), 4932–4946*, p.g 4945*.

this case, R&D expenses are insulated to an extent. The opportunity for new knowledge spillover between firms is also significant for technology subsidies.

In contrast, innovation subsidies increase R&D investment intensity and improve innovation output, particularly for private companies, whereas tax incentives also boost R&D investment but have a negligible impact on patent applications.[37] This is because private companies already have more constrained budgets, so during economic upturn periods, they are incentivized to produce quality innovation to be competitive and gain market share.

In contrast to innovation subsidies, subsidies for final products can stimulate immediate demand and reduce production costs. These subsidies are also known as green product subsidies and they directly reduce the retail price of EVs for consumers.[38] However, they may inadvertently reduce manufacturers' incentives to continue innovating, as the immediate market demand created by the subsidy can be sufficient for profitability. This was evident in the case of the U.S. EV subsidy, which lowered retail prices and boosted sales but did not necessarily lead to continued technological advancements, and especially those that can match international competitors like China.[39] Moreover, the U.S. currently hyper focuses on subsidizing American EV purchases.[40] This reduces domestic firms' incentives to innovate and produce efficiently, among several concerns. Firstly, for the U.S. EV market's ability to compete with foreign markets like China in the long term depending on individual vehicles' quality. Secondly, for American EVs to contribute to the fullest extent of their potential to alleviate environmental burdens. Lastly, for American EV consumers to benefit from long-term use of their EVs, as companies lack incentives to develop charging infrastructure once their vehicles are assured to be sold. It is safe to assume that Canada is similar enough to the U.S. (regarding consumer behavior and habits and producer incentives) to predict that if the necessary precautions are not taken, the results of our efforts in the EV market will be similarly disappointing. Furthermore, such subsidies can create economic inefficiencies, reallocating resources from potentially more innovative or sustainable projects to those that are merely profitable in the short term. One upside to final product subsidies is that their effect is immediate and targeted.[41] This may be needed in Canada where economic capabilities (on the producer and consumer ends) are more inherently limited, and consumers tend to be frugal.

Balancing these two kinds of subsidies in policy and practice is crucial for fostering sustainable but relatively quick economic growth and innovation. This challenge is relevant and timely to discuss. After years of low R&D spending as a fraction of GDP and GDP growth, Canada currently pledges billions of dollars to subsidize various foreign vehicle companies to set up EV charging infrastructure in Canada,[42] primarily to "seize the moment" while the U.S. is constrained by interest rates and a relatively harder recession.[43] According to the economic models comparing GIS

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[37] Kang, F., Yu, Q., & Wan, M. (2023). Corporate Innovation Incentive Policy During Business Cycles: Fiscal Subsidies or Tax Incentives? Emerging Markets Finance & Trade, 59(7), 2190–2203. https://doi.org/10.1080/1540496X.2023.2167488*, p.g 2202*.

[38] Li, Y., Tong, Y., Ye, F., & Song, J. (2020). The choice of the government green subsidy scheme: innovation subsidy vs. product subsidy. International Journal of Production Research, 58(16), 4932–4946. https://doi.org/10.1080/00207543.2020.1730466, *p.g 4937*.

[39] Muresianu, A. (2024, March 6). *U.S. must fix R&D treatment to compete with China*. Tax Foundation. https://taxfoundation.org/blog/us-china-competition-technology-rd-tax-treatment/

[40] Welsh, J. (2024, April 18). *The paradox of U.S. government R&D funding: Barriers for non-U.S. owned firms*. SpaceNews. https://spacenews.com/the-paradox-of-u-s-government-rd-funding-barriers-for-non-u-s-owned-firms/

[41] Li, Y., Tong, Y., Ye, F., & Song, J. (2020). The choice of the government green subsidy scheme: innovation subsidy vs. product subsidy. International Journal of Production Research, 58(16), 4932–4946*, p.g 4943*.

[42] Hinton, J. (2024, February 12). *In giving billions to electric car makers, Canada is blinded by economic delusion.* The Globe and Mail. https://www.theglobeandmail.com/business/commentary/article-canada-electric-vehicle-companies-subsidies/

[43] Platt, B., Dion, M. (2024, February 9). *Honda talks test Canada's desire to move away from blockbuster EV subsidies*. Financial Post. https://financialpost.com/commodities/energy/electric-vehicles/honda-tests-canada-move-away-ev-subsidies

and GPS, either subsidy action should be good for our economy.[44] There should also be one that is optimal, and therefore, preferable.

Subsidies for Public Transportation

The transportation sector is the second largest contributor to GHG emissions, accounting for 28% of global energy consumption and emitting 25% of greenhouse gases, even more than passenger vehicles at 21%.[45]

In Quebec, even though an overall 9% GHG emission declined since 1990, emissions from the public transportation sector increased by over 6%.[46] In 2016, 73.5% of the population in Canada was identified as commuters, who rely on public transportation for daily commuting. To reduce emissions caused by public transportation, an establishment of policy includes the TTC Green Bus Program. Since 2017, there are 60 eBuses operating in service; to date, there are 310 clean diesel buses, with 255 of the latest generation HEVs. In the future, there will be approximately 300 HEVs and 240 eBuses.

Nova Scotia is also moving toward electrifying its public shuttle bus. Nova Scotia's government has invested CAD 17.9 million toward the addition of charging and maintenance infrastructure to support purchasing 44 electric buses to aim for net zero emission by 2050 (Green Transit Rolling into Cape Breton).[47]

Moreover, the TTC scheduled 3,215 zero-emission replacement buses between 2024 and 2040, but 2,875 replacement buses are currently not funded yet (TTC). As a result, challenges faced by EV public transportation include lack of funding since the government puts most of the subsidy on passenger vehicles and difficulty in publishing it to the entire Canada; a limited amount of buses in transportation is fixed, but demand for electric passenger vehicles could be maximized.

Besides Toronto, British Columbia is aiming to add 205 battery-electric buses by 2030, aiming to reduce carbon emission by 45%; while the province has committed funds, many projects still require federal support. For Quebec, the The Société de transport de Montréal (STM) plans to purchase 600 electric buses by 2030; however, electrifying public transports require high cost of infrastructure, such as charging stations and pose challenges[48].

Electric buses are expensive to purchase, when a diesel bus has an average amount of CAD 750,000, each electric bus is estimated to cost CAD 200,000 to CAD 500,000 more per bus to purchase.[49] With the heavy amount of government expenditure, it pushes electric transportation inefficiently and takes longer time to accomplish.

