

On designing Québec's Zero-Emission Vehicle mandate

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Executive Summary

The government of Québec acted towards the electrification of its transportation sector as soon as 2011 by offering incentives and other measures to support the demand for electric vehicles (EV). As the demand kept being stronger than the offer, with long waiting lists and few EV models in the dealerships, Québec eventually regulated the car manufacturers. In 2016-2017, Québec based a lot of its first Zero-Emission Vehicle (ZEV) act and regulations on the mandate adopted by California. But it also introduced key differences that made them unique to Québec in order to reach its own EV adoption objectives. The ongoing evolution of Québec's ZEV mandate introduces other marked differences in pursuing its goals. This communication examines the choices made in the design of this important policy.

Keywords: electric vehicle (EV), light vehicles, mandate, provincial government, regulation.

1 The importance of electrifying the Transportation sector in Québec

The Transportation sector is the main emitter of greenhouse gas (GHG) in Québec, with 44.8% of the total generated in the province [1], as illustrated in Fig. 1.



Figure 1: Percentage of GHG emissions by sector in Québec

Since its electricity grid is clean, with 99.9% being generated from renewable sources, electrifying the transportation sector is therefore a priority included in several policies and measures adopted by the Government of Québec.

The government put many programs in place to support the demand for EV, among other incentives for vehicles and chargers, the development of an extensive public charging station network, and outreach

campaigns. But waiting lists kept getting longer, and the automobile industry reserved certain EV models to the States with ZEV mandates.

A ZEV mandate seeks to spur the supply of EV through a regulation where automakers need to earn credits by selling or leasing EV, or by purchasing said credits from other motor vehicle manufacturers. The credit requirements are determined for each model year (MY) by applying a percentage to the total number of light vehicles sold or leased, on average, by each manufacturer. The credits earned vary by type of EV sold or leased and their characteristics. Imposing credit requirements on the automakers aims to ensure that consumers have access to a greater number and a broader range of plug-in motor vehicles.

Québec announced in 2015 its will to act on the offer of EV by putting in place its own mandate. One target, at the time, was to reach 100,000 EV on the road by the year 2020 [2].

2 Designing Québec's first ZEV mandate for model years 2018-2025

In 2015, the new light vehicle sales in Québec formed approximately 23% of the Canadian market, but only 2.3% of the very integrated combined Canadian and American market. It made sense to base Québec's first ZEV regulation on the one adopted by California and 9 additional Section 177 states (Connecticut, Maine, Maryland, Massachusetts, New Jersey, New York, Oregon, Rhode Island and Vermont). Many of these states with ZEV regulations are near Québec's borders, and all together – including California – they formed 28% of the American market in 2015.

Therefore, many parameters of Québec's current ZEV mandate [3] are identical to these 10 states [4]. The fundamental similarities with the American system are:

- a. Which manufacturers are subjected to the mandate, and if so, what conditions apply. We calculate a motor vehicle manufacturer's category annually using its average sales and leases over the three preceding years:
 - Small volume motor vehicle manufacturers:
 - fewer than 4,500 vehicles sold annually on average in Québec;
 - not subjected to the ZEV mandate;
 - can voluntarily take part in the scheme, by declaring the number of their eligible vehicles and then exchanging or selling earned credits.
 - Intermediate motor vehicle manufacturers:
 - 4,500 to 19,999 vehicles sold annually on average;
 - subjected to the ZEV mandate.
 - Large motor vehicle manufacturers:
 - 20,000 and more vehicles sold annually on average;
 - subjected to the ZEV mandate;
 - have additional ZEV credit requirements starting with MY 2020.
- b. Which types of vehicles are eligible for credits, and how many credits they can earn. The only difference in the formulae and requirements are adaptations to the metric system used in Canada (by adding a conversion factor in Québec's formulae):
 - Zero Emissions Vehicles (ZEV):
 - battery electric vehicles (BEV);
 - hydrogen fuel-cell vehicles (HFCV);
 - formula: Number of ZEV credits = $(0.01 \times \text{range [in km]} \times 0.6214) + 0.50$;
 - must have a minimum all-electric range of 80,47 km;
 - maximum 4 credits per vehicle.
 - Low Emission Vehicles (LEV):
 - plug-in electric vehicles (PHEV);
 - formula: Number of LEV credits = $(0.01 \times \text{range [in km]} \times 0.6214) + 0.30$
 - must have a minimum all-electric range of 16 km;
 - maximum 1.10 credit per vehicle;

