



Ensuring ZEV Adoption in Nova Scotia

Analysis of Policy Options and Possible Adoption Outcomes

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EXECUTIVE SUMMARY

In December 2022, the federal government released proposed regulations to implement the previously announced sales targets for zero-emission vehicles (ZEVs). These regulations are a crucial step toward achieving Canada's greenhouse gas (GHG) emissions reduction targets. The objectives of the proposed ZEV sales regulation are to further reduce GHG emissions in the transportation sector.

The proposed regulations will add requirements for manufacturers and importers (together, "regulated entities") to meet annual ZEV sales targets of 20% by 2026, 60% by 2030, and 100% by 2035. Importantly, while regulated entities must meet these targets nation-wide, there is no requirement to meet the targets in each province or territory. As a result, ZEVs deliveries could be concentrated in certain markets (for example, provinces with local sales regulations or large markets) for many years under the regulation until the targets are high enough to require "spillover" sales in other regions.

The Ecology Action Centre, based in Nova Scotia, commissioned Dunsky Energy + Climate Advisors ("Dunsky") to research and document the following:

1. Lessons learned from the experience implementing ZEV sales regulations, and associated regional targets, at the state level in the U.S..
2. Possible ZEV adoption scenarios for Nova Scotia under the ZEV sales regulation as proposed.
3. Policy and program design options, within the federal legislation, to encourage more regional distribution of ZEV sales to provinces without a provincial sales mandate.

This report does not answer the question of *whether* the federal government should act to encourage regional adoption in the design of the federal regulation. Rather, it explores *how* this could be done, and what the potential impacts and benefits of this action would be. Advising on the appropriate role for the federal government or the legal feasibility of these options is outside of the scope of this report.

Why does regional supply matter?

Historically, ZEV adoption has been slower in Atlantic provinces—including Nova Scotia—compared to provinces with their own provincial ZEV mandate (BC and Quebec) and larger markets (like Ontario). As of the third quarter of 2022, the year-to-date share of ZEV sales was 3% in Nova Scotia, compared to 18% in BC and 13% in Quebec.

Low supply has been one of the key reasons for lower adoption. Indeed, compared to Quebec and BC, ZEV availability in Nova Scotia (and most other provinces) has been lagging since at least 2018 when Transport Canada began tracking ZEV inventories and availability and reporting via regular reports.¹ In February 2021, Nova Scotia had eight ZEVs available per 100,000 residents, whereas BC had 27 and Quebec had 36—three to four times the rate of availability of Nova Scotia.

¹ For the latest version, see Dunsky Energy + Climate, 2023. [Zero Emission Vehicle Availability: Estimating Inventories in Canada: 2022 Update](#). Prepared for Transport Canada.

In the current context where ZEV supply is concentrated in certain provinces, policies and programs from all orders of government can help drive supply in underserved regions. This can bring about a number of benefits, including:



Emissions reductions, air quality benefits and cost savings for drivers and residents in underserved regions.



Guaranteed and predictable ZEV supply, which creates investor certainty and a utility **business case to deploy ZEV charging infrastructure**. Infrastructure deployment, in turn, creates a virtuous cycle with ZEV supply and adoption.



Greater visibility of ZEVs in communities, which helps to bring more Canadians along in the energy transition.

Most importantly in the context of the proposed federal ZEV sales regulation, the regulation must be designed to generate **net GHG savings**. Under current conditions, ZEVs must already be sold in BC and Quebec under provincial legislation. As a result, vehicles sold in those provinces up until those provinces' targets are met do not provide a net GHG benefit to Canada. Vehicles sold outside of those regions, however, would provide a net GHG benefit.

What can we learn from the US experience?

California has had a ZEV sales regulation in place since the early 1990s. Under the U.S. *Clean Air Act*, certain states (referred to as "section 177 states") can adopt California's more stringent standards in lieu of federal standards without seeking approval from the Environmental Protection Agency. Fifteen of the eligible 17 states have adopted California's ZEV sales regulations or will have done so by 2025.

Through to 2018, the California ZEV regulation contained a "travel provision" which allowed regulated entities to count ZEVs that were placed in service in California towards compliance with a section 177 state requirement, and vice versa. Based on our interviews, many stakeholders in the U.S. observed that the travel provision limited ZEV availability in states outside of California. We examined US ZEV sales data by state and observed that the period where there were no regional requirements (e.g. the travel provision) coincides with a period where there was little regional allocation of ZEVs and its removal coincides with a period where there has been more widespread distribution. **This suggests that during the earlier stages of adoption, when markets are not saturated, there is little incentive for automakers to invest in supply, advertising and building demand outside of already-established markets unless incentivized to do so.**

What will happen if Nova Scotia's ZEV supply continues to lag?

Both the Canada and Nova Scotia governments control factors that will influence how long Nova Scotia's sales rates lag Canadian leaders, along with external factors. For example, circumstances that could serve to narrow the gap include:

- The Canada ZEV sales regulation is designed to directly or indirectly drive regional delivery of vehicles or includes a higher overall sales target.
- Nova Scotia adopts a provincial ZEV regulation or pursues other supportive provincial actions.
- Favourable external conditions emerge (low battery prices, high gas prices, etc.).

The inverse conditions would lead to a widening gap. We developed two plausible adoption curves to understand what impacts lagging adoption could have on the number of ZEVs on the road and

GHG emissions in Nova Scotia over time.² As shown in the table below, a difference in sales share significantly impacts the cumulative number of ZEV on the road over time. The **high adoption scenario** results in nearly **94,000 vehicles** on the road in 2030, compared to nearly **29,000 for the low adoption scenario**—a difference of 65,000 vehicles.

We also estimated the annual and cumulative emissions reductions that are possible from the high and low adoption scenarios. Because LDV fleet replacement occurs earlier in the high adoption scenario, that scenario results in an additional **5.2 Mt CO₂eq of avoided emissions** between 2022 and 2050. The portion of those megatonnes that would be net new reductions depends on where the vehicles would otherwise be sold.

Table 1. ZEV adoption as % annual sales and number of vehicles on the road under different possible futures, 2025-2040

Measure	Adoption Scenario	2025	2030	2035	2040	2050
% annual sales	High	10%	47%	100%	100%	100%
	Low	3%	15%	100%	100%	100%
ZEV on the road	High	13,300	94,000	323,000	565,000	698,000
	Low	6,300	28,800	201,000	468,000	697,000
	Difference	7,000	65,100	121,000	97,000	1,000
High Adoption in NS	Cumulative avoided GHG emissions (kt CO ₂ eq)	0	600	3,500	11,200	37,300
Low Adoption in NS		0	-	1,200	7,000	32,100
Difference between High and Low Scenarios	Cumulative avoided GHG emissions (kt CO ₂ eq)	0	600	2,300	4,200	5,200

A summary of the assumptions and sources used in the above analysis is provided in Appendix A.

What could be done to increase regional supply?

ZEV regulations can be designed with different degrees to which they require geographic distribution of vehicles. These choices can be represented as a spectrum of policy design options, ranging from **maximizing flexibility for regulated entities**, to **maximizing regional distribution**.

