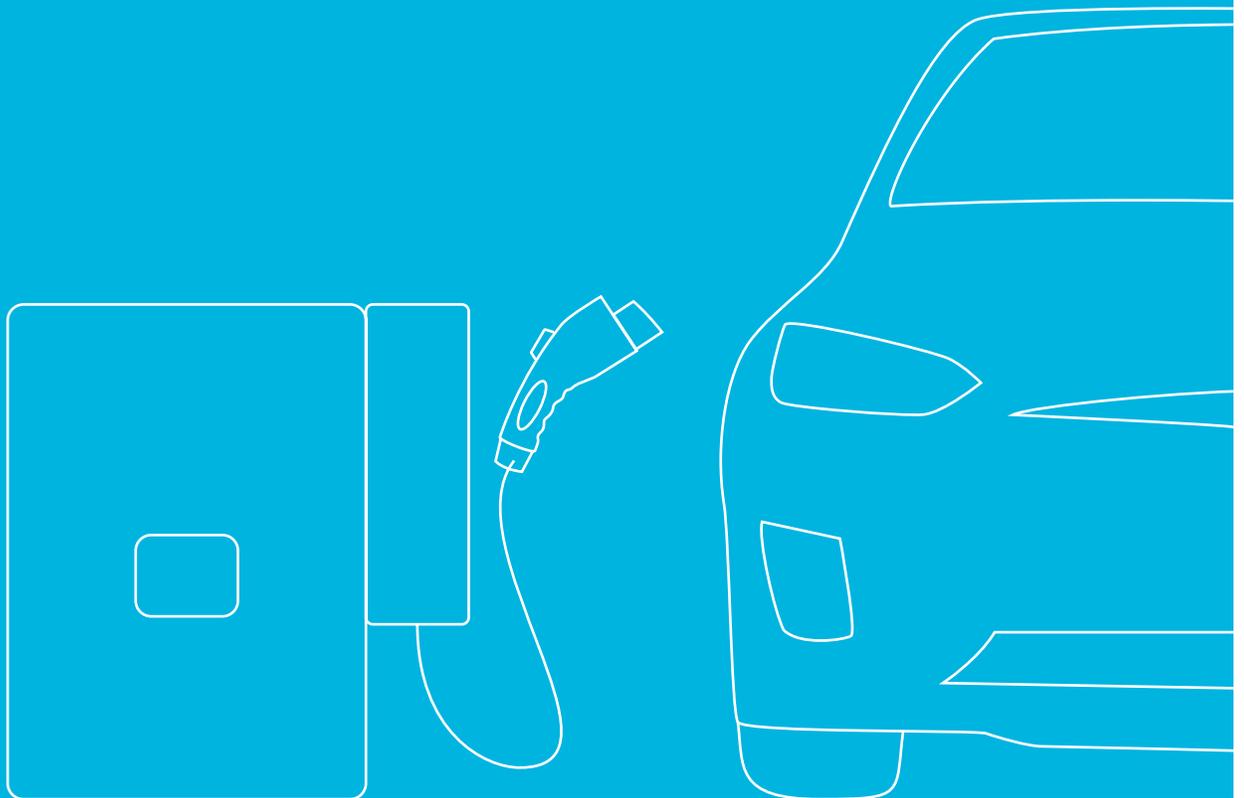


Unplugged: Myths block road to the electric car dream



Report
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 **BC Hydro**
Power smart

Unplugged: Myths block road to the electric car dream

Rising gas prices, a greater variety of plug-in vehicles, and advances in battery capacity, make electric vehicles an attractive alternative to gas-powered cars. But fewer than one in 50 cars sold in B.C. in 2017 were battery electric or plug-in hybrid electric vehicles. This report unearths and addresses the misconceptions blocking greater adoption of plug-ins in B.C.

