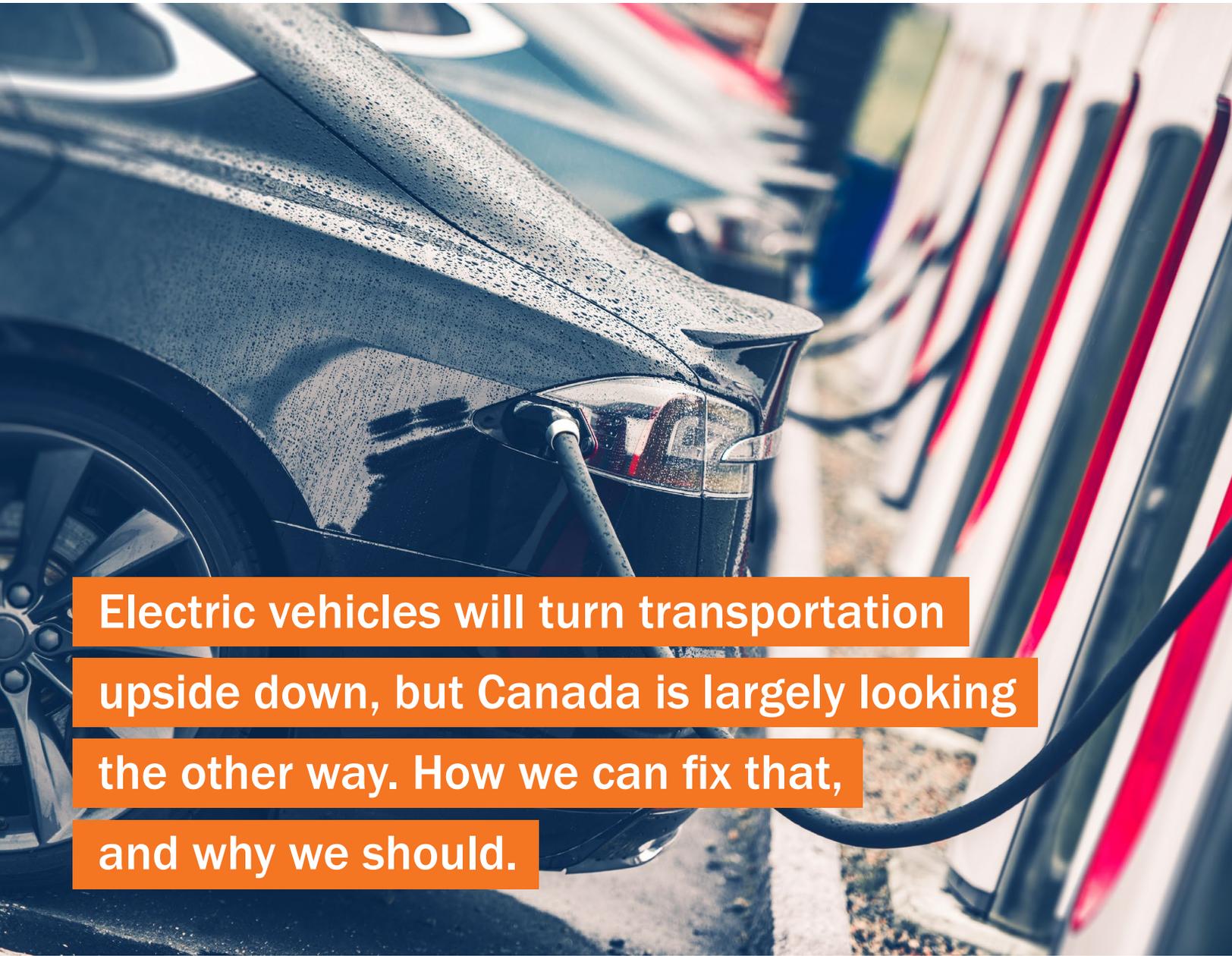


Stuck in Neutral



Electric vehicles will turn transportation upside down, but Canada is largely looking the other way. How we can fix that, and why we should.