In Table 6 table below, we explore modifications that could be made to the proposed Canada regulation to move it further along the spectrum toward more predictable regional allocation and GHG benefits, along with the potential advantages and drawbacks of each option. Measures to

² Although these curves were developed based on historical adoption and professional judgement, we did not conduct economic modelling and these curves should not be interpreted as forecasts.

support regional equity would be most impactful in the early years of the regulation: as the targets approach 100%, it is more reasonable to expect that regulated entities will need to sell some vehicles outside of major markets to meet their targets. In practice, these options could be combined or further iterated as the Government of Canada and stakeholders explore the pathways forward.

Table 2. Policy options for increasing certainty of regional supply in the proposed ZEV sales regulation for Canada

Policy option	←					→					Considerations
	More flexibility for regulated entities					More certainty of regional supply					
Require under the regulation that targets must be met in each P/T ³	█	█	█	█	█	█	█	█	█	█	<ul style="list-style-type: none"> • May require a grace period in P/Ts with currently low sales
Specify that the regulation only applies in P/Ts without their own sales mandate	█	█	█	█	█	█	█	█	█	█	<ul style="list-style-type: none"> • May require a grace period in P/Ts with currently low sales • Effectively raises the overall sales target
Create regional pools in the regulation (e.g., Atlantic pool) and require sales targets be met within those pools, with no trading between pools, for an interim period	█	█	█	█	█						<ul style="list-style-type: none"> • Relatively administratively burdensome
Develop the regulation such that P/Ts can opt-in and adopt the regulation in their province, with administrative/tracking support from Canada ⁴	█	█	█	█	█						<ul style="list-style-type: none"> • Opportunities to learn from section 177 experience in the U.S.
Offer an optional compliance pathway where regulated entities obtain credit multipliers for delivering vehicles in underserved areas, for an interim period	█	█	█	█	█						<ul style="list-style-type: none"> • May weaken the overall sales target; would only be acceptable in exchange for higher sales targets
Adopt higher sales targets	█	█	█	█	█						<ul style="list-style-type: none"> • Does not guarantee regional supply but may achieve market saturation earlier, leading to some “spillover” to underserved markets
Require regulated entities to report ZEV sales by P/T ; Canada tracks and reports publicly on ZEV sales by P/T; Canada offers administrative/tracking support to any P/T that adopts its own ZEV mandate											<ul style="list-style-type: none"> • Should be incorporated in the regulation as a matter of course to ensure stakeholders have useful data

³ P/T refers to provinces and territories.

⁴ The relative flexibility/regional certainty of this policy option depends on how many P/Ts would ultimately opt in. For that reason, it is ranked as halfway between those ends of the spectrum.

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List of Abbreviations

BEV: battery electric vehicle (a subtype of EV)

DCFC: Direct Current Fast Charging

EV: Electric Vehicle

GHG: greenhouse gas

LDV: light-duty vehicles

MHDV: medium- and heavy-duty vehicles

PHEV: plug-in hybrid electric vehicle (a subtype of EV)

ZEV: zero-emissions vehicle (includes EVs and fuel cell electric vehicles)

1. Introduction

In December 2022, the federal government released proposed regulations to implement the previously announced sales targets for zero-emission vehicles (ZEVs). These regulations are a crucial step toward achieving Canada's goal of reducing greenhouse gas (GHG) emissions to 40 to 45% below 2005 levels by 2030, and net-zero emissions by 2050, which requires ensuring that all new light-duty vehicles sold are ZEVs by 2035. A 75-day consultation period was launched upon the regulations' publication in the Canada Gazette, Part I, on December 31, 2022, which ends on March 16, 2023.

The Ecology Action Centre, based in Nova Scotia, commissioned Dunsky Energy + Climate Advisors (Dunsky) to research and document the following:

1. Lessons learned from the experience implementing ZEV sales mandates, and associated regional targets, at the state level in the U.S.,
2. Possible ZEV adoption scenarios for NS under the federal ZEV mandate as proposed,
3. Policy and program design options, within the federal legislation, to encourage more regional distribution of ZEV sales to provinces without a provincial sales mandate.

To undertake this work, we undertook the following:

- Interviewed personnel in U.S. States, agencies and organizations to learn more about the lessons learned from ZEV sales regulation design and implementation in US states, particularly with respect to regional allocation (credit pooling) and data collection/reporting requirements.
- Reviewed trends from U.S. ZEV sales data at the state level.
- Quantified potential adoption trajectories for Nova Scotia, and their impact on the cumulative number of EVs on the road and avoided GHG emissions.

This report summarizes our findings.

This report does not answer the question of *whether* the federal government should act to encourage regional adoption in the design of the federal regulation. Rather, it explores *how* this could be done, and what the potential impacts and benefits of this action would be.

2. Context

2.1 Proposed Canada ZEV Sales Regulation

The objectives of the proposed ZEV Sales Regulation are to further reduce GHG emissions in the transportation sector, as laid out in the Government of Canada's commitment in the Emissions Reduction Plan.

The proposed Regulation is being implemented via amendments to the existing *Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations* under the *Canadian Environmental Protection Act* (CEPA). The purpose of CEPA is to protect the environment; reducing pollution (including GHGs) is one of the applications of CEPA.

Key features of the proposed regulations that are relevant to this paper include:

- The Regulation adds requirements for manufacturers and importers (together, "regulated entities") to meet annual ZEV sales targets of:
 - 20% ZEV sales in the 2026 model year,
 - 60% ZEV sales in the 2030 model year, and
 - 100% ZEV sales in the 2035 model year.
- The annual targets must be met nation-wide, but there is no requirement to meet the targets in each province or region. Theoretically, therefore, ZEV could be largely delivered to regulated provinces (Quebec and BC) where OEMs already have sales obligations, sales infrastructure and know-how, without directing significant new ZEVs to non-regulated provinces until later in the regulation period. (This is assessed in Section 4 of this report).
- The Regulation would apply to all companies that manufacture in Canada or import into Canada.
- The Regulation establishes a compliance credit system.
- Regulated entities would be provided with a flexibility mechanism that would allow them to create some credits through "ZEV activities," namely, investing in charging infrastructure.

2.2 Why Regional ZEV Access Matters

In the context where ZEV supply is concentrated in a few provinces, policy and programs (from any order of government) to help drive supply in underserved regions can bring about a number of benefits:



Emissions reductions, air quality benefits and cost savings for drivers and residents in underserved regions.



Guaranteed and predictable ZEV supply, which creates investor certainty and a utility **business case to deploy ZEV charging infrastructure**. Infrastructure deployment, in turn, creates a virtuous cycle with ZEV supply and adoption.



Greater visibility of ZEVs in communities, which helps to bring more Canadians along in the energy transition.

NET GHG EMISSIONS REDUCTIONS

Most importantly in the context of the proposed federal ZEV Sales Regulation, the regulation must be designed to generate **net GHG savings**. Under current conditions, ZEVs must already be sold in BC and Quebec under provincial legislation. As a result, vehicles sold in those provinces do not provide a net GHG benefit to Canada. **Vehicles sold outside of those regions, however, would provide a net GHG benefit.**

2.3 Current State of Adoption of ZEVs in Nova Scotia

Historically, ZEV sales have been much lower in Atlantic provinces—including Nova Scotia—compared to provinces with their own provincial ZEV mandate (BC and Quebec) and larger markets (like Ontario), as shown in Figure 1.