Currently, the Zero Emission Vehicle Infrastructure Program, which targets electric network operators and transport companies, is covering up to 50% of the cost for federal services and multi-unit residential complexes. In addition, as a result of expensive replacement costs, a large proportion of the planned EV bus replacements remain unfunded in Toronto (TTC), Montreal (STM -

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[44] Li, Y., Tong, Y., Ye, F., & Song, J. (2020). The choice of the government green subsidy scheme: innovation subsidy vs. product subsidy. International Journal of Production Research, 58(16), 4932–4946*, p.g 4944.*

[45] Environment and Climate Change Canada. (n.d.). *Greenhouse gas emissions*. Government of Canada. Retrieved August 27, 2024, from https://www.canada.ca/en/environment-climate-change/services/environmental-indicators/greenhouse-gas-emissions.html

[46] Environment and Climate Change Canada, *Canada's Electric Vehicle Standard*.

[47] Nova Scotia Government. (2023, November 15). *Green transit rolling in Cape Breton*. https://news.novascotia.ca/en/2023/11/15/green-transit-rolling-cape-breton

[48]Government of Canada. (2024, June). Budget 2024: Investing in public transit for growing communities. https://www.canada.ca/en/department-finance/news/2024/06/budget-2024-investing-in-public-transit-for-growing-communities.html

[49]CBC News. (2020, December 4). *Electric buses gain traction in Canadian transit systems*. https://www.cbc.ca/news/science/electric-buses-transit-1.5823166

Société de transport de Montréal), and Vancouver (TransLink). With a significant funding shortage, and lack of transparency, the focus on public transit funding is complicated and an inefficiency with current secured funding from the allocation process.

Manufacturing Investments

Currently Canada is not on track to reaching the goal of having all new vehicle sales be zero-emission by 2035. From a demand perspective, sales of EVs are uncertain going forwards. With the market share of zero emission vehicles (ZEV) growing over the past years reaching a high of 13.3% according to S&P Global in 2023, the past three quarters have shown a slowdown of ZEV sales as their market share declines to 12.5% in quarter one of 2024.[50] Consumer interest in purchasing a new ZEV as their next vehicle has also dropped from 68% in 2023 to 56% in 2024.[51] The reason for this is mainly due to the high prices, inflation rates, and interest rates. The decrease in gas prices could be another reason that people are hesitant on purchasing a ZEV, even though the government of Canada has released their goal.[52] Other factors including range, charging infrastructure, and waiting for a more developed technology are also motivators in the diminishing growth of ZEV sales. Several new EVs are also positioned in the high-end and not applicable for people of lower income.

Considering the supply side, the government has obtained and invested a total of CAD 98.6 billion to develop the supply chain of EVs in Canada for several different companies including Honda, Ford, Northvolt, Stellantis, Volkswagen, and POSCO.[53] The goal of these investments is so that in the long term, having domestically produced EVs will lower upfront cost of an EV and drive more demand. This will also motivate the building of more charging infrastructure. These investments can also hope to diminish the amount of inequality in the market as currently there are several new EVs that are considered high-end, on top of the already highly priced vehicles. The investments can be broken down into investments from the Federal and Provincial governments, funds and loans, and tax credits under the clean technology manufacturing and electric vehicle supply chain investments[54].

A challenge that is faced here is the uncertainty of the effectiveness of these investments, and whether these manufacturing plants will be able to be established and effective in time for the mandate of 2035. Some of the barriers to this is due to the amount of time it takes to process permits and impact assessments.[55] Another consideration is about other competitors and countries. It suggests that going forwards with all these investments to establish manufacturing in Canada could open the market to China.[56] With BYD, a Chinese EV company, having newly developed technologies at fast speeds and initial cost of ownership to be low, moving fast in establishing a domestic supply chain

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[50] Banks, B. (2024, June 19). Echoing StatsCan, S&P Global Mobility reports Canada's ZEV market share fell to 12.5 per cent in Q1 from 13.2 in Q4. Electric Autonomy Canada. https://electricautonomy.ca/data-trackers/2024-06-19/sp-zev-q1-market-share-canada/

[51] Ibid.

[52] Bubbers, M. (2024, January 31). Are drivers really losing interest in electric vehicles? The Globe and Mail. https://www.theglobeandmail.com/drive/mobility/article-are-drivers-really-losing-interest-in-electric-vehicles/#:~:text=More%20illuminating%20were%20the%20top,t%20afford%20them%20right%20now.

[53] Staff, G., & Subdhan, A. (2024b, April 25). Canada's committing tens of billions of dollars to the EV industry. Here's a list of the planned projects so far. The Globe and Mail. https://www.theglobeandmail.com/business/article-canada-ev-battery-plants-list-honda-stellantis/

[54] Tallying government support for EV investment in Canada. (n.d.). https://www.pbo-dpb.ca/en/additional-analyses--analyses-complementaires/BLOG-2425-004--tallying-government-support-ev-investment-in-canada--bilan-aide-gouvernementale-investissement-dans-ve-canada#:~:text=For%20the%20%2446.1%20billion%20in,cent)%20higher%20than%20announced%20investments.

[55] Kyriazis, J. (2024, April 16). Capturing Canada's electric vehicle opportunity - Clean Energy Canada. Clean Energy Canada. https://cleanenergycanada.org/capturing-canadas-electric-vehicle-opportunity/

[56] Gollom, M. (2024, January 10). Who benefits most from Canada's ambitious EV targets? Maybe China. CBC. https://www.cbc.ca/news/business/china-ev-targets-canada-auto-industry-1.7075508

could cause more competition.[57] There would be the issue of considering new import laws to control this competition.

Solutions

Differences in Outcomes: Focus on Growth, not Size

One issue that can be resolved is that of firm size significance. While small companies have shown to have greater need for subsidies to be incentivized to innovate, it has not been empirically or theoretically proven that they are more efficient than their large firm counterparts at earning quality patents. This is especially due to the disincentivization of smaller firms to scale up by maximizing their profits, once they are promised subsidies solely because of their size.[58] While the subsidy rate for larger firms is 15%, small firms benefit at a rate of 35% despite already benefiting from other small-business-oriented funds, a gap that is not filled by knowledge spillover differences. Rather, by making subsidy qualification requirements easier to achieve, the quality of innovation produced by smaller firms becomes limited. Some critics of current Canadian R&D subsidies in general argue that subsidies should be awarded based on merit and potential, and should be expected to be paid back over time and green earnings compensated with more generous tax credits.[59]

To achieve maximum efficiency and well-rounded effectiveness of subsidies in their allocation and use by EV firms, it would be ideal for governments and funds to not treat applicants differently based on firm size, but rather, on potential for growth: actionability of business plan, soundness of financial forecasts, verified sound technology, and entrepreneur-minded leaders. Canadian small businesses in particular already tend to receive a sizable amount of aid from specialized organizations, but these small businesses do not typically grow provided this aid.[60] That is fine in many industries, such as local retail and authentic cuisine. It is definitely not desirable in the EV industry, where policymakers and citizens may hope for EV infrastructure and vehicle availability to develop and expand quickly and robustly. Therefore, preventing firms' incentives to grow by tailoring EV subsidies based on company size is not ideal. In contrast, Canadian governments should aim to incentivize growth by expressing a preference for subsidy applicants with competitive and ambitious business plans to grow and innovate, regardless of current size.

