THE GLOBE AND MAIL

Canada wants an all-electric vehicle fleet by mid-century. A patchwork of charging stations stands in the way

For Canadians who want to switch to electric, a lack of infrastructure and real concerns about range are holding them back

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PUBLISHED YESTERDAY
UPDATED 3 HOURS AGO

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Parkland opened an electric vehicle charging site in Kelowna last fall as part of a pilot project, before expanding its network to 25 locations across major routes in B.C. and Alberta over the course of the

summer.

AARON HEMENS/THE GLOBE AND MAIL

When the four Parkland executives set out in late May to do some market research on electric-vehicle charging in Britain, they couldn't have predicted how their time in London would end.

The company – a Calgary-based supplier and marketer of fuel and petroleum products that also operates a chain of convenience stores and quick-service restaurants – is getting into EV charging. Last fall, Parkland rolled out a pilot project in Kelowna, B.C., installing four charging ports at one of its locations. The company plans to expand its footprint to 25 sites along B.C. and Alberta highways by the end of the summer.

Darren Smart, Parkland's senior vice-president of energy transition and corporate development, was among the executives who rented a Tesla Model X and drove around London. They took note of the good – well-lit locations with easy access to amenities – and the bad.

'We're far behind': Public charging lacking, say most Canadian EV owners

How do I know how much range I actually need in an EV?

Over the course of one day, they encountered 10 different charging problems, including incompatible plugs (the rental company forgot to give them a particular adapter), payment issues and out-of-service chargers. At one point, they had only two kilometres of remaining battery range to reach the nearest compatible charger, located at a shopping mall. They turned off the air conditioning to conserve energy, rolled up the ramp toward the site and watched the range click down to zero. They plugged in the car, but for some reason a connection couldn't be established.

The Parkland executives had no choice but to abandon the EV and order an Uber. "It was a very extreme experience," Mr. Smart said. "But it really typifies the range-anxiety issue."

A biker passes an electric charging station in Ottawa.
SPENCER COLBY/THE GLOBE AND MAIL

Range anxiety consistently ranks among Canadians as one of the top barriers to EV adoption. Drivers are worried that a charge won't be there when they need it, or at least that it won't be convenient. If Canada is going to meet its goals on light-duty EV adoption – ostensibly, an all-electric fleet by mid-century – the country has a long way to go on charging. It's a chicken-and-the-egg type conundrum. If you build it, they will come, but it's hard to make a business case for building such capital-intensive infrastructure if enough people aren't currently, or even imminently, coming.

That's where Ottawa comes in. The federal Liberal government has provided hundreds of millions in funding to spur the construction of public charging sites. The idea is to encourage the private sector to make investments in these early days, until a tipping point is reached and consumer demand is so great that charging becomes a lucrative space on its own merit.

Time is of the essence. Earlier this year Prime Minister Justin Trudeau's government unveiled a climate plan that aims to force a faster change in the driving habits of Canadians.

By 2026, 20 per cent of light-duty vehicle sales in Canada will need to be zero-emissions cars. The sales mandate will rise to 60 per cent in 2030 and to 100 per cent in 2035. Last year, zero-emissions vehicle sales stood at 5.2 per cent of all vehicle sales, up from 3.5 per cent the year prior.

If EV adoption is going to steadily ramp up, so, too, must the country's charging infrastructure. To understand where we need to get on this front, we must first understand where we are.

The Globe and Mail set out to get a clear picture of Canada's current public charging landscape and of its future needs. What emerged is a nascent, patchwork ecosystem with myriad business models and a complex web of players.

There are the equipment manufacturers, the network operators (which are sometimes the same as the manufacturers), the site owners (which may buy or lease network-branded chargers, and are typically private businesses but can also be governments or utilities), the installers and electricians, the utilities (which are sometimes also the site owners or network operators), and various levels of government (which are involved through financing, permitting, regulations or ownership).