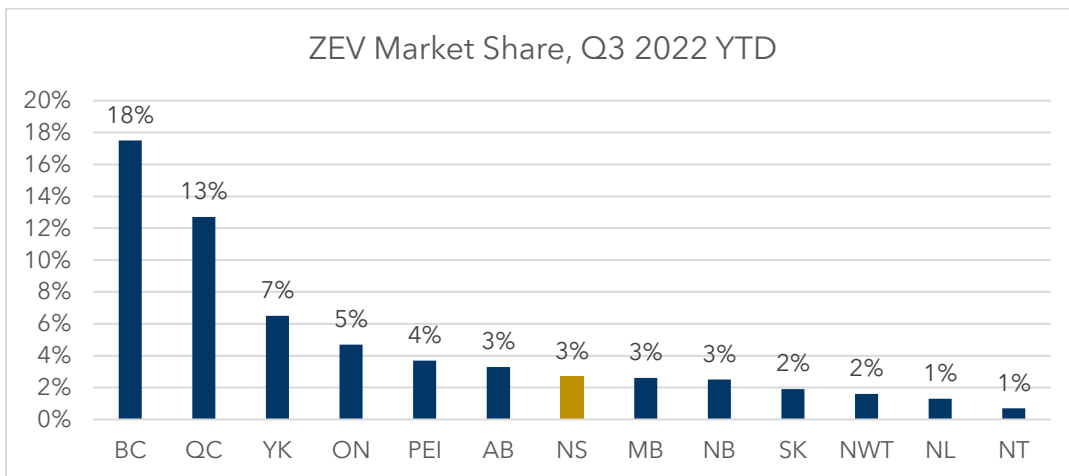


Figure 1. Market share of ZEVs as a per cent of new registrations, year-to-date in Q3 of 2022. Source: S&P Global Mobility, 2022

ZEV Inventory

Low supply has been one of the key reasons for lower adoption in Nova Scotia. Indeed, compared to Quebec and BC, ZEV availability in Nova Scotia (and most other provinces) has been lagging since at least 2018 when Transport Canada began tracking ZEV inventories and availability and reporting via regular reports.⁵

As shown in Figure 2, in February 2021, Nova Scotia had eight ZEVs available per 100,000 residents, whereas BC had 27 and Quebec had 36—three to four times the rate of availability of Nova Scotia. All regions saw dramatically reduced supply in 2022 due to global market dynamics, but the relative positions among provinces and territories were similar. In March 2022, Nova Scotia had four ZEVs available per 100,000 residents, whereas BC had ten and Quebec had eight.

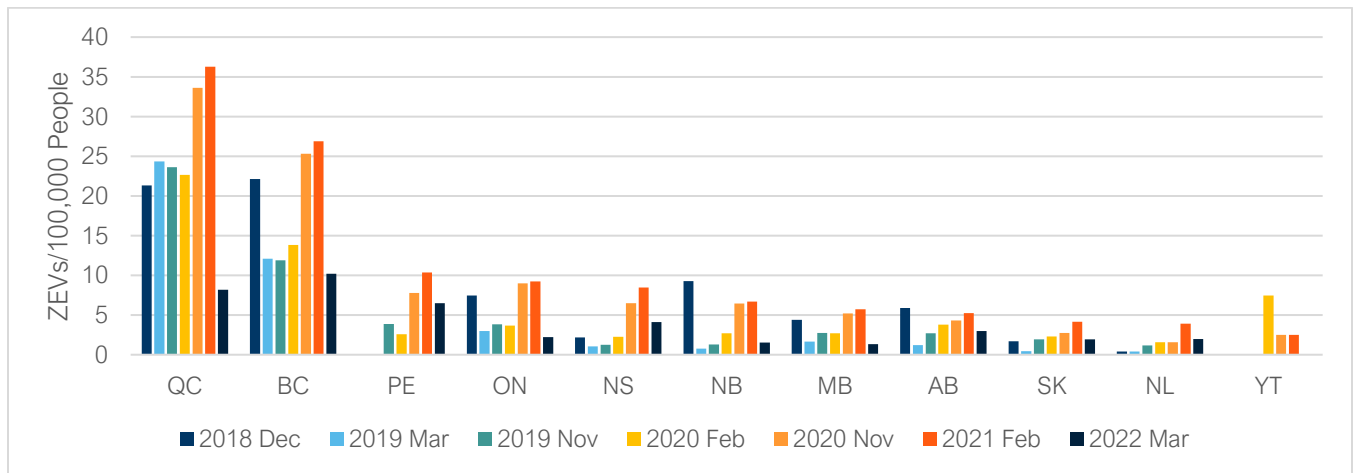


Figure 2. ZEV inventory per 100,000 residents since 2018, by province. Source: Dunsky 2023, prepared for Transport Canada

ZEV Wait Times

Wait times are another indicator for ZEV availability. Global supply limitations in 2022 resulted in long wait times across the country. However, they were relatively worse in Nova Scotia compared to BC and Quebec, as well as Ontario, Alberta and PEI (Figure 3). In February 2022, 26% of Nova Scotia dealerships reported average wait times for ZEVs of greater than six months; this share was 13% in BC, 15% in Ontario and 21% in Quebec. Indeed, Nova Scotia, Newfoundland and Labrador, and Manitoba had some of the slowest supplies.⁶

⁵ For the latest version, see Dunsky Energy + Climate, 2023. [Zero Emission Vehicle Availability: Estimating Inventories in Canada: 2022 Update](#). Prepared for Transport Canada.

⁶ Dunsky, 2023.

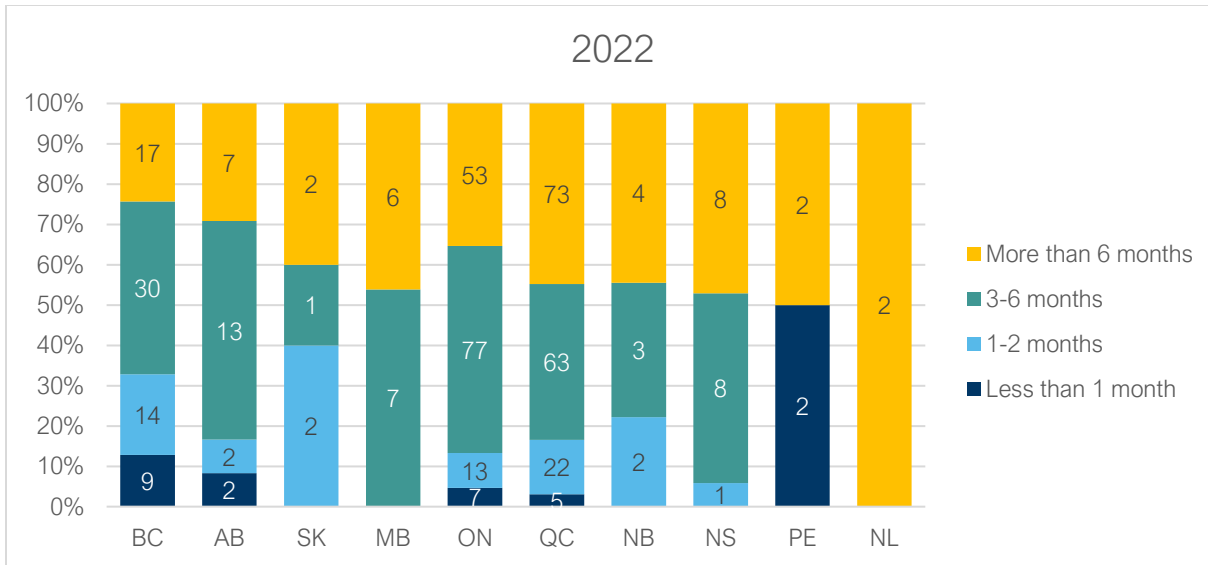


Figure 3. Average wait times for ZEVs at dealerships, by province. Source: Dunsky 2023, prepared for Transport Canada

ZEV Infrastructure

ZEV adoption and ZEV charging infrastructure are mutually reinforcing in a virtuous cycle: the presence of ZEV infrastructure enables ZEV adoption, but certainty about ZEV adoption helps provide the business case for infrastructure investment.