Still, the key issue with focusing subsidies and grants on growth versus size may be the political feasibility aspect. To maintain popularity among voters, politicians might be cautious of advancing policies that would not explicitly favour small businesses, especially because small businesses comprise the vast majority of Canadian businesses at 97%.[61] Fortunately, advancing technology, including EV infrastructure and technology, tends to include larger companies or growth-oriented startups more than small businesses anyway. If the policy is intended to benefit Canadian consumers at large in the long run, providing funds to companies that are not necessarily small in the short run, voters should not be expected to be surprised or offended.

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[57] Ibid.

[58] Lester, J. (2024, July 4). *Opinion: Size shouldn't matter for R&D business subsidies. Microsoft Start.* https://www.msn.com/en-ca/money/topstories/opinion-size-shouldn-t-matter-for-r-d-business-subsidies/ar-BB1poCIX?ocid=finance-verthp-feeds

[59] LeRoy, G., & Tarczynska, K. (2022, October 13). *Report: At $13.8 billion, unnecessary electric vehicle factory subsidies are in Overdrive*. Good Jobs First. https://goodjobsfirst.org/report-at-13-8-billion-unnecessary-electric-vehicle-factory-subsidies-are-in-overdrive/

[60] Gale, W., & Brown, S. (2013). Small Business, Innovation, And Tax Policy: A Review. National Tax Journal, 66(4), 871–892. https://doi.org/10.17310/ntj.2013.4.05*, p.g 877*.

[61] Blair, N. (2023, January 29). *Small Business Statistics in Canada for 2023 - Made in CA*. MADE in CA. https://madeinca.ca/small-business-statistics-canada/#:~:text=A%20vast%20majority%20of%20Canadian

Boosting Demand and Supply Through Incentives Beyond Subsidies

Innovation subsidies are always preferable to product subsidies because they are always more efficient and often, more effective.[62] A more nuanced analysis of different subsidy programs shows that there is much more to take into consideration, however. Subsidies are considered more effective during recessionary periods, and tax credits are more beneficial during expansionary periods.[63] Another perspective to motivate demand in the market is through increasing supply. As manufacturing becomes significantly established, the upfront cost of an electric vehicle decreases, which can increase the demand for EVs. Ultimately, these investments are to help phase out internal combustion vehicles, yet this process takes time and there seems to be a discrepancy as to whether automakers can reach the mandate of 100% zero-emission small vehicles by 2035. An incentive for people to buy hybrid vehicles could allow more people to adopt to experience electrified vehicles without needing to fully commit to them. Additionally, manufacturing investments can be more efficient if they are going toward building vehicles that have longer ranges, better fuel efficiency, and better battery densities.[64]

The economic effect of subsidies differs based on the current economic cycle as well as the nature of recipient firms. In China, subsidies are more effective, relative to corporate tax benefits, during recessionary periods than during expansionary periods.[65] This is because tax benefits are considered long-term, and are appreciated more when companies can make money (i.e. during economic upturns) from which they can enjoy deductions. Subsidies can be quickly and accurately implemented during cyclical downturns to inspire innovation investment when firms' budgets are tightly constrained due to economic uncertainty. During the recession following the 2008 financial crisis, Germany recovered more quickly and steadily than other European Union nations.[66] Germany's government made R&D subsidies more accessible to more small and medium-sized businesses, which encouraged R&D spending to continue despite a contractionary period. As a result, Germany quickly saw positive trends in job creation, economic production, and GDP growth.

With Canada gaining investments of CAD 46.1 billion for the EV supply chain, the government has matched the investment amount, and an additional 14% of CAD 6.3 billion to a total of CAD 52.5 billion between the provincial and federal governments.[67] These investments will go towards both capital and operational expenses. These investments will drive demand once the lines of manufacturing are established in which the upfront costs of EVs decrease. However, the President and CEO of Honda Canada, Jean Marc Leclerc, argues that currently, even with these investments, the goal of reaching 100% emission-free small vehicle sales by 2035 is still very ambitious.[68] He suggests

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[62] Li, Y., Tong, Y., Ye, F., & Song, J. (2020). The choice of the government green subsidy scheme: innovation subsidy vs. product subsidy. International Journal of Production Research, 58(16), 4932–4946, *p.g 4945.*

[63] Kang, F., Yu, Q., & Wan, M. (2023). Corporate Innovation Incentive Policy During Business Cycles: Fiscal Subsidies or Tax Incentives? Emerging Markets Finance & Trade, 59(7), 2190–2203. https://doi.org/10.1080/1540496X.2023.2167488*, p.g 2193*.

[64] Policies to promote electric vehicle deployment – Global EV Outlook 2021 – Analysis - IEA. (n.d.). IEA. https://www.iea.org/reports/global-ev-outlook-2021/policies-to-promote-electric-vehicle-deployment

[65] Kang, F., Yu, Q., & Wan, M. (2023). Corporate Innovation Incentive Policy During Business Cycles: Fiscal Subsidies or Tax Incentives? Emerging Markets Finance & Trade, 59(7), 2190–2203. https://doi.org/10.1080/1540496X.2023.2167488*, p.g. 2193*.

[66] Brautzsch, H.-U., Günther, J., Loose, B., Ludwig, U., & Nulsch, N. (2015). Can R&D subsidies counteract the economic crisis? – Macroeconomic effects in Germany. Research Policy, 44(3), 623–633. https://doi.org/10.1016/j.respol.2014.11.012*, p.g 624*.

[67] Tallying government support for EV investment in Canada. (n.d.). https://www.pbo-dpb.ca/en/additional-analyses--analyses-complementaires/BLOG-2425-004--tallying-government-support-ev-investment-in-canada--bilan-aide-gouvernementale-investissement-dans-ve-canada#:~:text=For%20the%20%2446.1%20billion%20in,cent)%20higher%20than%20announced%20investments.