It's time Canada got serious about electric cars

Not long ago, electric cars were curiosities—auto-show novelties, toys for the rich, outliers in oil-demand forecasts. But like the iPhone, Netflix, and other history-bending innovations, **electric vehicles, or EVs, are poised to rewrite the book on transportation.** The global shift to electric cars is now well underway, accelerating, and bringing with it big changes for drivers, companies, industries, and governments around the world.

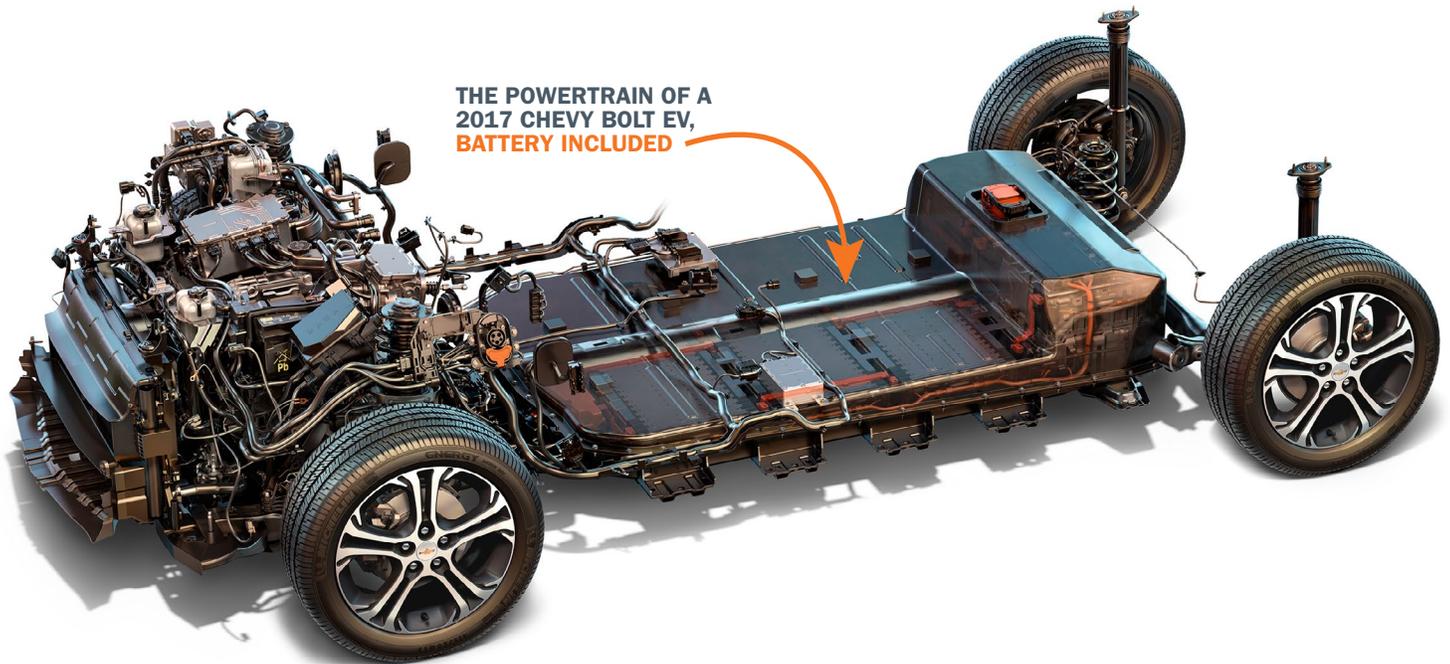
Canada is no exception. But as our peers accelerate, we're coasting, on both EV policy and per-capita sales. It's not for lack of interest: Canadians must wait months to get their hands on new EVs when they hit the market. Worse still, we're missing out on opportunities to innovate, to make our economy cleaner and more competitive, to

reduce pollution—and its public health and climate change impacts—and to export our metals and minerals to a growing global marketplace.