Nova Scotia’s public charging infrastructure supply is lower on a per-vehicle basis than the leading Canadian provinces. In Q1 of 2021, Nova Scotia had 5 public fast-charging ports per registered vehicle (all fuel types), putting it at the same level as Alberta, compared to 16 in New Brunswick and 22 in BC.⁷

However, Nova Scotia has a good foundation of ZEV infrastructure and programs that can be built upon as adoption increases. Recent announcements are building momentum: the province, through Efficiency Nova Scotia, recently launched EV charging rebates for apartments and condo buildings.⁸ The province also issued a request for proposals for a delivery agent to run a \$4 million fast-charging program starting in May 2023, and the Halifax Regional Municipality is aiming to install seven public fast charging stations by 2024.⁹ To keep the momentum, more certainty on ZEV adoption would help to create certainty for investors in public infrastructure.

⁷ Electric Mobility Canada, 2022. [Provincial and Territorial Zero-Emission Vehicle Scorecard.](#)

⁸ Efficiency Nova Scotia, [“Electric vehicle charging station rebates for your apartment or condo building.”](#)

⁹ Saltwire, Jan 2 2023. [“Super-fast, public EV chargers coming to the HRM in 2023.”](#)

3. Lessons from the U.S.

Findings in this section are based on desktop research and interviews with key personnel in the U.S. (Please see Appendix A for a list of interviewees).

3.1 Key Features of U.S. ZEV Sales Regulations

California has had a ZEV sales regulation in place since the early 1990s, initially as part of its vehicle exhaust emissions standards. Under the U.S. *Clean Air Act*, certain states can adopt California's standards (which are more stringent) in lieu of federal standards without seeking approval from the Environmental Protection Agency. These states are referred to as "section 177 states."¹⁰

Fifteen of the eligible 17 states have adopted California's ZEV sales regulations or will have done so by 2025. Together, California and these states cover 36% of the North American vehicle market.¹¹ This significant coverage means that the ZEV adoption dynamics between states under different iterations of the ZEV regulations can shine some light on how a national ZEV sales regulation may play out in Canada.

Travel Provision

From its early iterations through to 2018, the California ZEV regulation contained what has commonly been referred to as the "travel provision." The travel provision specified that regulated entities with credits earned from ZEVs that are placed in service in California may be counted towards compliance with a section 177 state requirement, and vice versa.¹² In other words, regulated entities did not have to sell ZEVs in a given state to meet that state's target. This clause provided regulated entities with ultimate flexibility on where they could sell their vehicle within the regulated territories, and section 177 states who had adopted the California ZEV regulation could not, in practice, require ZEVs to be placed into service in their state. This is not dissimilar to the proposed Canada regulation, where a vehicle could be sold anywhere in the regulated territory to earn a credit.

Regional Credit Pooling

Another feature of interest in the California ZEV regulation is regional credit pooling. Pooling was brought in when the travel provision was eliminated. It was provided as an "optional compliance pathway" available to manufacturers for model years 2018 to 2021 (with a ramp-up in 2016 and 2017).

Regional credit pooling required more regional allocation; regulated entities that opted in had the benefit of slightly reduced sales obligations in key years but needed to sell a certain volume of vehicles outside of California. Two "pools" were created, one in the east and one in the west (initially excluding California). Regulated entities could still trade credits between states, but only within the

¹⁰ The California Air Resources Board has published the list of states [here](#).

¹¹ Government of Canada (2022). [Canada Gazette, Part I, Volume 156, Number 53: Regulations Amending the Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations](#).

¹² California Air Resources Board. Final Regulation Order - Part 1. [ZERO-EMISSION VEHICLE STANDARDS FOR 2009 THROUGH 2017 MODEL YEAR PASSENGER CARS, LIGHT-DUTY TRUCKS, AND MEDIUM-DUTY VEHICLES](#). §1962.1 ZEVs (C). Credits for 2009 through 2017 Model Year ZEVs. Adopted March 22, 2012.

applicable geographic pool. They could also trade between pools, but a 30% credit penalty was applied for doing so.

Another version of pooling will be reintroduced for the late 2020s, with a declining cap on the number of credits that can be pooled. In model year 2026, 25% of ZEV requirements may be met through pooling; that cap declines to 5% in 2030 and 0% in 2031.¹³ In other words, as of 2031, regulated entities must deliver the vehicles in the applicable state.

Environmental Justice Credits

Under the updated California ZEV requirements, regulated entities can also offset some of their ZEV requirements using environmental justice (“EJ”) credits in model years 2024 to 2031.¹⁴

This clause offers additional credit for vehicles placed into service for “community-based clean mobility programs which are defined in the regulation as clean mobility solutions for disadvantaged, low-income and/or tribal communities, run by community organizations.¹⁵ Specifically, regulated entities may claim an additional 0.50 vehicle value for ZEVs and additional 0.40 vehicle value for PHEVs placed into service in these programs, if the vehicle is provided for at 25% less than the manufacturer’s suggested retail price (MSRP).

3.2 Impact of Regulatory Design on the Distribution of ZEV Sales in the U.S.

Based on our interviews, many stakeholders in the U.S. observed that the travel provision limited ZEV availability in states outside of California.¹⁶ Indeed, a dealership audit conducted by the Sierra Club in 2016 found manufacturers provided fewer ZEVs outside of California: at the time of the audit, **the average number of ZEVs on the lot in section 177 states was three, while it was six in California**, even though many of those section 177 states had adopted the regulations eight years or more prior to the audit.¹⁷

ZEV demand in a given region is not fixed; it is influenced among other things by efforts to educate the public and to advertise ZEVs. The Northeast States for Coordinated Air Use Management (NESCAUM) commissioned surveys of advertisement spending by manufacturers on ZEV promotion in different US regions in 2016 and 2018.¹⁸ These studies found that **certain manufacturers were**

¹³ California Air Resources Board (2022). [Proposed new text to be added to Title 13, section 1962.4](#). See clause (g) (D) on p. 25.

¹⁴ California Air Resources Board (2022). [Proposed new text to be added to Title 13, section 1962.4](#). See clause (2) on p. 13.