[68] Canada can't meet goal of 100% EV sales by 2035, automakers say. (2024, June 19). Financialpost. https://financialpost.com/commodities/energy/electric-vehicles/canada-cant-meet-goal-of-100-ev-sales-by-2035-automakers-say#:~:text=Just%2011%20per%20cent%20of,of%20new%20passenger%20vehicle%20sales and (J.M. Leclerc, personal communication, July 15, 2024).

that there should not only be EVs leading the change for GHG reductions, but rather the model that the United States is taking could be a better option.

Currently, in the United States, the efforts that motivate GHG reduction come from various aspects. The different pathways include owning hybrids, zero-emission vehicles, and more.[69] From the requirement of having zero-emission vehicles account for two-thirds of all new vehicles by 2032 in the United States, people are allowed to make choices in their vehicles between the different variations, before fully committing to an all-electric vehicle.[70] This mandate helps the phase-out of internal combustion vehicles as there is a proportion of people who would choose hybrid vehicles over full electric vehicles while waiting for the technology in EVs to be more stable and that positive stories overtake the momentum of EV "horror stories". Canada can consider this as a model to help motivate the phase-out of GVs and the transition to fully electric vehicles. Using this incentive can allow people who do not want to go fully electric to have a greater incentive and also move people toward the phase-out of EVs more effectively.

The challenge of this solution is that there is an uncertain effective rate as of now, and how quickly the Canadian market will adjust to it. Also with the underlying problems that the demand side is facing, this solution can only benefit those who are considering hybrid models, meaning that it does not help with demand, but rather makes the phase-out period more gracious and not losing as much money on the suppliers' end.

Leclerc also states that most people who purchase EVs don't do it for the global benefits, but rather for the financial benefits. Although there are mixed perspectives regarding this, automakers are now facing the challenge of reaching the mandate by 2035, consumers will eventually only have EVs as an auto choice. Taking on this perspective, EVs in Canada are currently highly-priced, and the new models are positioned to be more luxurious, making affordability a greater challenge.[71] Not to mention that most people are still concerned about the range, speed, and charging facilities for EVs.[72]

China, which has the largest EV market, drove their market by the NEV credit mandate which requires automakers to have a certain percentage of their total vehicle sales to be zero-emission vehicles, with the target being 18% in 2023.[73] This program motivated technology improvements for automakers and had subsidies that favoured EVs that had longer driving ranges, more efficient fuel economy, and higher battery densities. Bringing this back to the investments that the governments have made, there should be sufficient policies that ensure these investments are going towards the development of manufacturing that will produce vehicles that cater to these needs or moving forwards, newer subsidies will favour these vehicles over the others.

This solution ultimately helps drive demand through the encouragement of purchasing vehicles that people ideally want, EVs with longer driving ranges. The flaws of this lie in that the implementation in the current market may not be very effective, which would be more beneficial once automakers bring more advanced EVs to the market, which takes time. Although this could increase EV sales after the market has been improved with more advanced EVs, there is no reason to believe that it will directly help automakers reach the mandate in time.

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[69] Biden administration rolls out new tailpipe rules that will boost EVs and hybrids. (2024, March 20). CTVNews. https://www.ctvnews.ca/autos/biden-administration-rolls-out-new-tailpipe-rules-that-will-boost-evs-and-hybrids-1.6815084

[70] Ibid.

[71] Bubbers, M. (2024, January 31). Are drivers really losing interest in electric vehicles? The Globe and Mail. https://www.theglobeandmail.com/drive/mobility/article-are-drivers-really-losing-interest-in-electric-vehicles/#:~:text=More%20illuminating%20were%20the%20top,t%20afford%20them%20right%20now.

[72] Javed, B., Kandlikar, M., & Giang, A. (2024). Variability in costs of electrifying passenger cars in Canada. Environmental Research: Infrastructure and Sustainability. https://doi.org/10.1088/2634-4505/ad253e

[73] Policies to promote electric vehicle deployment – Global EV Outlook 2021 – Analysis - IEA. (n.d.). IEA. https://www.iea.org/reports/global-ev-outlook-2021/policies-to-promote-electric-vehicle-deployment

In conclusion, subsidies and tax credits should be balanced with the consideration of economic growth. In addition, another solution to solving demand and supply is by having more financial incentives that support EVs with greater driving ranges and durability. Finally, by supporting the transition to EVs through having incentives for hybrids will allow manufacturers to have a smoother transition towards the mandate.

Investment Toward Public Transportation and Charging Systems

Another pertinent issue with the Canadian vehicle market is that public transportation infrastructure is lacking and leads to significant dependency on vehicles, which promote larger emissions[74]. To address this issue and promote sustainable infrastructure, a solution is proposed using Quebec as a focus: enhancing connectivity between urban areas, the north and south of Montreal, and other parts of Quebec.[75] The investment would involve several key strategies aimed at improving public transit accessibility and reducing the reliance on personal vehicles. Individually suggested solutions should seek convenience for people to live further without increasing traffic congestion and environmental impact.

The investment toward electronic transportation infrastructure should focus on expanding the existing transit network and creating new routes to connect previously underserved regions. Currently, the Quebec government has established the Green Municipal Fund looking to fully electrify the public bus fleet, procuring 21 electric buses, including 10 paratransit shuttles with 12 charging stations among the service area. However, they are not region-owned but subcontracted to six private companies, with no timeline given.

Additionally, extending from current progress, the government should establish certain standards to ensure investments align with the initial mission of sustainable development. These standards include emission reductions, cost-effectiveness, fiscal responsibility, political feasibility, and simplicity.

Emission reductions refer to recording a significant reduction in greenhouse gas emissions, comparing emissions from previous seasons. Standards should mandate a specific percentage reduction in emissions over a set timeline, ensuring that electrification contributes to national and international climate targets.

Cost-effectiveness would evaluate a cost-per-ton of carbon reduced basis to ensure funds are being used efficiently and transparently. In the long-run perspective, the long-term benefits of electric buses against their initial cost, including the cost of infrastructure such as charging stations.

Fiscal responsibility speaks to government spending on EV public transportation should not lead to unsustainable debt levels or financial pressure on taxpayers. Government could develop clear budgetary limits and explore public-private partnership to share costs, eliminating taxpayers' pressure.

While expanding EV public transport, the government should also expand the network of public transport charging systems to ensure transportation is able to function properly within the service area while preventing insufficient battery charge. For example, the government should prioritize the development of fast-charging stations in urban areas, along major transit routes, and at depots to prevent service disruptions due to insufficient battery charge[76].

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[74] Rethinking Quebec's Support for Electric Vehicles. (2020, November 11). McGill University. Retrieved June 16, 2024, from https://www.mcgill.ca/maxbellschool/files/maxbellschool/channels/attach/rethinking_quebecs_support_for_electric_vehicles.pdf, p.g 10

[75] *Rethinking Quebec's Support for Electric Vehicles*, McGill University.