Highlights

- A recent survey conducted for BC Hydro¹ found that while a third of respondents expect their next vehicle purchase to be electric, more than half believe electric vehicles are too expensive.
- With gas prices rising dramatically in recent months, ownership costs over the long term for some electric vehicles are expected to be lower than the costs of owning similar-sized gas-powered vehicles.
- Driving B.C.'s all-time top-selling electric vehicle (Nissan Leaf) 20,000 kilometres a year rather than the top-selling gas-powered car (Honda Civic), would save more than \$1,200 a year in fuel costs alone² at today's gas and electricity prices.
- 55% of those surveyed said saving money on gas and maintenance would be the biggest motivation for buying an electric vehicle.
- The survey also found several other perceived barriers to ownership – in addition to purchase price – still exist:
 - Range anxiety: Four in 10 British Columbians think today's electric cars do not have enough battery range for longer trips.
 - Charging station availability: While a standard 120-volt household outlet can be used for vehicle charging, nearly nine in 10 surveyed are under the impression there is not an electric vehicle charging station available at their home or residential complex.
 - Finding the right car: Nearly one in five British Columbians say there is already an electric car available that's sized and equipped to suit their needs, while another 37% said the options are good, but not perfect.
- There are seven fully electric vehicle models for sale in B.C. that have a battery range of at least 150 kilometres and that are available at a price of less than \$40,000³ after a provincial rebate. At least seven new plug-ins enter the B.C. market this year, possibly including the highly-anticipated Tesla Model 3, expected to have a range of 350 kilometres.
- While 27 different plug-in hybrid electric vehicles have been sold in B.C., last year was the first year in which fully electric cars outsold plug-in gas-electric hybrids across Canada. In B.C., battery electrics have outsold plug-in hybrids four of the last five years.

Solutions

- B.C. is one of only three Canadian provinces to offer rebates for the purchase of an electric vehicle. Rebates of up to \$5,000 are available for full plug-in electric vehicles (and up to \$2,500 for plug-in hybrids) and there are a limited number of \$6,000 SCRAP-IT program subsidies available for buyers who scrap their old gas-powered car.
- There are well over 1,000 public charging stations in the province. The bulk of the stations are Level 2, and the number of DC fast chargers will hit 58 later this month.
- Earlier in 2018, the BC Government announced three new rebates for the purchase and installation of electric vehicle chargers at homes, residential complexes, and workplaces.

¹ Electric vehicle survey was conducted for BC Hydro by Vancouver-based NRG Research Group in April 2017, from a sample size of 800 adult B.C. residents 18-plus years of age.

² CAA online cost calculator, comparison of 2018 models

³ PlugInBC list of 2018 vehicles available in B.C.

British Columbians like the idea of electric cars, but are hesitant to buy them

Despite gas prices hitting all-time highs in B.C., perceptions around purchase price, range anxiety, lifestyle fit, and where to charge plug-in vehicles, remain barriers to widespread adoption of electric vehicles in B.C.

A new survey conducted by Vancouver-based NRG Research Group⁴ for BC Hydro shows that a third of British Columbians think their next new car purchase could be electric, and that two in three think B.C. would be a better place with more electric vehicles. But the same survey shows that owning an electric vehicle is considered by many to be a fantasy, as more than half believe electric vehicles are still too expensive.

More than six in 10 surveyed said there is not enough charging infrastructure in B.C. to make them feel comfortable about purchasing or leasing an electric vehicle. Almost 40% said plug-ins do not have the range for longer trips.

Those sentiments are illustrated in actual electric vehicle car sales numbers in B.C. Even though the number of plug-in vehicles sold in B.C. doubled from 2015 to 2017, battery electric and plug-in hybrid electrics' share of total car sales in B.C. is still less than 2%. That is less than one out of 50 cars sold.

The math on electric vs. gas-powered vehicles continues to move in favour of electric vehicles. In B.C., the most expensive province for gas, prices at the pump increased an average of 20.5 cents since last year, and around 16 cents since the beginning of 2018.⁵

Meanwhile, by 2019, automobile manufacturers will introduce more models than ever before, most of them priced below \$40,000 and several that are SUV-sized.

WHERE THE ELECTRIC VEHICLES ARE

Electric vehicle sales world-wide reached an all-time high last year with over 735,000 purchased worldwide. While electric vehicle adoption is on the rise in Canada, Canadians are still far behind the adoption rates seen in several other parts of the world.

Aided by generous subsidies, Norway is the leader in electric vehicle adoption, with battery electric and hybrid-electric plug-ins combining to represent more than 50% of new registrations of vehicles in 2017. In Canada, sales of EVs have been less than 1% of overall sales and are expected to continue to grow.

Electric vehicle sales in Canada rose 68% in 2017, with over 9,800 battery and plug-in hybrid electric vehicles sold. The majority of these (7,500) were sold in Ontario, which saw a 120% increase in sales. Quebec had the second highest with 7,200, representing a 41% increase in sales. In B.C., 3,217 were sold, for a 50% increase over a year earlier.