¹⁵ Defined in the regulation as a program that: 1) provides access to clean mobility solutions other than vehicle ownership including ZEV car sharing, ride-sharing, vanpools, ride-hailing, or on-demand first-mile/lastmile services; 2) serves a community in which at least 75 percent of the census tracts in the project area (where community residents live and services operate) are: a disadvantaged community, as defined in California by Health and Safety Code section 39711, a low-income community as defined in California by Health and Safety Code section 39713, or a tribal community regardless of federal recognition; and 3) is implemented by a community-based organization; Native American Tribal government regardless of federal recognition; or a public agency or nonprofit organization[...].

¹⁶ And, to an extent, Oregon, which benefits from geographic proximity to California.

¹⁷ Sierra Club (2016). [Multi-state Study of the EV Shopping Experience](#).

¹⁸ NESCAUM (2019). [2018 EV Advertising Spending](#), and NESCAUM (2016). [EV Marketing Analysis](#).

driving most of their ZEV advertising to California and much less to the Northeast in 2016, prior to the removal of the travel provision.

We explored historical U.S. ZEV sales data to understand to what extent stakeholders' observations were reflected in ZEV registrations. Figure 4 shows absolute ZEV sales normalized by population, for California and the northeastern section 177 states that have adopted the California ZEV regulation.¹⁹ According to this analysis, the per capita sales rate in northeast states ranged from 13% to 24% of California's sales rate in the 2011-2017 period. In 2018 to 2021, the per capita sales rate in northeast states ranged from 24% to 39% of California's sales rate. **In other words, the gap between the northeast states and California appears to have begun to close in the late 2010s.** The travel provision was eliminated in 2018, and regional pooling was fully in place by that year.

We cannot make direct conclusions about the isolated impact of these specific regulatory provisions from this finding, since many forces were at play. For example, there was a general increase in ZEV supply in 2018 that benefitted all regions, with new models coming on the market. The findings are, rather, indicative that a lack of regional requirements (e.g. the travel provision) coincides with a period where there was little regional allocation, and its removal likely helped shift toward more widespread distribution outside of California, alongside other forces. **This suggests that during the earlier stages of adoption, when markets are not saturated, there is little incentive for automakers to invest in supply, advertising and building demand outside of already-established markets.**

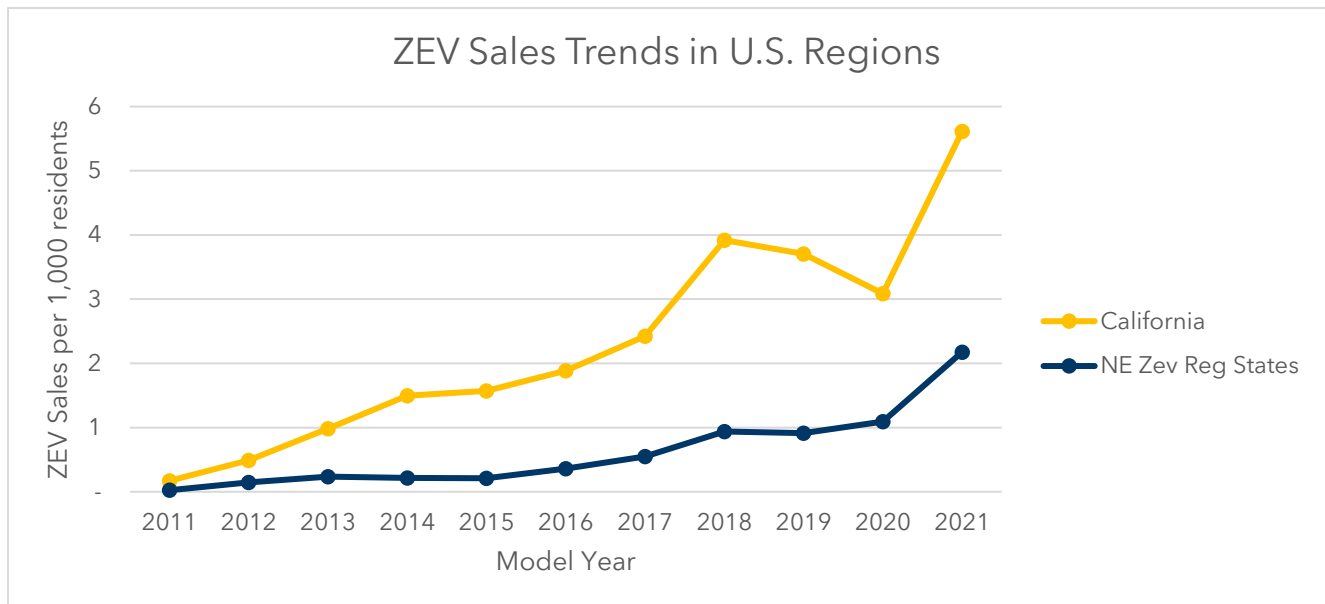


Figure 4. ZEV sales in California and the northeastern section 177 states having adopted the ZEV regulation, 2011-2021, normalized by population. Sources: Alliance for Automotive Innovation²⁰ and United States Census Bureau²¹

¹⁹ Those states are Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Rhode Island, and Vermont.

²⁰ Alliance for Automotive Innovation. [Electric Vehicle Sales Dashboard](#).

²¹ United States Census Bureau. [State Population Totals and Components of Change: 2020-2022](#).

4. Possible ZEV Adoption Trajectories in Nova Scotia

4.1 EV Adoption

Taking together the current state of ZEV adoption in Nova Scotia and the trends observed in the U.S. under rules with little or no regional requirements, it is reasonable to expect that adoption in Nova Scotia will continue to lag behind the national targets for several years, with this gap narrowing as the federal annual sales targets increase to 100% in 2035. As discussed in Section 2.2, narrowing the adoption gap between leading provinces and other regions sooner will help to create the conditions to accelerate ZEV adoption across Canada (for example, by improving certainty for infrastructure investors, by providing greater visibility of ZEVs to the public, and by incentivizing manufacturers to invest in ZEV advertising and promotion in new regions), ultimately leading to greater emissions reductions.

Both the Canada and Nova Scotia governments control factors that will influence how long Nova Scotia’s sales rates lag Canadian leaders, along with external factors, as summarized in Table 3.

Table 3. Factors that will influence the degree to which ZEV adoption in Nova Scotia lags that of leading provinces

	The gap will be widened if...	The gap will be narrowed if...
Federal regulation	<ul style="list-style-type: none"> The Canada ZEV sales regulation is designed to be very flexible, allowing regulated entities to take other actions rather than deliver vehicles, thereby delaying achievement of the targets 	<ul style="list-style-type: none"> The Canada ZEV sales regulation is designed to directly or indirectly drive regional delivery of vehicles The Canada ZEV sales regulation is adopted with a higher overall sales target, leading to earlier saturation in major markets and earlier spillover into regional markets
Provincial actions	<ul style="list-style-type: none"> Nova Scotia takes little or unsupportive actions (removing the purchase rebate, etc.) 	<ul style="list-style-type: none"> Nova Scotia adopts provincial ZEV regulation Nova Scotia pursues other supportive provincial actions (continued infrastructure investment, etc.)
External factors	<ul style="list-style-type: none"> BC or Quebec increase their provincial targets, drawing even more supply to those markets Unfavourable external conditions emerge (high battery prices, low gas prices, etc.) leading to lower ZEV supply/sales overall 	<ul style="list-style-type: none"> Favourable external conditions emerge (low battery prices, high gas prices, etc.) leading to more ZEV supply/sales overall

We developed two plausible adoption curves to understand what impacts lagging adoption would have on the number of ZEVs on the road and GHG emissions in Nova Scotia over time.²² Although these curves were developed based on historical adoption and professional judgement, we did not conduct economic modelling and these curves should not be interpreted as forecasts.