This worldwide shift is profound. Regardless of what Canada does, it adds another layer of uncertainty on our oil sector. For this reason and others, **we need a strategic policy response, and quickly.** Ottawa's forthcoming national Zero-Emissions Vehicle Strategy could help maximize the opportunities the shift presents, while minimizing and proactively managing its impacts.

Preserving the status quo is not the same as playing it safe—slow and steady won't win this race.

Canada needs to speed up and get serious about electric cars. The next big thing in transportation is already here. A few challenges aside, that's good news, and a significant opportunity for Canada.



Stuck in Neutral

Tracking the Energy Revolution 2017

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SFU

MORRIS J. WOSK
CENTRE FOR DIALOGUE

THE NISSAN LEAF IS CANADA'S TOP-SELLING EV



The evidence

A profound shift is underway

GOVERNMENTS AROUND THE WORLD understand the financial, technical, and psychological barriers to EV adoption and are targeting each of them with policy. From Norway to China, leading nations are working to steadily increase EV availability at car dealerships, while also boosting demand in the marketplace—via purchase and ownership incentives, and investments in charging infrastructure.¹

It took two decades to sell the first million electric cars. But thanks in large part to supportive policies, the second million rolled out just a year and a half later. We'll clock the third million in less than a year,² though that's nothing compared to what's to come. Bloomberg New Energy Finance expects there will be 100 million electric cars on roads around the world by 2030.

WHEN WILL THERE BE 100 MILLION ELECTRIC CARS ON THE ROAD? THAT DEPENDS WHOM YOU ASK

Bloomberg
NEW ENERGY FINANCE

2030



Organization of the
Petroleum Exporting Countries

2032



PRE-2035

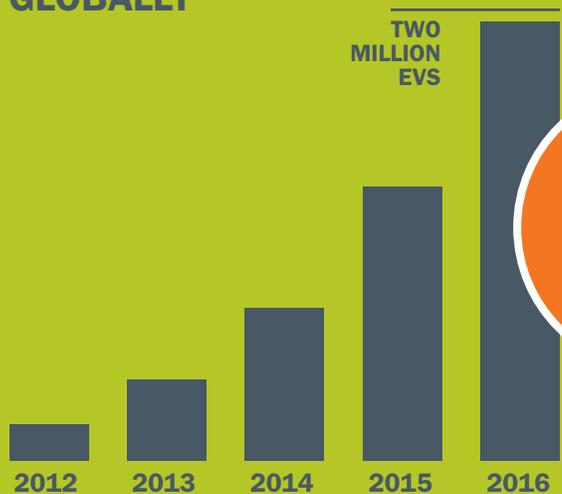


2035



2040

NUMBER OF EVS ON THE ROAD GLOBALLY



In 2016, sales of EVs crested 735,000—a 40% jump over the previous year.

Batteries are getting cheaper and more powerful

The most expensive component of an EV—its power pack—is at the centre of a global innovation race. And that research and development is yielding a new generation of attractively priced cars that can really go the distance.

Improving economies of scale and increasing battery density are driving down battery prices, thanks to advances in chemistry, engineering, and material efficiencies. If the trend continues as predicted, EVs will soon achieve sticker-price parity with competing internal combustion models.

Falling battery prices—down 73% since 2010³—have proven a major EV sales driver. These next-generation storage cells are not only lowering the sticker price, they're allowing those travelling in EVs to cover more distance between charges. Combine this with increasingly ubiquitous public charging and dramatically lower operating costs (from maintenance to fueling) and EVs are poised to take-off.

The menu of EV offerings is expanding

Even a few years ago, tire-kickers could choose a Leaf, a Volt, a Model S, and not much else. The range of available models has since broadened considerably, and automakers are promising dozens of different offerings. A mini-bus for road trips? Coming soon, mom and dad. A pickup for the job site? In the works, guys.