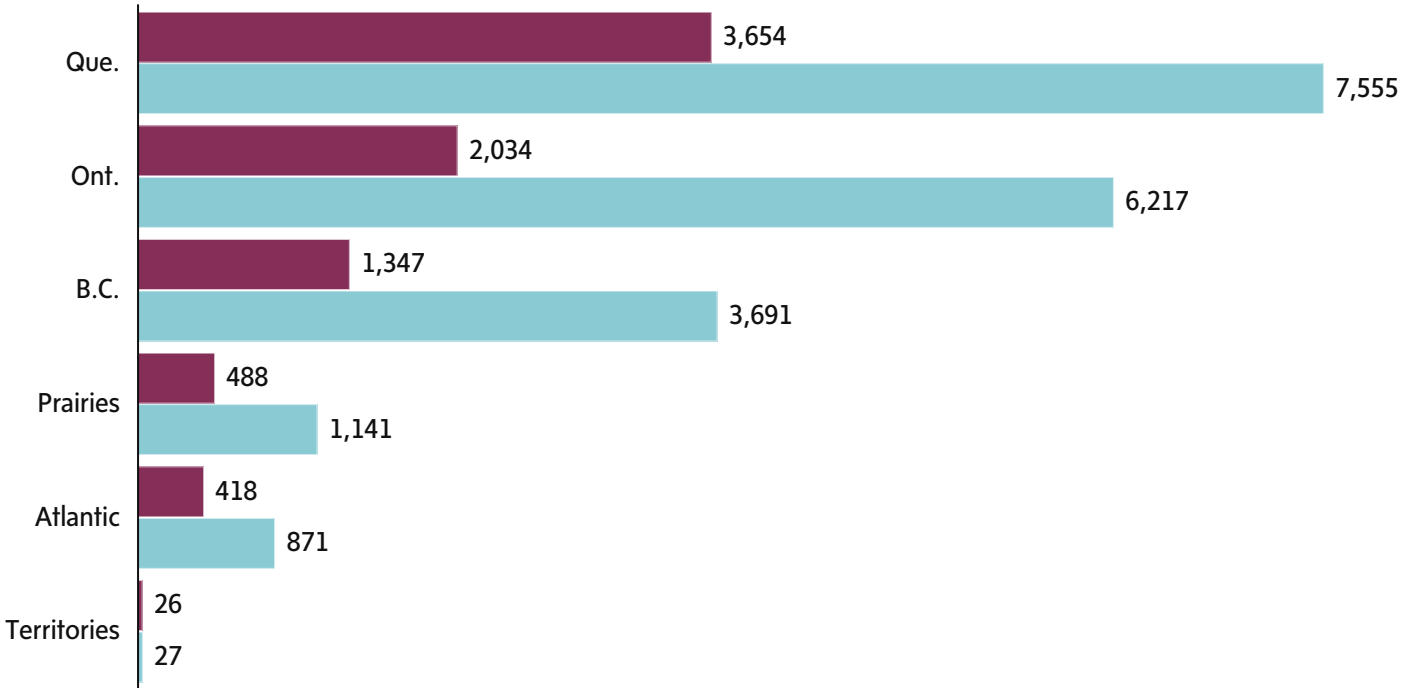
As it stands, the public charging system has some bright spots and some blind ones. Canada has relatively more chargers per capita than the United States. You can drive from the East Coast to the West Coast and find fast chargers along the way. The two provinces with the highest EV uptake – B.C. and Quebec – have clean electricity grids.

But how people experience charging depends very much on where they live. The majority of Canada's public charging sites are in large cities, and about 90 per cent are located in B.C., Quebec and Ontario. If you have a driveway, you can install a charger on your property and do most of your charging at home.

Current public charging infrastructure for EVs in Canada

As of Jan. 28, 2022. Includes 1,000 ports still under construction

Total charging sites Total charging ports



THE GLOBE AND MAIL, SOURCE: MOGILE TECHNOLOGIES INC.

DATA SHARE

Finding convenient public charging is more of a challenge for those living in remote areas and those in densely populated urban ones. At least one-third of Canadians live in a multiunit residential building. In the EV world, these people are known as garage orphans.