1. High adoption in NS

To understand the upper bounds of possible adoption in Nova Scotia, we started by developing an extreme high adoption scenario. We considered the national picture and determined how many ZEVs would theoretically be available to Nova Scotia each year to 2050 if:

- BC and Quebec receive only enough ZEVs to meet their most recently-announced targets.
- Remaining ZEVs required nationally to meet the draft Canada targets are distributed evenly among all other provinces and territories according to current LDV market size.
- Sales in Canada do not exceed the draft Canada targets.

In this scenario, Nova Scotia's sales would increase very rapidly in the coming years. However, there are a few key reasons why this extreme scenario would not come to bear:

- Based on historical precedent, BC and Quebec are likely to continue to exceed their provincial targets in the near term.
- Automakers are unlikely to push advertising, promotion and supply to non-leading regions in the near term if not incentivized to do so.
- There is a limit to how quickly supply and demand can increase in a given region.

From this starting point, we produced a **high adoption in NS** scenario (Figure 5) that represents a more plausible version of the initial high trajectory. This curve shows a possible future where adoption in Nova Scotia follows slightly behind the federal targets and attains 100% by 2035. This future would correspond with the presence of some or all factors listed under "narrow the gap" in Table 3 (such as a stricter federal ZEV regulation, stronger regional allocation requirements and/or a provincial ZEV regulation from any level of government).

In this future, Nova Scotia would exceed its current target and could hit a hypothetical increased provincial target of **50% by 2030** (in line with the provincial target adopted by New Brunswick).

2. Low adoption in NS

To understand the lower bounds of possible adoption in Nova Scotia, we started by developing an extreme low adoption scenario. We considered the national picture and determined how many ZEVs would theoretically be available to Nova Scotia each year to 2050 if:

- All ZEVs required nationally to meet the draft Canada targets are supplied to BC, Quebec and Ontario, according to those province's targets and LDV market share (in other words, there is no upper limit to adoption in these three provinces other than their total market size).
- Remaining ZEVs to meet the draft Canada targets are distributed evenly among all other provinces and territories according to current LDV market size, only once there is "spillover" from saturation in the three large provinces.

²² For the light-duty vehicle (LDV) sector, we anticipate that nearly all ZEVs will be electric vehicles (EVs), a category that contains battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs); we do not anticipate a significant share of fuel cell electric vehicles (FCEVs) so they were not addressed here.

- Sales in Canada do not exceed the draft Canada targets.

In this scenario, sales in Nova Scotia and other regions would stagnate until somewhere between 2029 and 2032, when BC, Quebec and Ontario can no longer absorb additional new ZEV sales. Like the extreme high scenario, there are a few key reasons why this extreme low scenario would not come to bear:

- There is already some ZEV supply in Nova Scotia and elsewhere, and it is unlikely that this adoption would be entirely stagnant for the next seven years, given supportive government actions and consumer interest.
- There is a limit to how many new car buyers in the three large provinces will purchase a ZEV in the near term, based on economic, cultural and practical factors.

From this starting point, we produced a **low adoption in NS** scenario (Figure 5) that represents a more plausible version of the initial low trajectory. This curve shows a possible future where adoption continues to lag in Nova Scotia, corresponding with the presence of some or all factors listed under “exacerbate the gap” in Table 3 (such as a very flexible federal ZEV regulation and/or little additional provincial action). In this future, Nova Scotia would not attain its existing target of 30% sales by 2030. We assume that the sales regulation would force ZEV sales to 100% in 2035 in accordance with the proposed regulation. The rate of growth in sales in the early 2030s would be very steep in order for sales in the province to “catch up” by 2030.

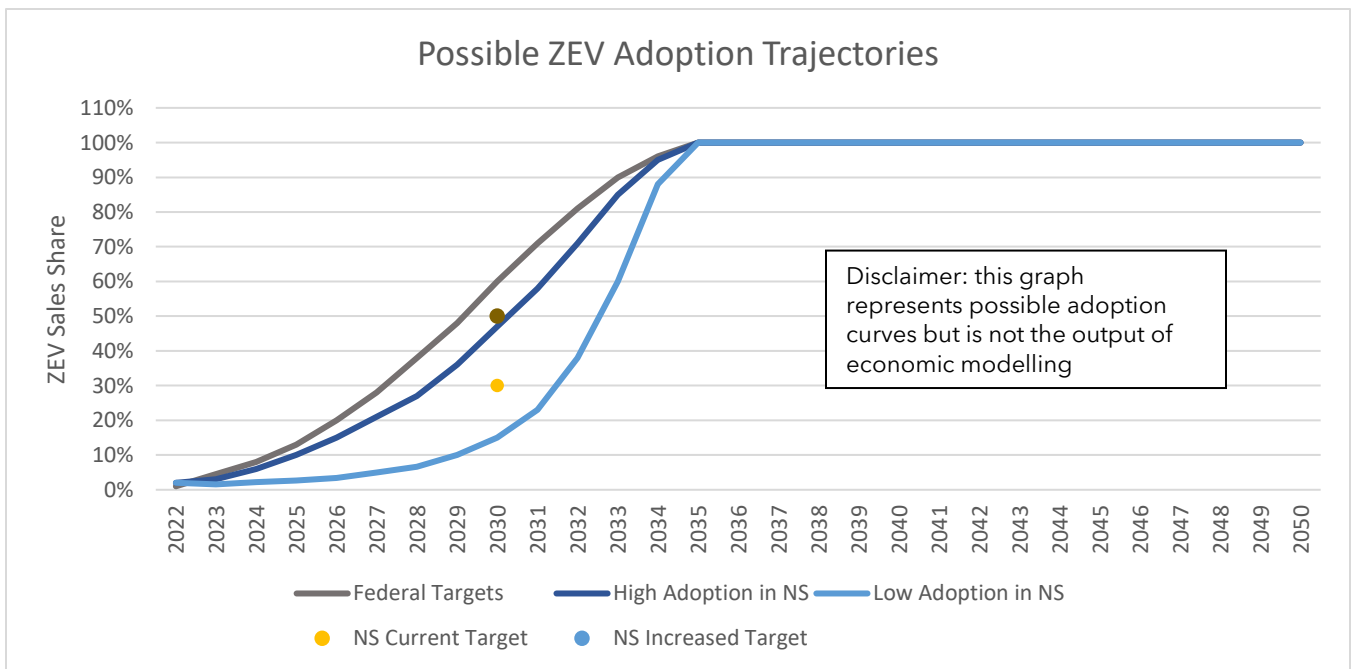


Figure 5. Possible ZEV adoption trajectories in Nova Scotia (% sales)

As shown in Table 4, a difference in sales share significantly impacts the cumulative number of ZEV on the road over time. The **high adoption scenario** results in nearly **94,000 vehicles** on the road in 2030, compared to nearly **29,000 for the low adoption scenario**—a difference of 65,000 vehicles. As the whole LDV fleet transitions over time, the scenarios converge by 2050. These differences in fleet turnover rates are also illustrated in Figure 6.