ANNUAL CUMULATIVE GROWTH (2017 VS 2016)

	2013	2014	2015	2016	2017	'16-'17 Change
Ontario	1,092	1,736	2,049	3,400	7,477	120%
Quebec	1,438	2,679	3,229	4,987	7,194	44%
British Columbia	567	769	1,546	2,132	3,270	53%
Alberta	94	78	162	342	430	26%
Manitoba	28	29	33	58	64	11%
New Brunswick	10	18	14	24	53	124%
PEV Total	3,254	5,356	7,072	11,023	18,564	68%

Salt Spring Island in the Southern Gulf Islands was named the unofficial "electric car capital of Canada" in 2017. There are around 10,200 residents on the Island and over 111 electric vehicles.

⁴ Electric vehicle survey was conducted for BC Hydro by Vancouver-based NRG Research Group in April 2017, from a sample size of 800 adult B.C. residents 18-plus years of age.

⁵ gasbuddy.com comparison of average gas prices by province, April 2018

Barriers to electric vehicle adoption

Even as the affordability of electric vehicles increases, the survey conducted for BC Hydro⁶ shows there are still significant perceived barriers to the purchase of an electric vehicle.

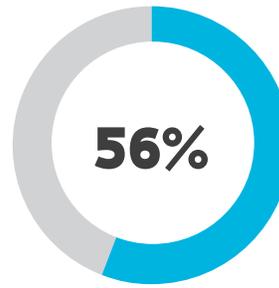
Cost: Sticker shock vs. total cost

A Bloomberg New Energy Finance Forecast study published in 2017⁷ estimated that by the year 2025 the purchase cost of electric vehicles will be around the same as gasoline models, due in large part to the declining cost of batteries. While trends suggest electric vehicles are becoming more affordable, initial cost remains a major barrier to electric vehicle adoption, with over half of British Columbians (56%) saying electric cars are too expensive.

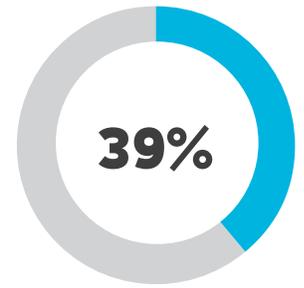
Studies indicate that compared to the buyer of gasoline versions of the same vehicle, electric vehicle buyers tend to be wealthier and younger. A recent study conducted by the U.S.-based National Renewable Energy Laboratory (NREL)⁸ found that those with an income over \$100,000 were the most likely to consider purchasing an electric vehicle. And last year in B.C., two of the top three battery electric models sold were the Tesla S (\$96,000-plus) and the Tesla X (\$110,000-plus).

However, there are more models to choose from than ever before with 41 different plug-in hybrid or fully electric vehicles on Canadian roads. Fourteen plug-ins available in B.C. can be purchased for less than \$40,000⁹ once B.C.'s battery electric or plug-in hybrid electric rebates are factored in. Not only is that making the cars more attainable for those with more modest incomes, it is also changing the math around long-term cost of ownership.

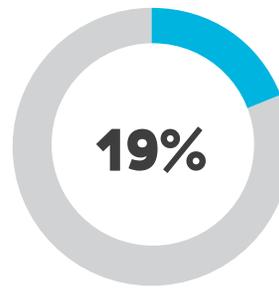
BARRIERS TO OWNERSHIP



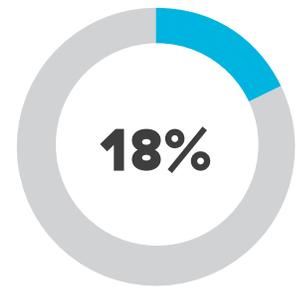
It's too expensive



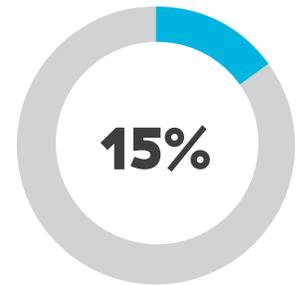
It doesn't have the range for longer trips



I want to wait for the next generation of batteries before I buy



Not enough information out there about electric cars



I'm still not sold on the technology

⁶ Electric vehicle survey was conducted for BC Hydro by Vancouver-based NRG Research Group in April 2017, from a sample size of 800 adult B.C. residents 18-plus years of age.