[76] Department of Finance Canada. (2024, June). Budget 2024: Investing in public transit for growing communities. Government of Canada. https://www.canada.ca/en/department-finance/news/2024/06/budget-2024-investing-in-public-transit-for-growing-communities.html

By electrifying public transportation, multiple advantages toward economics are driven, even more beneficial than direct economic impacts as it stimulates various sectors of the economy. Expanding public transit requires purchasing materials such as wood, cement, aluminum, and steel, boosting demand in these local industries. Additionally, creating new transit infrastructure opens up job opportunities, contributing to economic dynamism and, ultimately, Canada's GDP growth. As a result of public transportation investment, each $1 billion invested would yield 50,731 jobs, offering a 4 to 1 economic return in the United States[77]. For local businesses, public transit investments will yield a 2 to 1 return to aim local businesses generating income and increasing economic standard with workers and neighborhoods[78].

However, realizing these given positive impacts requires multiple rounds of economic activity with ongoing reviews to ensure investment is worthy in the long run. Given the long-term effects of the post-pandemic recession, the investment in public transit infrastructure is seen as a long-term strategy rather than an immediate market boost. In the short run, the government will need to allocate larger funds for future growth.

Under the light of evidence, the solution is most effective in building reliance on public transportation through strategic budget allocation and is deemed more beneficial than subsidizing individual vehicles, which goes directly to the economy. The solution itself requires to be implemented in a low-interest-rate environment, allowing the government to borrow additional funds at a low cost, making it an opportune time to finance long-lasting public infrastructure projects. This solution not only aligns with broader goals of sustainability and economic resilience but also offers a new pathway to generate economic growth locally.

In conclusion, the proposed solution offers the potential for significant efficiency gains and environmental benefits, despite the challenge of prolonged impact times. By focusing on electrifying public transit infrastructure, it aims to create a more sustainable transportation ecosystem that reaches the needs of urban and suburban residents.

Subsidies Toward Small EVs

Subsidies toward small EVs based on size are preferable to align with energy efficiency goals, have a distinct focus on reducing emissions, and maintain energy consumption with a joint standard.[79] Currently, larger vehicles emit more pollution and consume more energy than smaller ones. However, the Canadian government inadvertently encourages automakers to produce bigger and less efficient vehicles by subsidizing large vehicles. Without any doubt, this policy is arguable because this approach raises market price and diverts attention from the government's energy efficiency objectives instead of focusing on market reform.

The Canadian Honda CEO suggests that providing subsidies for smaller vehicles and batteries could boost consumer confidence, give companies wider opportunities for research and development of small batteries, as well as promote the adoption of energy-efficient technology.[80] Smaller vehicles inherently have lower emissions and energy consumption[81], making them ideal for subsidies programs. Harvey further recommends that the government implement light-duty vehicle standards,

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[77] American Public Transportation Association. (2020). Economic impact of public transportation investment. APTA.
https://www.apta.com/research-technical-resources/research-reports/economic-impact-of-public-transportation-investment/

[78] American Public Transportation Association. (n.d.). Public transit knowledge. APTA.
https://www.apta.com/research-technical-resources/research-reports/public-transit-knowledge/

[79] Harvey, "Rethinking Electric Vehicle Subsidies," Energy Policy 146 (2020): 111760.

[80] Leclerc, J.-M. (2024, July 15). *Interview with the Canadian Honda CEO on subsidies for smaller vehicles and LDV standards*. [Zoom interview].
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[81] Envo Drive. (n.d.). Are smaller or micro electric vehicles relevant in North America? Envo Drive Systems.
https://envodrive.com/blogs/news/are-smaller-or-micro-electric-vehicles-relevant-in-north-america

which are widely applied in China, Europe, the United States, and India. These standards also applied to internal combustion electric vehicles, hybrid electric vehicles, and plug-in hybrid electric vehicles to prevent the dilution of standards. By adopting these standards, the government can ensure that subsidies have a direct impact on vehicles that truly offer environmental benefits and make policy less complicated.

In the short term, subsidy applications on smaller vehicles would push manufacturers to concentrate their technological advancements on these models.[82] Smaller vehicles, which require smaller batteries, allow for faster technology production with shorter lead times. Additionally, shorter charging periods for smaller vehicles would reduce consumer inconvenience, boosting attractiveness to potential buyers. This focus could lead to an easier transition to a more sustainable automotive industry.

In a long-run perspective, prioritizing subsidies for smaller vehicles would lower emissions while increasing willingness to pay for energy-efficient options.[83] And systemized standards allow flexible policy adjustments based on technological advancements and benefit periodic reviews, ensuring alignment with current energy efficiency and sustainability goals. For bug EVs production line, required. Based on a study from the International Council on Clean Transportation[84], it indicates that larger batteries inside large EVs could increase energy consumption by 13.4% to 16.9%. Showed smaller EVs contain better energy efficiency and lower lifecycle greenhouse gas emissions, reinforcing the efficiency benefits of smaller electric vehicles.

While this solution emphasizes smaller vehicles, it also highlights "no other exceptions," which includes public transportation that tends to produce higher emissions. Consequently, subsidies for public transportation would be lower, reflecting their higher emissions compared to smaller vehicles. However, the government should maintain a balance by supporting technological advancements in larger vehicles, ensuring that improvements in energy efficiency are achieved across the board.

Overall, subsidizing smaller vehicles would encourage innovation and ensure manufacturers are incentivized to improve energy efficiency, regardless of vehicle size. This approach not only aligns with environmental goals but also drives technological progress in the automotive sector. By strategically focusing subsidies on smaller, more efficient vehicles, the government can foster a more sustainable and economically viable transportation ecosystem that benefits both consumers and manufacturers.

Targeting the EV Subsidies to Different Consumer Groups and Vehicle Types

Studies from other countries proposed that instead of subsidizing every EV buyer, targeting subsidies to specific consumer groups could significantly improve the cost-effectiveness of the EV subsidies. It is argued that focusing on "marginal" consumers who are undecided or could be encouraged to buy a PEV through subsidies can significantly lower the expenses associated with these demand-side policies.[85] This is because the price-discriminated policy could reduce the free-rider problem, that is, not subsidizing buyers who would purchase an EV without the subsidies.