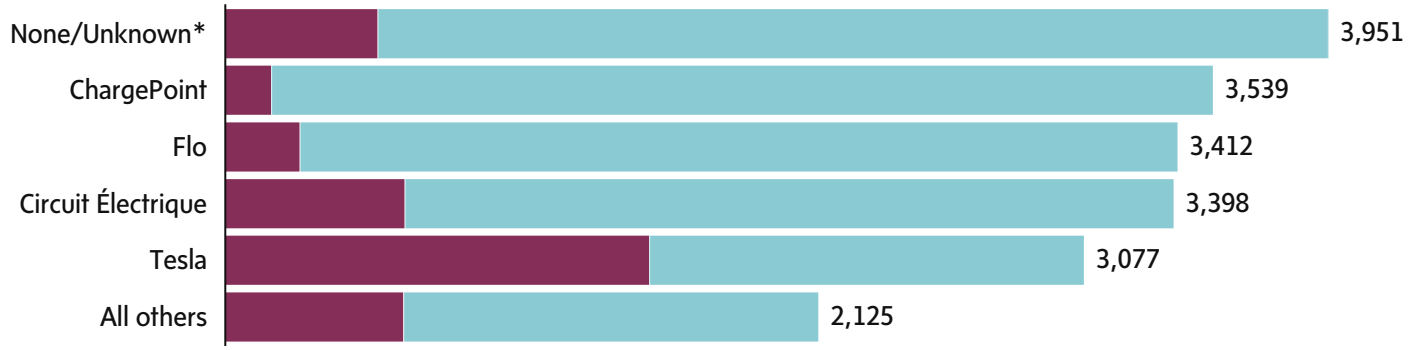
There are also the matters of reliability and pace of expansion. Since 2016, Natural Resources Canada has approved funding for the construction of roughly 25,000 public chargers. As of late April, about 1,620 had been built and are open. The funding agreements say nothing about maintenance obligations. “We’re a capital investment program that de-risks the initial instalment of chargers,” said Louise Tanguay, a senior manager with Natural Resources Canada. The department recognizes the importance of reliability, she said, but the issue is not its responsibility. Aside from third-party surveys, then, Ottawa has no visibility into how often the chargers it funded are out of service.

Jeff Turner, director of clean mobility with Dunsky Energy + Climate Advisors, a Quebec consulting firm that conducts modelling for the federal government on EV infrastructure, said it’s important that people feel confident they can leave home and get the charge they need. “It’s a lot of work,” he said, “but a lot of actors are mobilizing.”

Number of charging ports in Canada by charging network and charger level

As of Jan. 28, 2022. Includes 1,000 ports still under construction

Level 3 Level 2



THE GLOBE AND MAIL, SOURCE: MOGILE TECHNOLOGIES INC. *CHARGERS NOT PART OF A NETWORK ARE OFTEN NON-COMMUNICATING RESIDENTIAL CHARGERS INSTALLED BY BUSINESS OWNERS AND OFFERED FOR FREE TO PATRONS. THESE CHARGERS MIGHT HAVE BEEN PART OF A NETWORK IN THE PAST BUT BECAME DISASSOCIATED WHEN THE BUSINESS STOPPED PAYING THE NETWORK FEES.

DATA SHARE

There are more than 18,500 public charging ports across roughly 8,000 sites in Canada, according to a recently released report prepared by Mogile Technologies for the federal government. A further 1,000 or so are known to be under construction. The report is based on data sourced from Mogile's ChargeHub platform, which contains information about the type, status and location of public charging sites across North America.

Around four-fifths of Canada's public chargers are Level 2 chargers. These are relatively slow, with charging sessions taking several hours. They're mostly located on curbsides and in retail parking lots.

The rest are Direct Current Fast Chargers, which are mostly located along highways and major corridors, but can also be found in some towns and cities. Sessions at fast chargers take about 20 to 30 minutes.

Twenty-eight networks operate the chargers, with four – ChargePoint, Electric Circuit, FLO and Tesla – accounting for nearly 70 per cent of the ports, the Mogile report says. Traditional fuel suppliers such as Petro-Canada and Shell Canada have also entered the market. The former built sites across the country, with chargers at least every 250 kilometres from Halifax to Victoria.

Tesla, which has its own network with a proprietary connector, has more fast chargers than any other operator. Roughly 40 per cent of the country's fast chargers are Tesla Superchargers.

Under the new federal climate plan, the Liberals have pledged to invest another $900-million to expand the country's charging system. The government has committed to adding

50,000 ports by 2029. That's on top of the 34,500 it previously set as a target.

The Canadian Vehicle Manufacturers' Association, which includes General Motors, Ford Motor Co. of Canada, and Stellantis (FCA Canada Inc.), opposes the government's EV sales mandates, saying they're redundant because existing emissions regulations have the effect of increasing electric vehicle purchases. The real barriers to consumer adoption, it says, are insufficient consumer incentives and inadequate public charging.