After compiling announcements by the world's automakers (we flag a handful to the right), Bloomberg New Energy Finance found that, **by the end of 2017, there will be 156 electric car models to choose from**, up from just 97 at the start of 2016. By 2020, the number of available models will grow to 217.

50X

By 2030, Bloomberg New Energy Finance expects there will be **50 times more electric cars** on the road than there are today.

TIPPING POINT ALERT

Sales of electric cars are projected to remain relatively low until 2025. But sometime within the subsequent five years, we'll reach a tipping point, and the purchase price of an EV will match that of a gasoline-powered car. According to Bloomberg New Energy Finance, **by the mid- to late-2020s, electric cars will cost the same as their internal combustion competitors.** And eventually, they'll be cheaper.



General Motors will introduce 20 new all-electric vehicles over the next six years, and launch two new EVs within the next 18 months.



As of the 2019 model year, **Volvo** Car Group will no longer introduce new cars that are solely powered by petroleum. All will be either fully electric or hybrids.



Volkswagen has pledged 20 plug-in models by 2020. The company also set a long-range goal to market a stunning 300 all-electric models by 2030.



Volkswagen's new **Electrify America** subsidiary has broken ground on what will eventually be a \$2-billion nationwide network of more than 2,500 high-speed chargers at over 450 station sites across the U.S.





China is currently targeting annual sales of two million EVs by 2020, and seven million by 2025, or one in five vehicles sold. And this is just a start. If China follows through on its plan to ban internal combustion vehicle sales—announced without details—the transition to EVs will be accelerated. Energy analysts at Wood Mackenzie modelled the impact of a 2035 ban and found that it would drive up annual sales to 50% by 2030—and lead to more than 200 million EVs on Chinese roads by 2035.⁶

Power points are proliferating

Governments are supporting EVs with policies that require (or allow) vehicle chargers at new commercial and residential buildings, and by introducing financial incentives for at-home installations. The number of publicly accessible chargers globally reached 320,000 in 2016—a ratio of six cars for every plug-in point.

While the spread of infrastructure is helping transform so-called “range anxiety” into range confidence, consumer education helps too. **Studies have shown that electric cars available in Canada meet 90% of Canadians’ daily driving needs.**⁴ According to Transport Canada, the average Canadian drives just 50 kilometres a day, a distance easily covered by EVs.⁵

Political leaders are demanding change

A small but growing number of countries have announced dates beyond which they will prohibit the sale of internal combustion vehicles. These statements have sent shockwaves through the global automotive and oil sectors. The one to watch? As usual, China.

BANNING INTERNAL COMBUSTION VEHICLE SALES IN...

	Norway	2025
	Netherlands	2030
	India	2030
	Scotland	2032
	France	2040
	Britain	2040
	Germany	TBD
	China	TBD



WHERE WILL CANADIANS PLUG IN?

At the store

Cadillac Fairview has begun building out what will ultimately be a series of 30 Level 2 chargers and 15 Level 1 fast chargers at its shopping malls nationwide. **IKEA Canada** has installed chargers at all of its Canadian stores; **Canadian Tire** is following suit in Ontario.

On the road

In early 2018, a joint venture of four energy-storage firms will begin electrifying the Trans-Canada Highway, with a \$17.3-million network of 34 Level 1 fast-charging stations.

Everywhere else

Tesla Canada is quadrupling its supercharger network, adding nearly 100 new charging stations—and closing the prairies-sized gap in its system between Ontario and Calgary.



Canada's challenge

Policy falls short

W

hile America electrifies its interstates and China cranks out hundreds of thousands of electric cars (and Norway's market share of EVs puts everyone to shame), Canada has yet to punch the accelerator.

Globally, just 10 nations account for 95% of EV sales. Canada

is among their ranks, but on most electrification indicators we're squarely in the back of the pack.