While discussing subsidy targeting factors such as vehicle disposal type, geography, and vehicle mile travel, Sheldon and Dua emphasize the significance of income-targeting in maximizing

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[82] Temple, J. (2022, October 26). The truth about electric vehicles and climate change. MIT Technology Review. https://www.technologyreview.com/2022/10/26/1061636/electric-vehicles-cars-climate-change-transit/

[83] Milman, O. (2023, May 4). Electric vehicles and the rise of SUVs: How they're shaping the future of the US vehicle fleet. The Guardian. https://www.theguardian.com/business/2023/may/04/electric-vehicles-suvs-us-vehicle-fleet

[84] Bieker, G. (2024, April). How EV size impacts energy efficiency: An in-depth analysis. International Council on Clean Transportation. https://theicct.org/wp-content/uploads/2024/04/ID-80-%E2%80%93-BEVs-size-Report-A4-70138-v9.pdf

[85] Sheldon, T. L., & Dua, R. (2019). Measuring the cost-effectiveness of electric vehicle subsidies.

the cost-effectiveness of EV subsidies.[86] Their study shows that, for the US EV consumer, limiting the subsidies to lower income could reduce the subsidies per additional EV purchased by USD 19,600, representing the most effective way of improving the cost-effectiveness of EV subsidies.[87] This is because the high upfront cost is among the most significant barriers for consumers to purchase EVs, especially for lower-income households.[88] Therefore, subsidizing EVs for lower-income individuals at the point of purchase nudges the "marginal buyer" from buying CVs to EVs. In addition to the financial benefit, the income-targeting policy also brings social benefits as it assists lower-income individuals and reduces the inequality between the rich and the poor.

Although the study by Sheldon and Dua was done in the US market, the proximity and similarity between the US and Canada mean this policy may also work in Canada.[89] Additionally, the policy could address the problem of households purchasing EVs as their additional vehicle.[90] The lack of subsidies for high-income households may disincentive them to purchase an additional EV, which reduces unnecessary consumption and the rebound effect (i.e., the cheaper EV leads people to buy more cars).[91] However, the practicality of the income-targeting policy is still being considered. For example, it could be hard to determine where the margin lies, i.e., the "lower-income individuals" bound. While Sheldon and Dua define "low-income" in their study as individuals with annual incomes less than $70k, this figure will be different in Canada and is yet to be determined. Additionally, the level of subsidies provided to lower-income individuals could be hard to determine, as significant studies are required to determine the amount of subsidies that will nudge lower-income individuals to switch from CV to EV. It could be ineffective if the subsidies are insufficient, whereas unnecessary costs may occur if the amount is too much. Nevertheless, if the bound and the amount of subsidies are determined accurately, the income-targeting policy could significantly benefit Canada financially and socially. It's also worth noting that such a policy could potentially negatively impact the second-hand car market, as used-car buyers, often lower-income individuals, are likely to purchase new EVs instead of second-hand cars.[92] The drop in demand for used cars could lower their price and lead to large disposal of used vehicles, negatively impacting the environment. However, this problem could be solved by promoting recycling of the used car and improving technology to maximize the benefit of recycling.

On the other hand, Sheldon and Dua also discuss using different subsidy-targeting policies to achieve different objectives.[93] While they found that an income-targeting policy is the most effective in increasing EV sales, the vehicle-disposal-type-targeting policy is more effective in minimizing gasoline consumption and, thus, greenhouse gas emissions.[94] They proposed that targeting subsidies to individuals who will dispose of gasoline-heavy vehicles to buy EVs could lead to the greatest gasoline reduction per unit of subsidies. For example, subsidies could be provided to rural residents who use large, gasoline-heavy trucks and drive more than 2000 miles daily.[95] If these large gasoline-consumption individuals switch to EVs, gasoline consumption will significantly reduce per person.

The gasoline-consumption-focus policy focuses more on the environmental side than mere EV sales, and it could be more effective in achieving the GHG emission goal. However, the policy may lead to reverse consequences due to the problem of moral hazard. Individuals may be encouraged to buy gasoline-heavy trucks to obtain EV subsidies later when they switch to EVs, and they may drive more unnecessarily to achieve the subsidy criteria of 2,000 miles. While income is an objective

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[86] Ibid.
[87] Ibid.
[88] Government of Canada. (2024, July). *Program overview.* Transport Canada.
[89] Sheldon, T. L., & Dua, R. (2019). Measuring the cost-effectiveness of electric vehicle subsidies.
[90] Thorne, Z., & Hughes, L. (2019). Evaluating the effectiveness of electric vehicle subsidies in Canada.
[91] Ibid.
[92] Sheldon, T. L. (2022). Evaluating Electric Vehicle Policy Effectiveness and Equity.
[93] Ibid.
[94] Ibid.
[95] Ibid.

factor that is hard to hide, individual behaviors are difficult to monitor and thus pose a significant challenge to the feasibility of this policy.

Combining Subsidies with Other EV Incentive Policies

It is questioned whether subsidy is the most effective way to promote EV adoption and reduce GHG emissions. Studies have shown combining subsidies with other EV incentive policies could lead to greater EV adoption and social welfare. A study by Srivastava et al.evaluated the effectiveness of different tax and subsidy-incentive EV policies currently implemented by different countries, and they found that a combination of green tax and EV subsidies is one of the approaches that maximizes social welfare.[96] While subsidies do increase EV adoption, it is highly costly to the government and could divert the government budget from spending on other projects that could improve social welfare, such as education and healthcare. Therefore, imposing taxation on GHG emissions while subsidizing EVs could help the government balance their budget and reduce the opportunity cost of its EV subsidy policy. However, there is a potential inequality problem in green tax, as low-income individuals who still can't afford new EVs with subsidies will face greater financial barriers.

Besides financial incentives, non-financial incentives in other countries have been proven to boost EV adoption when applied along with monetary incentives. This is evidenced in the study by Shang et al., who evaluated the interaction between the financial and non-financial EV incentives in China.[97] Shang et al. showed that non-financial incentives such as parking benefits, charging discounts, charging infrastructure development, and end-number limit benefits could reinforce the impact of financial incentives on EV penetration in China.[98] For example, while it is hard to apply for CV plates in a city like Beijing due to government restrictions, such restrictions are not applied to EVs and thus act as a significant incentive for EV purchases. While the end-number limit policy will likely not apply to Canada, improving infrastructure, charging discounts, and parking benefits could incentivize Canadian consumers to purchase EVs. For example, the government could reduce EV highway fees, provide parking discounts to EV in downtown, and improve EV charging infrastructure to reduce the range anxiety of EV buyers. Nevertheless, it is also worth considering the financial cost of providing non-financial incentives to EV owners, as it is still an expensive approach for the government.