⁷ Bloomberg New Energy Finance Forecast study, 2017

⁸ National Renewable Energy Laboratory study: <https://www.nrel.gov/docs/fy18osti/70371.pdf>

⁹ PlugInBC list of 2018 vehicles available in B.C.

Depending on the factors included in calculations, some electric vehicles are already as affordable as, and in some cases less expensive than, similar-sized gas-powered vehicles in overall cost of ownership in B.C. High gas prices in B.C., combined with BC Hydro residential electricity rates currently among the lowest in North America,¹⁰ mean that electric vehicles are becoming increasingly competitive in this province.

Many public charging stations in B.C. are free; most public stations do not charge fees for charging, but may require drivers to join a service network.

The Canadian Automobile Association’s popular online cost calculator is available for those who want to compare the total costs of ownership – for owning or leasing a vehicle for five years – between specific electric vehicles and gas-powered vehicles. But the CAA’s tool factors in resale values to produce depreciation numbers that – because plug-ins are a relatively new technology and used EVs have had low resale value – heavily skews the cost analysis in favour of gas-powered vehicles. However, EV depreciation is subject to debate given that the low number of plug-in vehicles on the road make calculating depreciation difficult.

With depreciation not factored in, the 2018 version of Canada’s all-time top-selling electric vehicle (Nissan Leaf), is estimated to be nearly \$1,500 a year less expensive to run – at 20,000 kilometres a year – than the top-selling gas-powered vehicle (Honda Civic). With depreciation, the Leaf is \$550 a year more expensive to run than the Civic.

The Leaf wins the comparison mostly due to “fuel” costs, \$449 for electricity vs. the Civic’s \$1,705 in gas for those 20,000 km a year.

Generally speaking, the cost analysis tends to favour electric vehicles the longer a vehicle is owned and those yearly savings add up. One argument on the side of gas-powered vehicles is that battery packs in electric vehicles degrade over time and are costly to replace, but advances in battery technology are bringing replacement costs down significantly each year.

Total cost of ownership for three EVs and three similar-sized gas cars

TOTAL COSTS OF OWNERSHIP PER YEAR, EXCLUDING DEPRECIATION COSTS, OVER THE FIRST FIVE YEARS OF OWNERSHIP FOR 2018 VEHICLES.

Battery-electric	VS	Gas-powered
Chevrolet Bolt	is \$999 less than	Chevrolet Spark
Kia Soul EV	is \$1,736 less than	Kia Soul
Nissan Leaf	is \$1,465 less than	Honda Civic

Source: CAA cost calculator

¹⁰ Hydro Quebec Comparison of Electricity Prices in Major North American Cities

The under-\$40,000 club

BATTERY ELECTRIC AND PLUG-IN HYBRID ELECTRIC VEHICLES AVAILABLE IN B.C. FOR UNDER \$40,000 WHEN PROVINCIAL REBATES ARE FACTORED IN

Current members		Next up:
Battery-electric vehicles	Plug-in hybrids	Tesla Model 3 (\$45,000 estimated)
Smartfortwo ED \$28,800	Hyundai Ioniq PHEV \$31,999	Hyundai Kona SUV (Price TBD)
Ford Focus Electric \$34,998	Toyota Prius Prime \$32,900	
Kia Soul EV \$35,895	Ford Fusion Energi \$33,588	
Nissan Leaf \$35,998	Chevrolet Volt \$38,995	
Volkswagen e-Golf \$36,355	Honda Clarity PHEV \$41,680	
Hyundai Ioniq Electric \$35,649	Kia Optima PHEV \$42,995	
Chevy Bolt \$43,195	Mitsubishi Outlander \$42,998	

Source: Source: Pluginbc.ca https://pluginbc.ca/wp/wp-content/uploads/2018/04/Electric-Car-Handout-8.5x14_180308.pdf

Range anxiety: British Columbians want more charging options

There are now more than 1,000 public charging stations for plug-ins across B.C., but range anxiety – worries over the practicality of getting from A to B without draining the battery pack – remain. More than six in 10 British Columbians surveyed by BC Hydro said there is not enough charging infrastructure in B.C. to make them feel comfortable about purchasing or leasing an electric vehicle.