- A bonus of 0.20 additional credits (up to a maximum of 1.30 credits per vehicle) may be awarded if the vehicle has a determined US06 all-electric range capability.
 - Vehicles with a Range-Extender (VRE):
 - PHEV where the gasoline engine recharges the vehicle's battery only when it is drained. Furthermore, the range made possible by the combustion engine is the same, or below, the all-electric range of the car;
 - formula: identical to the VZE formula, so we consider them ZEV credits;
 - maximum 4 credits per vehicle;
 - must have a minimum all-electric range of 121 km;
 - a restriction on the use of the VRE credits to fulfill the special ZEV requirements applied to large motor vehicle manufacturers.
 - Low-Speed Vehicles (LSV):
 - ZEVs with a maximum speed of between 32 and 40 km/h and an all-electric range of at least 40 km;
 - LSV sales or leases earn a fixed 0.15 credits, which can account for no more than 25% of the required total.
- c. We calculate the UDDS or Urban Dynamometer Driving Schedule electric range, used in the formulae above, using the method employed by California for its own ZEV mandate. The requirements for exhaust and evaporative emissions for LEV also point to the same methods;
- d. It is impossible to earn credits by deploying charging infrastructure or through other activities that aren't selling or leasing EV;
- e. The credit requirements for MY 2020 to 2025+, that include a percentage that must come from credits linked to ZEV sales for large manufacturers (in Fig. 2);
- f. The penalty for failure to meet requirements is ultimately \$5,000 by missing credit (in each country's currency).

Even though, because of the elements above, the regulatory texts between north-american jurisdictions with ZEV mandates are currently comparable, particularities remain for Québec. Here are the major elements that differ and why:

- a. Light-duty vehicles concerned by Québec's ZEV mandate are up to 4,500 kg (or 9,921 lb) of gross vehicle weight rating (GVWR), as it's the cut-off point between light-duty and heavy-duty vehicles in the province. In the United-States, the vehicles between 3,856 and 4,536 kg (8,500 and 10,000 lb, categorized as class 2b trucks) are not subjected to the light-duty ZEV mandate, but to the heavy-duty ZEV mandate;
- b. To earn credits, the EV makes and models must be pre-approved and figure on the list published each year by the minister of Environment, Fight against climate change, Wildlife and Parks.
 - When the manufacturers declare eligible vehicles, their vehicle identification numbers (VIN) must be present in the Société de l'Assurance Automobile du Québec's (SAAQ) database, therefore registered in the province;
 - We do not recognize credits if they were earned in a different jurisdiction, to guaranty vehicle supply in Québec;
 - In the American system, credits generated by HFCV can count towards compliance simultaneously in California and Section 177 states, through a proportional value mechanism;
 - In California, ZEV credits can be earned for advanced technology demonstration programs, for a limited number of ZEV sold or leased each year, even if they are not delivered for sale or registered with the California Department of Motor Vehicles (DMV);
 - The American regulation allowed, with conditions, the use of credits earned through over compliance with the National greenhouse gas program requirements through MY 2021.

- c. In order to support an increased supply of affordable EV to Quebecers, its ZEV mandate grants credits to manufacturers who import and sell or lease reconditioned vehicles:
 - The vehicles must be registered in Québec for the first time;
 - Eligibility conditions include, among others, being under warranty and manufactured less than four years before first registration in Québec, and having fewer than 40,000 km (24,855 miles) on the odometer;
 - We adjust the number of credits awarded per reconditioned vehicle, compared to a new vehicle, based on of the number of kilometers listed in the SAAQ's registry when the vehicle is imported into Québec. A decreasing percentage system rewards low mileage;
 - Credits derived from the sale or lease of reconditioned vehicles can count for a maximum of 30% of the total credit requirements of a manufacturer.

- d. MY 2018 was the first for which credits were required. However, to recognize the proactive efforts made by some motor vehicle manufacturers, Québec awarded ZEV and LEV bonus credits for MY 2014–2017. Motor vehicle manufacturers could then use these bonus credits to comply with their requirements for MY 2018 and following;

- e. California implemented its ZEV mandate in 1990, as a part of the Low-Emission Vehicle Regulation, but it underwent several evolutions since. To provide a gradual ramp up of the new obligations in Québec, the requirements for MY 2018 and 2019 were less stringent than California's (3.5% to 4.5% for MY 2018, and 6.5 to 7.0% for MY 2019), and did not require, for those MY, the percentage that must come from credits linked to ZEV sales for large manufacturers (Fig. 2);