"Canada is currently failing when it comes to building the necessary infrastructure," said association president Brian Kingston. The country is vast, he added, with many sparsely populated areas, and it experiences extreme cold, which reduces EV range.

The country will need four million chargers to support a fully electrified vehicle fleet, the association says. It might seem as though there's a massive gap between that figure and the government's commitments so far, but there's a lot to unpack.

Although Ottawa says 100 per cent of auto sales must be zero-emissions vehicles by 2035, Canada won't have a fully electrified fleet until mid-century, because of the lag in vehicle turnover.

Even Mr. Turner doesn't think the four-million number is far-fetched, with two important caveats. "That number makes sense to us when we look as far out as 2050 – and if you include chargers in apartment buildings," said Mr. Turner, who is on the board of not-for-profit Electric Mobility Canada.

He led Dunsky's work on a federally commissioned report outlining Canada's projected EV infrastructure needs. It hasn't yet been published, but Mr. Turner reviewed his findings with The Globe. The projections for public ports depend on how aggressively the country moves on access to private residential charging.

Under the "low access to home charging" scenario, the modelling shows that by 2025 Canada will need roughly 53,000 public ports, of which 49,000 should be Level 2 and the rest fast chargers. By 2030, the overall number will need to rise to about 200,000. Five years later, that number should climb to about 470,000.

"How accurate that modelling will be remains to be seen, but we're pro-actively doing studies and deeper dives to keep an eye on what's needed, including at the regional and

provincial levels, to meet the evolving demand," said Thierry Spiess, a senior manager in the fuels diversification branch of Natural Resources Canada.

Ms. Tanguay, his colleague, said it takes between 30 to 36 months from the time a contribution agreement is signed to when a site opens to the public. The latest request-for-proposals, which closes in August, includes multiunit residential buildings. These sites will be key to accelerating EV adoption among today's garage orphans.

Getting chargers into new builds is relatively straightforward. Some municipalities, many of them in B.C., have passed bylaws requiring a certain percentage of parking spots be equipped with chargers or are least EV-ready, with roughed-in electrical wiring. It's retrofitting existing buildings that will be a tall order.

A 2019 report prepared by Pollution Probe and sustainability consultancy the Delphi Group pointed to several concerns with upgrading older buildings, including grid preparedness, building design and financial constraints.

But these kinds of obstacles must be overcome. According to Mr. Turner's analysis, Canada will need somewhere between 1.8-million and 5.6-million ports in apartments and condos by 2050.

Christopher McDermott, a former Environment Canada policy advisor who is about to buy his first electric vehicle, at a charging station near his home in Montreal.

CHRISTINNE MUSCHI/THE GLOBE AND MAIL

It's not enough to get chargers into the ground, however. After all, a broken charger is worse than no charger, because in the case of the latter, at least the driver wasn't counting on it.

Chris McDermott is soon going to be an EV driver himself, so on a cold winter's day in Quebec this past February, he went out in his gas-powered car for some recon on charging. He wanted to know whether he could quickly and reliably charge an EV along his preferred route between his Montreal apartment and his house west of Ottawa.

It was one thing to look at online maps of charging sites and filter for fast chargers. It was another to actually visit them. What he encountered at an Electrify Canada site in Ottawa gave him pause. About half of the eight ports were out of service, he said. The discovery made him nervous.

“As part of my EV-purchase decision, I rolled up my sleeves and really looked into the charging issue,” said Mr. McDermott, a former federal public servant who was one of Canada’s negotiators on the Kyoto Protocol, and who is now working in the clean-energy industry. “People will get uncomfortable with buying EVs if this sort of thing keeps up.”

The extent to which public chargers don’t work isn’t clear. The latest best guess is contained in the Mogile report, which looked at a dataset of nearly two-million charging sessions in 2019, 2020 and 2021. But even then the information is limited, because the report doesn’t capture all public ports; nor does it reflect issues with chargers that don’t communicate problems remotely to the operator.

The report said downtime is “quite frequent if judged by the number of problems reported in the ChargeHub app.” Of the Level 2 ports for which status could be determined on Jan. 28, 2022, when a snapshot of the database was taken for analysis, 5.9 per cent were offline. For fast-charging ports, the figure was 4.7 per cent.