That perception is likely to change as auto makers produce more battery electric vehicles capable of going 300 kilometres or more between charges, and B.C.'s network of fast-charging stations (currently at 58), continues to expand. DC fast-chargers can fill most battery packs to 80% capacity in 30 minutes or less.

It's also important to note that about 95% of all car trips in British Columbia are less than 30 kilometres. That helps make the case for a more compact, less expensive plug-in with limited range as an option for the 51% of drivers surveyed who said they'd consider an EV as a second vehicle. Almost one in three said they had no need for a second vehicle.

One sign that range anxiety is easing is that battery electric vehicles are outselling hybrid gas-electric plug-in vehicles. There are now 10 fully electric vehicle models for sale in B.C. that have a battery range of at least 150 kilometres – including three with more than twice that range. For apartment dwellers and others without home charging access, plug-in hybrid electrics remain an attractive option.

Studies have shown that familiarity with locations of charging stations makes people more likely to purchase an electric vehicle. Even though a standard 120-volt household outlet can be used for vehicle charging, the vast majority of respondents surveyed for the BC Hydro report (87%) are under the impression their home or residential complex does not have a charging station.

Because most charging happens at home – estimated at more than 80% for most drivers – charging via a standard outlet for up to eight hours overnight can be a practical option for those with modest driving needs. Many EV drivers, however, opt to install a faster Level 2 charger in their homes (and the BC Government recently introduced incentives to reduce the cost of buying and installing Level 2 chargers in homes, residential complexes and workplaces).

Fit: Many B.C. drivers waiting for the right electric vehicle

The BC Hydro survey shows that many British Columbians are intrigued by the prospect of buying an electric vehicle, but about two thirds say they have never driven one. Many feel there is not a plug-in vehicle that is right for them.

On the question of whether there is now an electric vehicle sized and equipped to suit their needs and lifestyle, one in five say there is already an EV that suits their needs and lifestyle, while one in four (26%) selected the survey option “maybe, but it’s not 100% perfect.” Only 14% say there definitely isn’t a car to suit their needs.

The suitability question produced significant regional differences. The majority of those in the northern and southern Interior of the province say there is no available electric vehicle that would meet their needs. This could be attributed to the fact there are

no electric pickups so far (four of the top five selling vehicles in Canada in 2017 were pick-ups) and that there are doubts about the size and/or towing capacity of electrics. Conversely, in the Lower Mainland (and to a slightly lesser extent on Vancouver Island), the majority say that while there may not be an EV perfectly suited to their needs, there are EVs which are generally equipped to meet their lifestyles.

The vast majority of British Columbians (85%) think electric vehicles use proven technology. Electric cars have actually been around longer than gas-powered cars, making their debut in the 1800s, even if plug-in vehicle technology has come a long way, particularly in battery capacity.

B.C.’S ALL-TIME TOP-SELLING PLUG-INS

BEV		
Battery Electric Vehicles	1. Nissan Leaf	1,717
	2. Tesla Model S	1,522
	3. Chevrolet Volt	1,066
PHEV	4. Tesla Model X	882
	5. Chevrolet Bolt	327
	6. Kia Soul	432
	7. Smart ForTwo	245
	8. BMW13	232
	9. VolvoXC90	200
	10. AudiA3 and BMW13	181

BMW13
(shown twice because there are two BMW13 models)

Saving money, not the environment, the prime motivation

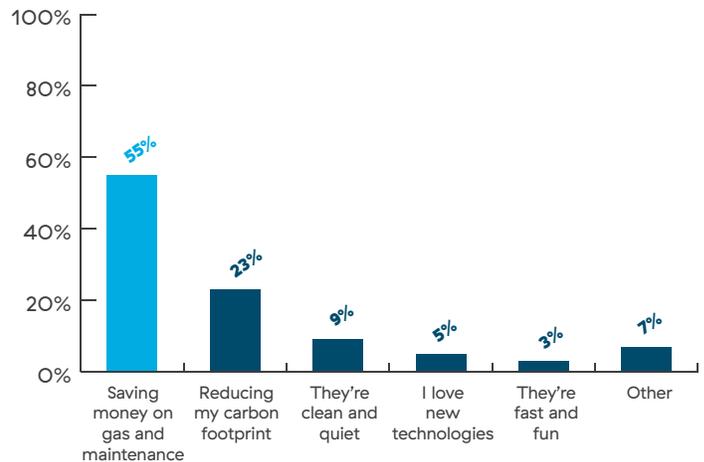
In areas of the world where electricity generation is largely from coal or other fossil fuels it is arguable that driving an electric vehicle does not dramatically reduce carbon emissions. But that is not the case in B.C., where 98% of electricity generation is clean.