- f. To allow a greater flexibility in the application of the ZEV mandate, Québec set up compliance periods for which motor vehicle manufacturers need to meet predetermined MY vehicle regulatory requirements:
 - Reporting deadlines on credits due to the government are set on September 1st of the calendar year that follows the end of a given compliance period;
 - The first compliance period covered MY 2018 vehicles sold in Québec. It included credits earned for the 2014–2018 MY vehicles (and therefore the bonus years);
 - Starting with MY 2019, compliance periods then have a duration of three years, as illustrated in Fig. 2;
 - For example, at the end of the 2019–2021 compliance period, on September 1, 2022, motor vehicle manufacturers had to have declared all EV sales for MY 2019, 2020 and 2021 in order to earn the credits they needed to meet their requirements for those three years;
 - It enables a greater flexibility in EV marketing, and does not unfairly penalize manufacturers for special issues (such as unexpected lower sales for a given MY, MY of different duration, etc.);
 - The American system requires credits from automakers each year, though they can carry forward a deficit if they compensate it by the next MY (or carry it forward for a maximum of 3 consecutive MY for intermediate manufacturers, with conditions.)

- g. It is possible for vehicle manufacturers to use credits earned in earlier compliance periods to meet their requirements in a subsequent one, up to a set ceiling:
 - For example, for the second compliance period (MY 2019-2021), credits earned, or bought, that relate to the first period (MY 2018 and bonus from MY 2014-2017) can only fill up to 35% of the regulatory requirements. As a result, even if some motor vehicle manufacturers earned a significant number of credits during the first compliance period, they had to acquire at least 65% of their needs in credits from vehicles of MY 2019-2021 to meet the requirements of period 2.
 - The ceiling lowers for period 3 (MY 2022-2024) and subsequently, where automakers can use their banked credits for up to 25% of the credits required in each new period.



Figure 2: Credit requirements as a percentage of average sales by manufacturers subject to the mandate, by model year

Québec’s National Assembly unanimously adopted the ZEV Act in 2016 [5]. It enacted the regulation described above in December 2017, which was put into force in January 2018 [6, 7]. Of note, the province of British Columbia (BC) subsequently passed its own ZEV Act in 2019. BC put in place a system close to the American version described in this section, but with requirements spanning MY 2020-2040+ [8].

3 Phase 2: Strengthening the ZEV mandate towards 100% light vehicles sales in 2035

All of the motor vehicle manufacturers subjected to the ZEV mandate met their requirements for the 2018 to 2021 MY, covering two compliance periods, either by selling or leasing their own EV models, or by purchasing credits from other automakers [9, 10]. As a whole, the automobile industry vastly over-complied, amassing more than twice as many credits as required for MY 2018-2021. The surplus of earned credits, in relation to the ZEV mandate requirements, can be explained by an enthusiasm for EV that exceeded the 2017 forecasts used to set, among others, credit requirements and bonus credit years. Also, more credits than expected were earned through an accelerated progress of battery technology; ZEV manufactured since 2018 have, in general, a growing electric range that often allows them to attain the maximum of 4 credits that we can award per vehicle. Demand for EV still vastly outpaces supply for certain vehicle models and leads, for those models, to long waiting lists that can span several years.

These observations support strengthening the ZEV mandate, a measure announced in Québec’s latest framework policy respecting electrification and the fight against climate change, the 2030 Plan for a Green Economy (2030 PGE) launched in November 2020 [11]. Strengthening the ZEV mandate aims to chart the path towards a goal of 100% light vehicles sales being EV in 2035. The 2022-2027 Implementation Plan of the 2020 PGE [12] also set a target of 1,6 M EV on the road by 2030, which became an intermediate target for the proposed future ZEV mandate.

In the summer of 2020, the Ministry of Environment, Fight against climate change, Wildlife and Parks initiated its reflection and begun exchanges with various stakeholders on possible regulatory modifications. In parallel, the California Air Resources Board (CARB) began their own strengthening process, also after setting a goal of 100% light vehicles sales being EV in 2035. It is interesting to note that both administrations reached similar orientations, but again with key differences (Table 1). We both prioritized a reform of the method to grant credits, currently linked to electric range and allowing up to 4.0 credits for a ZEV and 1.3 credit for a LEV. The management of excess credits is also a major concern in both jurisdictions.

Québec designed its future requirements with several elements in mind, among others:

- The system should aim, at term, towards 100% sales being ZEV and an intermediate goal of 1.6M EV on the road by 2030;
- We want to offer a flexibility for credits generated by efficient LEV in the early years, because of our cold climate and for the consumers – particularly in multi-unit dwellings – that could adopt this technology first;
- Therefore, the proposition withdraws a minimum credit requirements from ZEV sales, but gives half of the credits to LEV than can be granted by a ZEV, which still pushes towards all ZEV in the future;
- The market will adjust to the consumer’s needs and desires. A minimum electric range for ZEV would hinder smaller and less expensive vehicles that some buyers could favor;
- Safety measures in relation to excess credits – and credits from reconditioned vehicles – are needed to ensure reaching our goals;
- The penalties in case of non-compliance must be dissuasive.