Consideration of Other Countries' Incentives, Subsidies, and Policy Effects

The U.S., Japan, China, and Germany's EV subsidy program strategies offer valuable insights as to how advanced economies' investments in EV technology incentivized EV adoption, and how Canada can craft a parallel balanced approach that is sensitive to Canadian markets and global innovation trends, and robust to political fluctuations.

The United States shares many similarities with Canada in terms of consumer behavior, market structure, and environmental goals. Like Canada, they want to make their EVs more competitive globally, and lower prices so citizens can buy EVs. Based on a 2018 study by Jenn, Springel, and Gopal, the U.S. has aggressively promoted EV adoption through subsidies for both production and R&D.[99] These measures have shown that subsidies can be effective for their intended purposes, though not necessarily R&D industry knowledge spillover.[100] In fact, for every USD 1,000 offered as a rebate or tax credit, EV sales increase by 2.6%. So far, in the U.S., the Small Business

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[96] Srivastava, A., Kumar, R. R., Chakraborty, A., Mateen, A., & Narayanamurthy, G. (2022). Design and selection of government policies for electric vehicles adoption: A global perspective. Transportation Research. Part E, Logistics and Transportation Review, 161, 102726-. https://doi.org/10.1016/j.tre.2022.102726

[97] Shang, et.al (2024).Can financial subsidy increase electric vehicle (EV) penetration.

[98] Ibid.

[99] Jenn, A., Springel, K., & Gopal, A. R. (2018). Effectiveness of electric vehicle incentives in the United States. Energy Policy, 119, 349–356. https://doi.org/10.1016/j.enpol.2018.04.065*, p.g 350.*

[100] LeRoy, G., & Tarczynska, K. (2022, October 13). Report: At $13.8 billion, unnecessary electric vehicle factory subsidies are in Overdrive. Good Jobs First. https://goodjobsfirst.org/report-at-13-8-billion-unnecessary-electric-vehicle-factory-subsidies-are-in-overdrive/

Innovation Research (SBIR) and Small Business Technology Transfer (SBTT) grants, managed by the Small Business Association (SBA) with participation from 11 agencies and primarily, the Department of Defense, contribute CAD 2.72 billion annually.[101] Nevertheless, while R&D government expenditures have grown in the U.S. by billions each year, "growth" is a tricky word because due to inflation, the fixed year spending comparisons show relative stagnation in recent years. Compared to Canada, the U.S. subsidizes less as a percentage of GDP.[102]

Under the Biden-Harris administration, the Department of Energy (DOJ) was focused intensely on subsidizing EV battery and technology development.[103] In the years leading to October 2022, the U.S. had provided CAD 18.8 billion in subsidies to support EV and EV battery production, not counting 50+ projects with undisclosed subsidy amounts.[104] For 2023, they announced CAD 178 million to dedicate to clean energy through EVs specifically.[105]

The results of these policies have been ongoing overcapacity and hyper demand risks - by subsidizing industries and companies directly related to EVs, the U.S. could be missing out on indirect factors that impact the effectiveness of EVs - as well as concerns of overconsumption - too much production of anything, including EVs, can be detrimental to the environment. Other observations include that subsidies encourage negligible changes in private industry work environment quality and standards, while public industries, like electric transport, buses, have unions to press matters.[106] The concern of over subsidizing EVs is perhaps not so imperative for Canada. After all, R&D subsidies sometimes do not go straight to innovation, but rather, as increments to worker wages. In the U.S. this keeps entrepreneurs and skilled workers attracted. Canada's apparent shortage of competitive opportunities for STEM workers could benefit from R&D subsidies geared towards EVs, much more than our markets can struggle in the short-term from over subsidization.

There is potential variability in U.S. policies due to potential political changes. For instance, as President, Donald Trump intends to move the tax credits away from carbon-free initiatives and promote using oil, so the U.S.'s focus on vehicles might change dramatically, whereas Kamala Harris would likely continue the way Biden began.[107] Although the stability of Canada's political landscape differs from the U.S., the U.S. is our closest neighbour. The focus or lack of focus in their EV initiatives ties directly to how receptive they will be to trade goods, services, and technology with Canada in the EV sector.

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[101] Welsh, J. (2024, April 18). The paradox of U.S. government R&D funding: Barriers for non-U.S. owned firms. SpaceNews.
https://spacenews.com/the-paradox-of-u-s-government-rd-funding-barriers-for-non-u-s-owned-firms/
[102] OECD. (2019). *R&D tax incentives in United States*. INNOTAX.
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https://www.energy.gov/articles/us-department-energy-announces-131-million-boost-americas-battery-supply-chain-and
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[106] Reed, R. (2023, June 23). *What the US is getting right — and wrong — about the move to electric vehicles*. Harvard University.
https://hls.harvard.edu/today/what-the-us-is-getting-right-and-wrong-about-the-move-to-electric-vehicles/
[107] Shepardson, D. (2020, December 15). Automakers urge U.S. support for EV charging, R&D, incentives | Reuters. Reuters.
https://www.reuters.com/article/autos-emissions-electric/automakers-urge-u-s-support-for-ev-charging-rd-incentives-idUSKBN28P19K/

Like the U.S., China has recognized the positive effect potential in EV subsidies. A 2019 study by Zhang, Burke, & Wang found that a CNY 1,000 increase in the maximum per-vehicle subsidy is on average associated with a 4% increase in registrations of new domestically produced EVs.[108] Additionally, such a subsidy would save 264.4 million liters of lifetime gasoline use. However, a study by Zhao et al. revealed that firms tend to falsify battery testing reports and sales records to meet requirements to be eligible for subsidies.[109] With Zhang, Burke, & Wang adding that in 2015, survey respondents were 50% more likely to be willing to consider purchasing EVs when they were aware of subsidy policies than if they weren't, it is clear that for Canada as well, providing and clearly communicating subsidies on the consumer side to boost demand, might be more effective than prioritizing the supply side. China's success in its focus on leveraging its natural resources is also relevant to Canada, whose abundance and potential remains untapped.

Japan's strategies are comparatively different from Canada's, but the outcomes of these strategies still provide valuable insights. For instance, Japan focuses on Clear Energy Vehicles (CEV) and Fuel Cell Electric Vehicles, while Canada focuses on zero-emission vehicles. The nation provides up to JPY 400,000 for individuals purchasing FCEVs and JPY 150,000 for CEVs, in addition to tax benefits of up to 50% depending on the fuel reduction amounts.[110] Meanwhile, Japan invests CAD 3 billion in battery production, with CAD 1.3 billion in subsidies for manufacturers.[111] Even so, in 2022, EVs represented only 2% of passenger car sales, as cheap but low-quality domestically-produced EVs eroded Japan's reputation for EVs.[112] This case study implies that overdoing subsidies without paying adequate attention to quality expectations, assurance, and control, could have a converse effect where consumers do not purchase EVs despite subsidy-made low costs. This is certainly not the outcome we would like for Canada's sprouting market. Therefore, prioritizing quality when opening applications for EV production subsidies is in itself a priority.