Take the critical metric of market share—the proportion of electric cars sold relative to internal combustion cars. On this, we rank ninth, with a paltry 0.59%. That's far behind Norway, at a whopping 28.76%, and less than half of the market share achieved in China.

Then there's our neighbour to the south. We of course have far fewer registered EVs than the U.S., with a population nine times ours. But **on a per-capita basis, the Americans have twice as many plug-in cars.**

SHARE OF VEHICLE SALES FOR ELECTRIC CARS (2016)

1. Norway **28.76%**
2. Netherlands **6.39%**
3. Sweden **3.41%**
4. France **1.46%**
5. U.K. **1.41%**
6. China **1.37%**
7. U.S. **0.91%**
8. Germany **0.73%**
9. Canada **0.59%**
10. South Korea **0.34%**

ONLY IN QUEBEC? QUEL DOMMAGE!

Quebec's Zero Emission Vehicle Standard won't kick in until January 2018, but the province already leads Canada on adoption, boasting nearly half of Canada's EV sales in 2016. As a result, automakers are shuffling their already-limited stock of electric cars to that province. One model, the **2018 Ford Focus Electric**, will only be offered in Quebec.

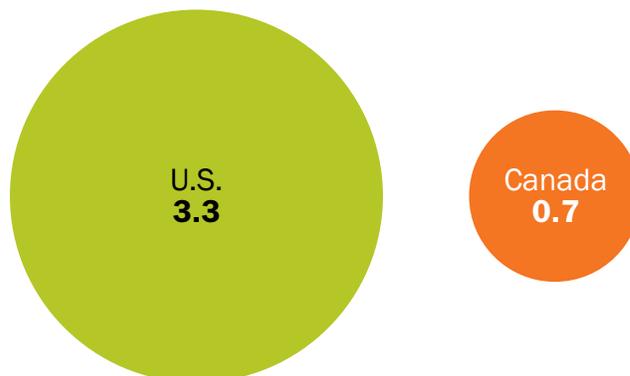


What's the problem? Policy, and not enough of it. **Ottawa offers no federal EV incentive (we are one of just two G7 nations without one),⁷** and only three provinces offer rebates: Ontario, Quebec, and B.C. A recent Simon Fraser University policy report card awarded Canada an overall grade of C-, which translates to a "marginal" impact on long-term EV sales.⁸

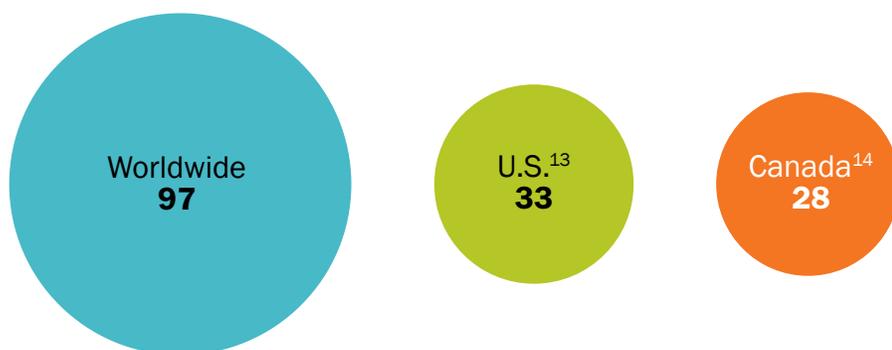
Further, only Quebec has policy designed to increase EV availability; its Zero Emission Vehicle Standard, which requires auto manufacturers to sell a growing percentage of EVs, will take effect in January 2018. Many auto dealers in English-speaking Canada don't even stock electric cars—or show much interest in doing so. **As of 2015, fewer than half (48%) of dealerships whose brand produced an EV were certified to sell them.⁹**

For example, Canadians interested in purchasing a Chevy Bolt, *Motor Trend* magazine's "2017 Car of the Year," need to sign on to waiting lists that last eight months.¹⁰ It's no wonder a recent study concluded **it's five times more difficult to purchase an electric car in Canada than in the U.S.^{11,12}**

AVERAGE NUMBER OF EVS AVAILABLE AT DEALERSHIPS (2015)¹⁵



NUMBER OF AVAILABLE EV MODELS (2016)



Clean Energy Canada is a founding partner in **EVchoice.ca**, a campaign that is working to bring more electric cars to Canada.