The proposed changes for Québec’s ZEV mandate were submitted twice to a formal consultation process in 2022. At the time of redaction of this article, in March 2023, the modification process is not finished (a finalized regulation is expected later in the year). Therefore, the elements described in Table 1 and Figure 3 are currently propositions from June 2022 [13, 14], which could change. They are compared in Table 1 to what CARB adopted in November 2022 [15]. Of note, the parameters list is not exhaustive.

Table 1: ZEV mandate parameters for MY 2025+ in Québec and MY 2026+ in California (and Section 177 states)*

	Québec (proposition)	California (adopted)
Maximum credit for a ZEV	1	1
Minimum electric range for a ZEV	No	Yes (124 km/200 miles)
Minimum credit requirements from ZEV sales	No	Yes (80%)
Maximum credit for a LEV	0.5	1
Minimum electric range for a LEV	Yes (80 km/50 miles)	Yes (equivalent)
Partial credits for LEV with a range between 50 and 80 km in firsts years following strengthening	Yes (MY 2025-2027)	Yes (MY 2026-2028)
Adjustment of excess credits banks (division factor for ZEV/division factor for LEV)	Yes (4.0/2.2)	Yes (2.1/2.1)
Introducing expiration of credits	Yes (after the end of the following period, which is 4 to 6 years)	Yes (after 5 years)
Maximum in excess credits usage	Yes (decreasing ceilings between periods, reaching 0% in 2034)	Yes (only if in deficit)
Maximum in reconditioned vehicles credits usage	Yes (decreasing ceilings between periods, reaching 0% in 2034)	N.A.
Increase of the penalty for a missing credit	Yes (CAD\$ 20K, indexed annually)	Yes (USD\$ 20K)

* The changes would start with MY 2025 in Québec because it’s the first year of a compliance period. It would be with MY 2026 in the United States, and also in the projects for British Columbia and the rest of Canada that are very similar.

In July 2022, BC published a Formal Review Intentions Paper [16], outlining the province’s intentions to amend its own light-duty ZEV mandate starting with MY 2026. Most of the amendments proposed were similar to the project proposed by California in April 2022, but with BC’s own credit requirements. One of the modifications from its current ZEV mandate would be to use Québec’s light-duty vehicles cut-off point of 4,500 kg (or 9,921 lb) of GVWR to ensure the supply of LDT in the province. BC requested comments from stakeholders until September 2022, and should finalize the amendment of its ZEV mandate in 2023.

In December 2022, Environment and Climate Change Canada (ECCC) published for comments its proposition for a Canada-wide ZEV mandate starting with MY 2026, through an amendment to the *Passenger Automobile and Light Truck Greenhouse Gas Emission Regulations* [17]. The parameters were similar to the project adopted by California in Novembre 2022, but with Canada’s own credit requirements. The proposition did not include regional targets, and therefore would be parallel to provincial ZEV mandates, if present. An EV placed in Québec or BC would receive both a credit at the provincial and the federal level. ECCC requested comments from stakeholders until March 2022, and should adopt its light-duty ZEV mandate in 2023.

The credit requirement and projected sales from Québec’s draft regulations published in June 2022, granting 0.5 credit for a LEV and 1 credit to a ZEV, forces the market towards all ZEV sales in 2035, and virtually 100% EV sales in 2032 with the ZEV/LEV sales ratio projected. Figure 2 illustrates the various ZEV propositions currently under review in Canada and the United States (California’s requirements will also be used by 13 Section 177 states).