The Canadian Automobile Association’s online comparison tool shows that over 100,000 km, powering the Chevy Bolt in B.C. produces less than 1,500 kg of greenhouse gases, compared to almost 16,000 kg of GHGs for the gas-powered Chevy Spark.

Helping fight climate change, however, is not the main reason British Columbians are considering electric cars. BC Hydro’s recent survey shows that more than half of respondents (55%) list saving money on gas and maintenance as the main reason they’d consider switching to electric. Less than one in four said reducing their carbon footprint was the biggest motivation, while another 9% said it was because they’re clean and quiet, and 5% said it was because they love new technologies.

Among those who already own an electric car, 52% said saving money on gas and maintenance was the No. 1 reason they bought one. More than a quarter (26%) said it is because electrics are fast and fun, and just 11% said it was to reduce their carbon footprint.

WHAT WOULD MOTIVATE YOU MOST TO BUY AN ELECTRIC VEHICLE?



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Incentives effective in increasing electric vehicle sales

As the only provinces in Canada to offer rebates on the purchase of electric vehicles, it is not a surprise that B.C., Ontario and Quebec have the highest electric vehicle adoption rates. Currently, the federal government does not offer electric vehicle incentives.

A number of countries, including Norway, the Netherlands and India are moving towards a complete ban on the sale of fossil-fueled power cars as early as the next decade. To date, Canada has no such legislation. Despite Canada being slower to adopt electric vehicle technology, 85% per cent of those surveyed for BC Hydro think they will outsell gas-powered vehicles within the next 20 years.

In B.C., rebates of up to \$5,000 are available for plug-in electric vehicles, and there are a limited number of \$6,000 SCRAP-IT program subsidies available for buyers who scrap their old gas-powered car and buy battery electrics. For those looking for used electric vehicles, the SCRAP-IT program also offers \$3,000 subsidies when gas-powered cars are taken off the road and a used vehicle is purchased at a participating B.C. auto dealership.

New to B.C.: Incentives for installing electric vehicle charging at home, at stratas, and at work

Three new rebates, funded with \$1.85 million from the Province of British Columbia as part of its Clean Energy Vehicle Program and administered by PlugIn BC, are available now through March 31, 2020 (or while program funding lasts):

- A rebate for single-family homes and duplexes covers 75% of costs, up to \$750, for the purchase and installation of a Level 2 (208v/240v) charging station for residential use installed February 1, 2018 or later.
- A rebate for multi-unit residential buildings covers 75% of costs, up to \$4,000, for the purchase and installation of a Level 2 station (208v/240v).
- A rebate for workplaces covers 50% of costs, up to \$4,000, per Level 2 station (or \$2,000 per Level 1 (120 v) station).

BC Hydro plays major role in expanding fast-charging network

BC Hydro is helping B.C. better prepare for adoption of electric vehicles by working with the provincial and federal government to explore opportunities to expand our DC fast charging station network across the province. BC Hydro is also investigating challenges and barriers to EV charging in all different types of communities, and identifying opportunities for innovation and solutions.

Charging initiatives to date include:

- Completion, in late 2016, of a BC Hydro pilot project to install 30 direct current (DC) fast charging stations throughout the province. The 30 fast charging stations connect drivers from the Lower Mainland to Merritt and on to Revelstoke, up to Whistler, Vancouver Island and the Southern Interior.
- A second phase of the DC fast charging pilot program, scheduled for completion by April 30, 2018, rolls out an additional 28 DC fast charging stations at 26 unique locations.
- The Accelerate Kootenays project to install 13 DC fast charging stations and 40 Level 2 charging stations across the Kootenays region in southeast B.C. by December 2018. The \$1.5 million project involves multiple partners, including BC Hydro.

Fast charging stations can charge an electric vehicle's battery to 80% in 30 minutes or less, and advancements in fast-charging technology are expected to increase charging speeds by more than six times by 2020. BC Hydro has been installing the stations since 2012 with support from the provincial and federal governments and in partnership with municipalities and regional districts throughout the province. While there are less than 9,000 electric vehicles on B.C.'s roads today, it's estimated that number will hit 300,000 by 2030.