Other apps provide insight into reliability, too. EV charging map PlugShare, for example, features commentary from drivers about their experiences at sites. Notes about the Electrify Canada site Mr. McDermott visited in February show that several drivers have faced problems in recent months.

Electrify Canada, which is a partnership formed by Volkswagen Group Canada and Electrify America, said it hasn’t received funding under the federal government’s two key infrastructure programs. It didn’t provide an uptime figure, citing competitive reasons. Suncor, which owns Petro-Canada, received federal funding for its network; it also didn’t provide The Globe with an uptime figure. Tesla didn’t respond to requests about its uptime rate, but the network is well known for its reliability.

Hydro-Québec put the uptime for fast chargers on its Electric Circuit network at more than 99 per cent, with Level 2s at roughly 96 per cent. BC Hydro said that over the past year, most of the sites in its network have been operational about 98 per cent of the time. Both utilities have received federal funding.

Natural Resources Canada said it knows reliability is important. “That is why, as part of the competitive process, we award merit points for sound operation and management plans,” the department said. “However, once the project is completed and operational, the ongoing maintenance is the responsibility of the equipment owner, site host or network provider.”

Quebec-based FLO, one of Canada's largest EV networks, put its uptime at more than 98 per cent. FLO also operates sites in the U.S., and has sponsored a private bill in the California legislature that would require the disclosure of reliability data for all publicly funded charging infrastructure in the state.

"This conversation is so key for EV adoption writ large," said FLO spokeswoman Frédérique Bouchard. It also matters for keeping EV drivers in their seats, she said, adding: "We don't want people switching back to a traditional vehicle."

A Parkland electric vehicle charging port station in Kelowna.

AARON HEMENS/THE GLOBE AND MAIL

Mr. Smart, who is leading Parkland's EV strategy, said his team has learned a lot in the nine months since it launched the EV pilot project in downtown Kelowna, at a site that features an On the Run convenience store and a Triple O's quick-service restaurant – both 24/7 Parkland brands.

Importantly, about half of EV-charging customers have been going into the store or restaurant, compared with 15 per cent of fuel customers. “Customers gravitate to our site over places that offer chargers only,” Mr. Smart said.

Branching out into charging is a costly proposition that often requires electrical upgrades. The fast chargers Parkland is using, for example, cost between $100,000 and $200,000. A new fuel pump, in comparison, goes for about $30,000 to $40,000. (Level 2 chargers cost a few thousand dollars.)

Unlike with fuel, drivers pay for charging by the minute, hour or session, instead of by the amount of electricity they consume. That’s because federal agency Measurement Canada doesn’t allow public charging to be billed by kilowatt hour. Two drivers who pay the same amount may have pulled different amounts of electricity owing to a number of factors, including the temperature and level of the battery when charging began. Measurement Canada is developing new standards that will allow for kilowatt-hour billing in the EV charging space.

How and whether to charge drivers is just one of the considerations when it comes to the economics of EV infrastructure. Indeed, the space is characterized by myriad business models.

Many site owners who sell merchandise or services got into EV charging as a way to attract customers to their location and increase sales. These retailers may choose to offer free or discounted charging as an added incentive. About half of the Level 2 chargers covered by the Mogile report – about 7,600 ports – are free to use.

Independent charging port operators may be vertically integrated – involved in many facets of the business, from manufacturing to software and a branded network. The customers of these operators tend to be site owners who enter into agreements with the networks, paying them recurring fees. They also pay for the electricity and set their own fees for charging.

Utilities either own charging sites or enter into agreements with site owners. The incentive for utilities to get into charging infrastructure is clear, since EV uptake means increased sales of the good they produce: power. Automakers have entered the market as a way to encourage drivers to convert to the EVs they sell.

There's also the matter of manufacturing. Parkland isn't in the business of building chargers, so it buys them from a supplier outside Canada. FLO, on the other hand, manufactures its own chargers at a pair of factories in Quebec, and plans to open a plant in Michigan this year; it also sells chargers to other network operators. Hydro-Québec recently selected FLO to supply Electric Circuit with up to 7,500 Level 2 chargers over the next four years. That's roughly double the network's charging footprint.

As EV penetration increases, Mr. Smart said, the profile of drivers will shift from early adopters who have chargers at home to those who will need easy access to public ports. "If you want to increase EV adoption, you need to have the public infrastructure," he said. "You need to make sure drivers aren't going to get stranded like we did."