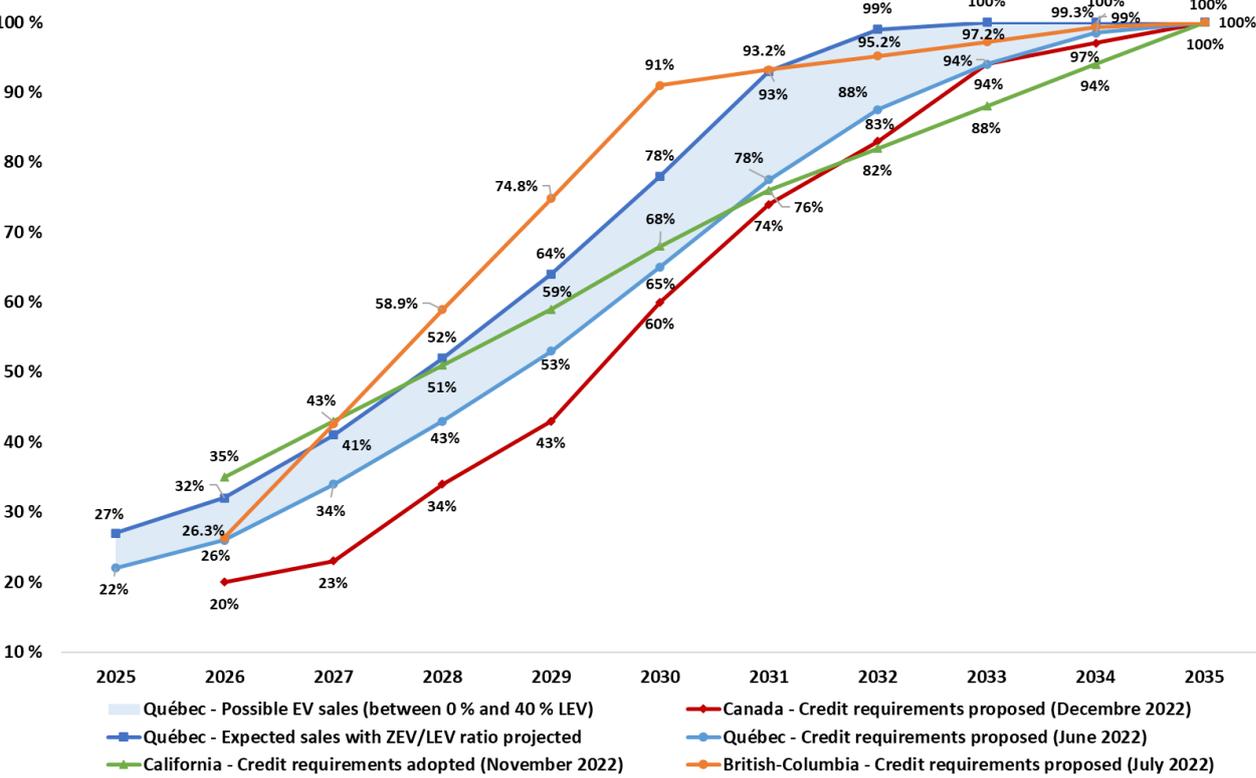


Figure 3: Comparison of credit requirements proposed for Québec, starting in MY 2025 (plus expected sales), and for British Columbia, Canada, California and Section 177 states, starting with MY 2026

4 Observed results and conclusion

Observed results pertaining to the electrification of transportation in Québec are that:

- The ZEV mandate played a key role in improving the supply of EV in recent years. When we adopted the ZEV Act in 2016, only 66% of models available in California were also marketed in Québec. In 2021, that figure was close to 85% [18];
- Québec became a prioritized province for the distribution of EV, prompting British Columbia to adopt its own ZEV mandate, then the government of Canada;
- Despite the market slowdown caused by the COVID-19 pandemic, the target of 100,000 EV on Québec's roads by 2020, set in 2015 when approximately 5,000 EV were registered, was attained in April of 2021 [19];
- The electrification of 168,610 light duty EV on December, 2022 [20], makes Québec a leader in Canada, and the second biggest EV market in North-America;
- Electric model in Québec's new vehicle sales increased from 0.7% in 2015 to 11.8% in September 2022, 53% higher than the Canadian national average (11.8% to 7.7%) [21].

The ZEV mandate is only one of a group of measures that the Government of Québec put in place to speed up EV adoption in Québec. Several more, included in the 2030 PGE and its implementation plans [11, 12], act in synergy to support consumer demand in order to remove barriers to purchasing. If it is impossible to precisely quantify the number of registered EV on our roads because of the ZEV mandate alone, its adoption played an important role in improving supply in recent years.

The will to significantly electrify the transportation sector is growing throughout the world. Numerous countries have set a goal of 100% electric new vehicle sales for years that vary between 2025 and 2050 [22]. Many announcements were also made by the automobile industry in the last years, promising more EV models and an increase in numbers of vehicles manufactured [23], which is excellent news. But there is a definite appetite for the limited quantity of new VE currently allocated throughout the world. Properly designed, a ZEV mandate is a powerful tool to ensure getting a nice piece of the pie, on the road to a greener transportation sector leading towards our GHG reductions goals.

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Presenter Biography



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