Table 4. ZEV adoption as % annual sales and number of vehicles on the road under different possible futures, 2025-2040

Possible Future		2025	2030	2035	2040	2050
Federal Targets	% annual sales	13%	60%	100%	100%	100%
	ZEV on the road	14,800	124,000	371,000	598,000	697,000
High Adoption in NS	% annual sales	10%	47%	100%	100%	100%
	ZEV on the road	13,300	94,000	323,000	565,000	698,000
Low Adoption in NS	% annual sales	3%	15%	100%	100%	100%
	ZEV on the road	6,300	28,800	201,000	468,000	697,000
Difference between High and Low Scenarios	ZEV on the road	7,000	65,100	121,000	97,000	1,000

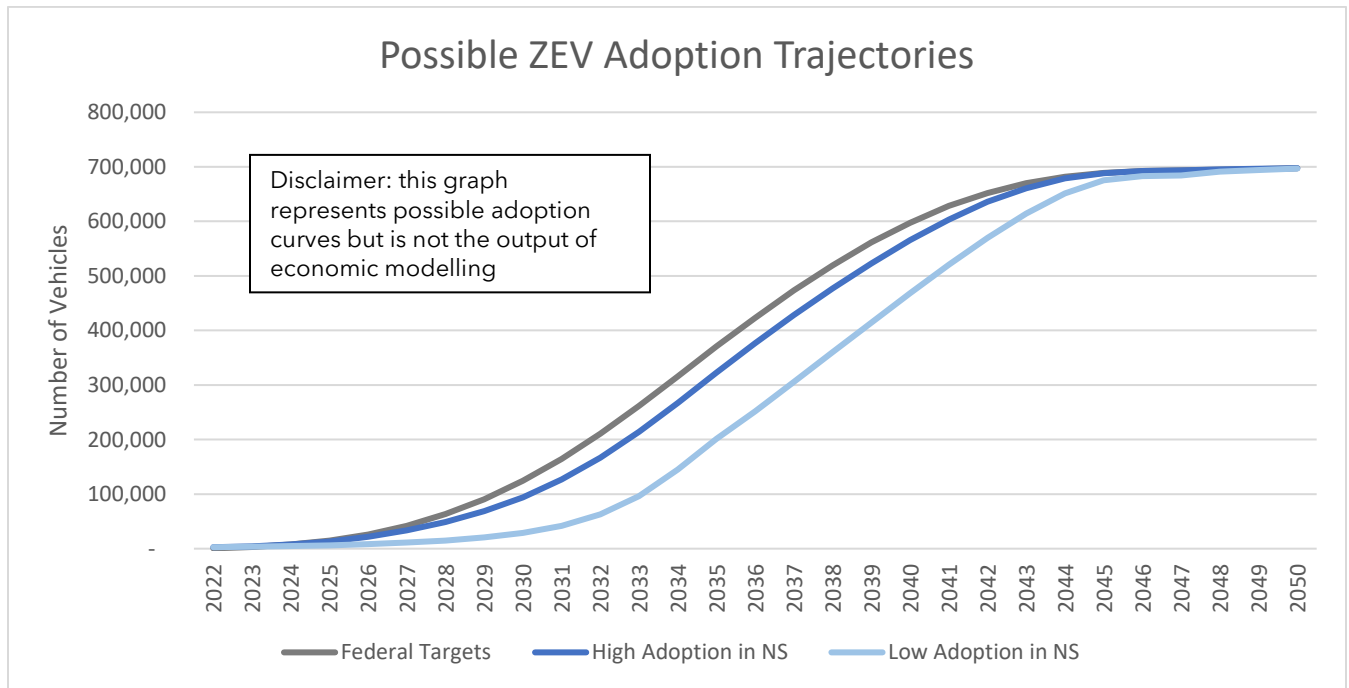


Figure 6. Possible ZEV adoption trajectories in Nova Scotia (cumulative vehicles on the road)

4.2 GHG Emissions Reductions

Under the proposed Canada ZEV sales regulation, ZEVs delivered to BC and Quebec will be able to be counted toward their provincial target and the national target. As such, the first sales in BC and Quebec each year, up until those provincial targets are met, will not represent net new vehicles or net GHG reduction for Canada, compared to the state of affairs prior to the federal regulation being adopted. From that perspective, potential emissions reductions from vehicles sold in Nova Scotia represent reductions that would potentially be left on the table without action to support regional adoption.

Table 5 shows the cumulative annual emissions reductions that are possible from the high and low adoption scenarios in Nova Scotia. Because LDV fleet replacement occurs earlier in the high adoption scenario, that scenario results in an additional **5.2 Mt CO₂eq of avoided emissions** between 2022 and 2050. The portion of those megatonnes that would be net new reductions depends on where the vehicles would otherwise be sold.

Table 5. Avoided GHG emissions in Nova Scotia under different possible futures, 2025-2040

Possible Future		2025	2030	2035	2040	2050
High Adoption in NS	Cumulative avoided GHG emissions (kt CO ₂ eq)	0	600	3,500	11,200	37,300
Low Adoption in NS	Cumulative avoided GHG emissions (kt CO ₂ eq)	0	-	1,200	7,000	32,100
Difference between High and Low Scenarios	Cumulative avoided GHG emissions (kt CO ₂ eq)	0	600	2,300	4,200	5,200

A summary of the assumptions and sources used in the above analysis is provided in Appendix A.

5. Policy Options

5.1 Regional Allocation Framework

As seen in the example of the California ZEV regulation and its adoption in section 177 states, ZEV regulations can be designed with different degrees to which they require geographic distribution of vehicles (or distribution to specific communities in the case of the environmental justice credits).

When there are no rules about distribution, manufacturers are afforded more flexibility in how they meet the requirement; on the other hand, regional requirements can help secure regional equity. In the case of the proposed Canadian regulation, regional requirements can also help ensure net new ZEVs are being sold outside of already-regulated provinces.

These choices can be represented as a spectrum of policy design options, ranging from maximizing flexibility for regulated entities, to maximizing regional distribution, as shown in Figure 7 below.