The eLion is the only all-electric conventional school bus built in North America. It's made in Quebec by Canadian company Lion Bus and has customers across the continent. Photo: Joan Sullivan



Canada's opportunity

Clean growth and climate leadership

ELECTRIC CARS ARE ICONS of the energy transition, and not just because they're fun to drive. The growth in their popularity presents Canada with a range of new opportunities and benefits. Here, we highlight three.

Cleaner air and less carbon pollution

Canada's transportation sector is the second-largest source of carbon pollution (after oil and gas), accounting for 24% of emissions in 2015—about half of which come from cars and trucks. A transition toward EVs will, over time, take a bite out of this pollution, helping Canada meet its climate commitments while contributing to cleaner air.

Growth in manufacturing, services, and innovation

A domestic and global shift towards EVs offers a range of economic opportunities, from auto parts and manufacturing to charging hardware and software.

Canada's auto-parts industry has begun to pivot to the EV opportunity. Guelph-based Linamar, Canada's second-largest auto parts manufacturer, estimates that it could potentially supply \$2,000 worth of parts on every electric car—a big jump from the \$150 worth of parts it currently supplies to all types of vehicles.¹⁶

On auto manufacturing and assembly, Canada lags. We do at least have one foot in the door: Chrysler Canada assembles its Pacifica plug-in hybrid minivan

in Ontario. But Canada does not yet produce any mass-market all-electric vehicles (see pie chart below).¹⁷

Fortunes beneath our feet

The shift to EVs will spur significant new demand for the metals and minerals needed for lithium-ion and other battery technologies. Many of these resources are found, produced, and processed in Canada.¹⁹

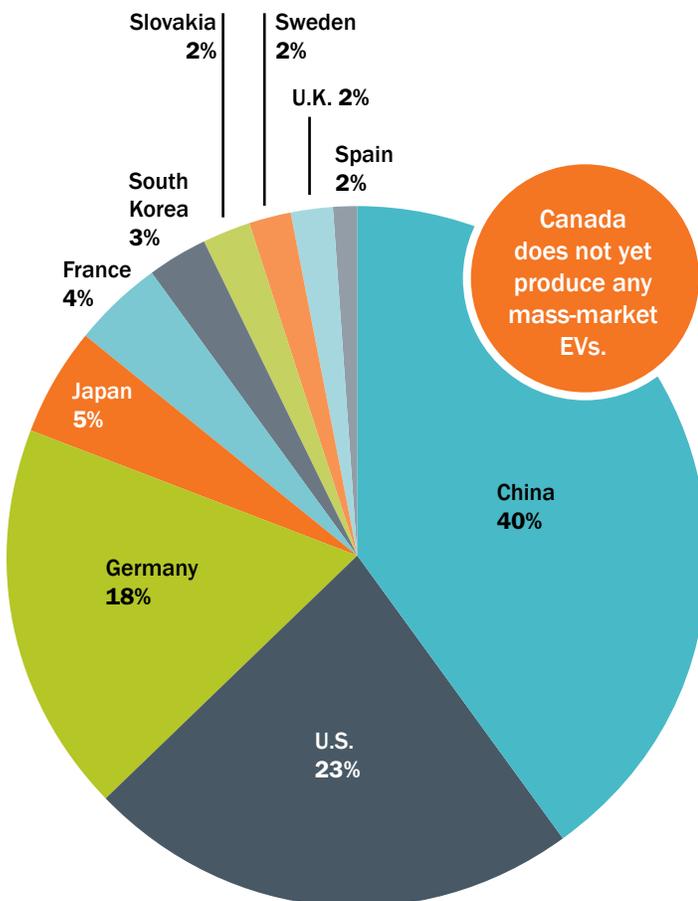
Analysts expect demand for copper in particular will surge, as EVs require four times more of the metal than internal combustion vehicles.²⁰ Canada also has reserves of the mineral spodumene—an important source of lithium—and active mining operations in Manitoba, the Northwest Territories, and Quebec.