With established vehicle brands, including luxury and resource-rich companies, Germany's transition into the EV market would appear markedly more natural than Canada's. For example, when Germany's government subsidy program was halted due to a budgeting crisis, Audi, Mercedes, Stellantis, and Volkswagen promised to fund private subsidies for German EV consumers.[113] This renders it all the more concerning that despite 1.48 million successful subsidy applicants between 2020 to 2022,[114] Germany has been unable to meet its overall carbon emissions target.[115] Perhaps omitting progressive income tax constraints, ensuring that those with higher incomes benefit relatively more when purchasing EVs than those with smaller incomes, has had confounding effects on the

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[108] Zhang, T., Burke, P. J., & Wang, Q. (2024). Effectiveness of electric vehicle subsidies in China: A three-dimensional panel study. Resource and Energy Economics, 76, 101424-.https://doi.org/10.1016/j.reseneeco.2023.101424, *p.g 14*.

[109] Zhao, Y., Jian, Z., & Du, Y. (2024). How can China's subsidy promote the transition to electric vehicles? Renewable & Sustainable Energy Reviews, 189, 114010-. https://doi.org/10.1016/j.rser.2023.114010*, p.g 3.*

[110] *Japan's 10-year Tax Reduction Strategy: A Boost for the Electric Vehicles and Semiconductor Chip Industries?* (2024, April 3). FPT Semiconductor .,JSC. https://fpt-semiconductor.com/japans-10-year-tax-reduction-strategy-a-boost-for-the-electric-vehicles-and-semiconductor-chip-industries/

[111] Bharadwaj, R. (2023, October 23). *The Rise of Electric Vehicles in Japan: An Exploration of Market Trends.* Bolt Earth. https://bolt.earth/blog/japan-ev-market

[112] *Japan EV Subsidy Program to Evaluate Measures by Manufacturers; Charging Point Numbers, Response to Issues to Impact Subsidies*. (2023, November 24). The Japan News. https://japannews.yomiuri.co.jp/politics/politics-government/20231124-151544/

[113] *Carmakers foot German EV subsidy bill after state backs out.* (2023, December 19). Reuters. https://www.reuters.com/business/autos-transportation/volkswagen-brand-take-over-german-govts-share-ev-subsidy-2023-12-19/#:~:text=The%20economy%20ministry%20halted%20the,the%20value%20of%20the%20EV

[114] Rao, S., Blauert, M., Schlomann, B., Stede, J., & Schaper, J. (2022). *Greening the drive: unpacking the impact and equity aspects of Germany's EV subsidy programme.* Target. https://publica-rest.fraunhofer.de/server/api/core/bitstreams/f13d2100-d7fb-4e0d-95ab-db188d111707/content

[115] Ahmad, A., Khan, Z. A., Alam, M. S., & Khateeb, S. (2017). A review of the electric vehicle charging techniques, standards, progression and evolution of EV technologies in Germany. Smart Science, 6(1), 36–53. https://doi.org/10.1080/23080477.2017.1420132*, p.g. 48*.

effectiveness of provided subsidies. Nevertheless, this is a warning to Canada that making EVs more accessible and affordable will not necessarily and directly reduce our national carbon footprint to zero. Rather than isolating EV subsidy goals to EV purchases, Canada should ensure that EV subsidies are recognized as endorsing eco-friendly lifestyles.

Conclusion

To improve Canada's electric vehicle we have identified different ways to help improve the effectiveness of the subsidy program and addressing the equity issue that is currently circulating the market. We also talked about how the subsidy program should consider different aspects beyond product subsidies including innovation subsidies. As Canada has received over CAD 90 billion dollars of investments towards EV manufacturing, we additionally consider how these investments can best help Canada and their goal for 2035.

The varying subsidy standards for small and large electric vehicles influence funding efficiency toward emission reductions. By focusing on larger models, the government should aim to accelerate the transition to a cleaner transportation sector. Meanwhile, subsidies for smaller vehicles would encourage the adoption of more energy-efficient options across the board and allow longer R&D time for manufacturers toward larger batteries. IA and rebate amounts across regions highlight the complexities of implementing a unified national policy. Moving forward, a more united approach that aligns with environmental goals will be crucial in ensuring that all vehicle types contribute effectively to reducing emissions and promoting energy efficiency in Canada's transportation sector.

Canada's current electric vehicle subsidy program presents significant challenges related to cost efficiency, greenhouse gas reduction, and social equity. The generalized subsidies could lead to wasted government resources while limited in their environmental impact. Additionally, social issues such as equity should also be considered when implementing the subsidies policy. To enhance the effectiveness of the subsidy program, one approach for Canada to adopt could be targeting the subsidy to consumer income and vehicle type to direct subsidy to those who are on the margin and those who will have the biggest impact on GHG reduction by switching to EVs. Additionally, combining financial incentives with non-financial benefits, such as improving charging infrastructure and parking advantages, could further stimulate EV adoption. By addressing these various challenges, Canada can create a more equitable and effective approach to promoting electric vehicles and reducing greenhouse gas emissions.

Our comparison of different types of subsidies, like innovation subsidies versus product subsidies, reveals significant differences in outcomes that Canada should consider. However, decisions for policymakers in power are not as straightforward as merely choosing to support either customers or manufacturers. When distributing millions and billions of dollars in funds, it is crucial to prioritize quality and innovation by conducting thorough diagnostics on subsidy applicants, regardless of firm size, and the produced EVs and batteries. This approach will help Canada avoid pitfalls like those seen in Japan, where consumer trust in EVs declined due to poor quality products, or in China, where companies resorted to falsifying reports to qualify for subsidies and tax breaks. Additionally, clear communication with consumers is key to ensuring they understand the environmental significance of EVs, encouraging them to adopt broader eco-friendly lifestyle changes after their EV purchase, and consequently, contribute to achieving Canada's overarching carbon footprint reduction goals.

Manufacturing investments is one way to drive demand, through reducing upfront cost of ownership in the short run, however, to motivate more people to actually switch to a form of EVs, there should be other policies in place. Canada can consider the different incentives that have been used by China and the United States to allow for more technological developments and subsidies for the EVs that people actually want, and allowing a more gracious way of phase out for the both the consumer and the manufacturer, respectively, Hopefully given these different suggestions, Canada will be able to achieve their overarching goal for 2035 while allowing both consumers and suppliers to be "winning".

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