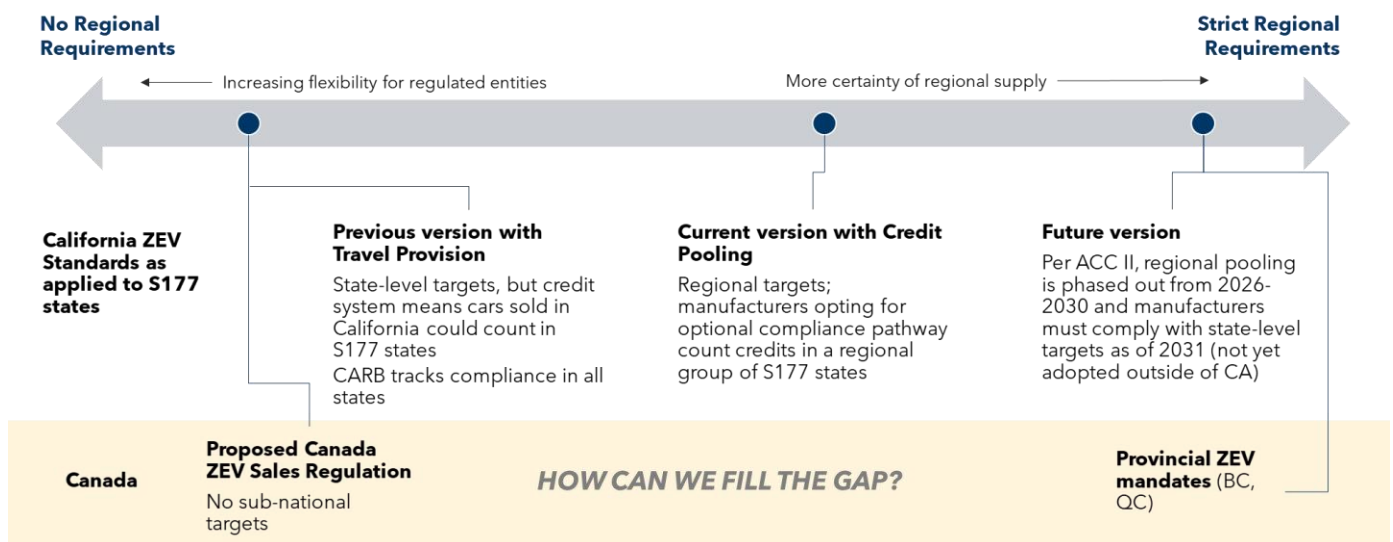


Figure 7. Policy framework for regional allocation, showing past and present iterations in U.S. and Canada

5.2 Options for Canada

Currently, the two existing provincial ZEV mandates in Canada (BC and Quebec) set clear targets for vehicle allocation to those provinces. For that reason, they are placed on the right side of the spectrum in Figure 7. The proposed Canada ZEV sales regulation, which does not provide certainty about geographical allocation of vehicles, is placed at the left.

In Table 6 below, we explore modifications that could be made to the proposed Canada regulation to move it further along the spectrum toward more predictable regional allocation and GHG benefits. We explore the considerations and potential advantages and drawbacks of each option. In practice, these options could be combined or further iterated. Further, as discussed in Section 4.1, measures to support regional equity would be most impactful in the early years of the regulation: as the targets approach 100%, it is more reasonable to expect that regulated entities will need to sell some vehicles outside of major markets to meet their targets.

Advising on the appropriate role for the federal government or the legal feasibility of these options is outside of the scope of this report.

Table 6. Policy options for increasing certainty of regional supply in the proposed ZEV sales regulation for Canada

Policy option	←					→					Considerations
	More flexibility for regulated entities					More certainty of regional supply					
Require under the regulation that targets must be met in each P/T ²³	█	█	█	█	█	█	█	█	█	█	<ul style="list-style-type: none"> • May require a grace period in P/Ts with currently low sales
Specify that the regulation only applies in P/Ts without their own sales mandate	█	█	█	█	█	█	█	█	█	█	<ul style="list-style-type: none"> • May require a grace period in P/Ts with currently low sales • Effectively raises the overall sales target
Create regional pools in the regulation (e.g., Atlantic pool) and require sales targets be met within those pools, with no trading between pools, for an interim period	█	█	█	█	█	█	█	█	█	█	<ul style="list-style-type: none"> • Relatively administratively burdensome
Develop the regulation such that P/Ts can opt-in and adopt the regulation in their province, with administrative/tracking support from Canada ²⁴	█	█	█	█	█	█	█	█	█	█	<ul style="list-style-type: none"> • Opportunities to learn from section 177 experience in the U.S.
Offer an optional compliance pathway where regulated entities obtain credit multipliers for delivering vehicles in underserved areas, for an interim period	█	█	█	█	█	█	█	█	█	█	<ul style="list-style-type: none"> • May weaken the overall sales target; would only be acceptable in exchange for higher sales targets
Adopt higher sales targets	█	█	█	█	█	█	█	█	█	█	<ul style="list-style-type: none"> • Does not guarantee regional supply but may achieve market saturation earlier, leading to some “spillover” to underserved markets
Require regulated entities to report ZEV sales by P/T ; Canada tracks and reports publicly on ZEV sales by P/T; Canada offers administrative/tracking support to any P/T that adopts its own ZEV mandate	█	█	█	█	█	█	█	█	█	█	<ul style="list-style-type: none"> • Should be incorporated in the regulation as a matter of course to ensure stakeholders have useful data

²³ P/T refers to provinces and territories.

²⁴ The relative flexibility/regional certainty of this policy option depends on how many P/Ts would ultimately opt in. For that reason, it is ranked as halfway between those ends of the spectrum.

Appendix A

List of Interviewees

Interviews were conducted by Dunsky and EAC with the following individuals and organizations to gather background information. All findings and conclusions in this report should be attributed to Dunsky and not these organizations.

- Elaine O’Grady, Policy and Program Director, **NESCAUM**
- John Shears, Consultant on Climate, Clean Transportation and Alternative Fuels, **The Center for Energy Efficiency and Renewable Technologies**
- Ben Sharpe, Senior Researcher, **International Council on Clean Transportation**
- Anna Wong, Sustainable Transportation and Communities Division, **California Air Resources Board**
- Dierdra Ritzer, Environmental Analyst, **Vermont Agency of Natural Resources**

Assumptions for ZEV Adoption and GHG Emissions Estimations

We used the following assumptions and inputs:

Assumption/ Input	Value	Source
Vehicle lifetime	11 years	Internal estimate.
Population growth	Follows StatsCan M3 Scenario.	Statistics Canada (2022). Population Projections for Canada (2021 to 2068), Provinces and Territories (2021 to 2043) .
Vehicle emissions factors	Passenger car (average fuel): 0.2077002 kgCO2e/km Light truck (average fuel): 0.2839555 kgCO2e/km	EPA (2022). GHG Emission Factors Hub. Center for Corporate Climate Leadership . April 2022.
Composition of the LDV fleet	Share of cars: 43% Share of light trucks: 57% Assumed these proportions stay constant.	Statistics Canada (2022). Vehicle registrations, by type of vehicle and fuel type .
Annual driving distance	16,600 km	Natural Resources Canada (2008). Office of Energy Efficiency. 2008 Canadian Vehicle Survey Update Report .
Average EV efficiency	20 kWh/100km	Internal estimate.

Share of BEVs versus PHEVs within EV registrations	Changes year over year, see below.	Internal estimate.
PHEV use patterns	Battery: 60% of the time, gas: 40% of the time	Internal estimate.
Electricity consumption emissions intensity	Target for 2030: 413.6 g CO ₂ e/kWh Target for 2050: 0 g CO ₂ e/kWh	Per NS' Environmental Goals and Climate Change Reduction Act.

Year	% BEVs within Annual EV Sales
2022	50%
2023	50%
2024	50%
2025	60%
2026	60%
2027	60%
2028	60%
2029	60%
2030	60%
2031	60%
2032	65%
2033	70%
2034	75%
2035	80%
2036	85%
2037	90%
2038	95%
2039	95%
2040	100%
2041	100%
2042	100%
2043	100%
2044	100%
2045	100%
2046	100%
2047	100%
2048	100%
2049	100%
2050	100%



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