MONTREAL'S FIRST MOVER

Montreal's Taxelco offers an example of how policy encouraging the shift to EVs can spark new business opportunities. The firm is expanding its all-electric taxi fleet from its current 110 cars to 350. In the coming year, it expects to launch Téo Cargo, a fleet of 10 all-electric 18-wheeler trucks that will transport cargo between Montreal and Toronto. Also in the works: Téo Express, an all-electric (and presumably *rapide*) local courier.²¹

GLOBAL MASS-MARKET EV PRODUCTION BY COUNTRY¹⁸



A SECOND LIFE FOR OIL WELLS?

Alberta, a globally significant producer of liquid transportation fuels, could one day help deliver electrons as well. Two Canadian companies, MGX Minerals and E3 Metals, are actively developing approaches to extract lithium—a metal critical to EV battery production—from the salty wastewater produced from oil wells.²²





Our shot

Canada's National Zero-Emissions Vehicle Strategy

Federal, provincial and territorial governments are working to develop a national Zero-Emissions Vehicle Strategy. It's a critical opportunity to put Canada in the EV game. To succeed, it will need to accomplish four things:

Define success

- Commit to a set of clear and ambitious national EV adoption targets (for 2020, 2025, and 2030) with a framework to achieve them.²³ While Canada has an aspirational target—to achieve 30% EV sales by 2030—it needs to **commit to a binding target, then put the policies in place to achieve it.**

Make it easier for Canadians to choose electric

- Require auto manufacturers to ensure that a minimum and growing percentage of all passenger cars sold in Canada will be zero-emissions vehicles. A proven **zero-emissions vehicle mandate**—a policy pioneered by California and since adopted by nine other states and Quebec—would guarantee results.
- Invest in a **national network of EV discovery centres**, which would allow Canadians to experience a wide array of electric cars on one site.²⁴
- Entice potential owners with a national incentive. Research suggests that **point-of-sale rebates** will prove most effective in influencing purchase decisions.

Make it easier for Canadians to plug in

- Develop an **EV-charging-infrastructure plan** informed by EV sales targets.
- Ensure that all residents in multi-unit residential buildings (such as condos and townhouses) have **opportunities to charge vehicles at home.**
- Ensure the National Building Code and the Canadian Electrical Code **facilitate EV charging in all new buildings with parking facilities.**
- Provide dedicated funding to increase Level 2 public charging infrastructure in cities and Level 3 DC fast charge points to **facilitate long-range travel and faster urban charging.**

Maximize clean-growth opportunities

- Update and expand the *Electric Vehicle Technology Roadmap for Canada*, a document published back in 2010 that's been largely overlooked ever since. A 2018 update would **identify the emerging opportunities** in manufacturing, software, and innovation, such as autonomous vehicles.
- Help Canada's mining sector **capitalize on the global demand for mining and processing metals and minerals** that will be central to this shift, while requiring world-leading practices.
- **Encourage EV parts and vehicle manufacturing** in Canada.

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ONE TOUGH CUSTOMER

Canadians love their trucks, and Havelaar Canada is answering the call with its **Bison all-electric pickup**. The company says the carbon-fiber-reinforced, all-wheel-drive rig will travel 300 kilometres between charges, and buyers will also be able to run their Hilti hammer drills out of the built-in power socket. The Bison is still in development.

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