City of Victoria Electric Vehicle and Electric Mobility Strategy

Executive Summary

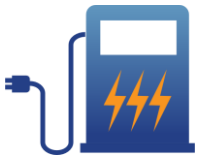
Victorians are leaders in low-carbon transportation. Residents choose to move in ways that are better for their health, the climate, and their community. The City of Victoria is looking to build on this leadership by planning for a city where transportation is safer, more sustainable, more convenient, attractive, and enjoyable for people of all ages and abilities with less environmental impact.

The Victoria region has made remarkable progress on electric vehicle (EV) adoption to date, with the highest percentage of EV sales anywhere in Canada. However, significant barriers stand in the way of building on this progress and supporting the uptake of EVs and other electric mobility options. With over 80% of Victorians living in multi-family homes, the key question is: how are they going to plug in and charge up their EVs?

The Victoria Electric Vehicle and Electric Mobility Strategy charts the course to reach the City's Climate Leadership Plan ambitious target of renewable energy powering 30% of passenger vehicles in Victoria by 2030, and to support the target of 55% of resident trips made by walking, rolling, and cycling by 2030. The Strategy was developed through stakeholder engagement, a review of leading practices, and modelling of Victoria's unique transportation landscape.

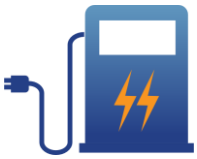
To reach the City's EV and electric mobility targets, the following suite of strategic investments, incentives, and initiatives is recommended.

- **Invest in EV Charging** to enable Victorians to charge at home, at work, and on-the-go. From 2022 to 2030, the City should invest in the following three key types of charging infrastructure:



DC Fast Charging

$3.3 M in 33 ports



Level 2

$2.64 M in 650 ports

EV Ready Retrofits

up to $9.75 M in 40,600 stalls

- **Fill Gaps in EV Incentives:** to maintain or enhance today's cost-effectiveness for EV ownership. The City should advocate at a minimum to keep the current provincial and federal incentives, or, if the current level of support drops off, maintain the financial benefit through City policies such as parking fees.
- **Build a Supportive EV Ecosystem:** to ensure EV ownership is accessible and equitable. We recommend developing a municipal EV charging program to facilitate and adapt the City's EV plans, enabling private investment in public charging, building local capacity with residents and EV businesses, and advocating for multilateral support and action.
- **Support modal shift** to e-bikes and other e-mobility devices to reduce reliance on personal vehicles. The City can encourage adoption by implementing actions to develop a safe and secure ecosystem for all riders.

Victoria's Strategy outlines an ambitious and comprehensive approach to putting the City on track to deliver a fair and equitable transition to electric mobility in the community and respond to the climate emergency.

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Renewable-powered Mobility: A Vision for 2030

Connecting Mobility and the Environment in Victoria

Victorians are leaders in low-carbon transportation. Residents choose to move in ways that are better for their health, the climate, and their community. More Victorians are opting to walk, bike, or take transit, with these modes representing 57% of all trips.

The City of Victoria is looking to build on its citizens' leadership by planning for a city where transportation is safer, more sustainable, more convenient, attractive and enjoyable for people of all ages and abilities with less environmental impact. Mobility choices have a significant impact not only on daily life but on greenhouse gas emissions. The City of Victoria council declared a climate emergency in March 2019, highlighting the urgency of reducing emissions. Transportation is a major opportunity for climate action as it accounts for 40% of emissions within the City in 2017 (**Figure 1**).

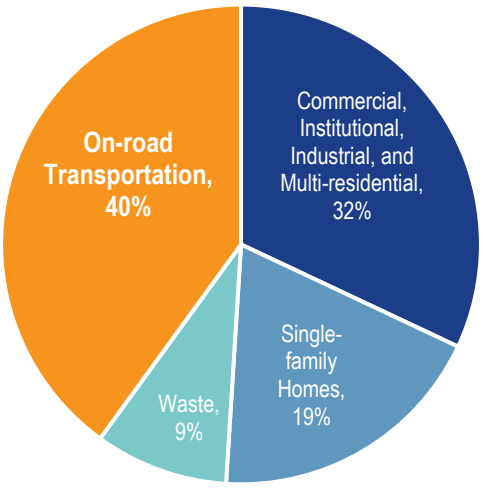


Figure 1. Victoria's community greenhouse gas emissions by sector in 2017. Source: City of Victoria

Victoria's Climate Leadership Plan 2050 vision is "a seamless and integrated mobility system prioritizes low carbon transportation including walking, biking, public transit and shared electric mobility options." Victoria's Official Community Plan sets out the hierarchy of mobility to prioritize pedestrians, cyclists, public transit, and commercial vehicles over single-occupancy vehicles (**Figure 2**). This transportation design emphasizes walking centres and thoroughfares, and strong cycling and transit link neighbourhoods to each other, employment areas, and amenities.

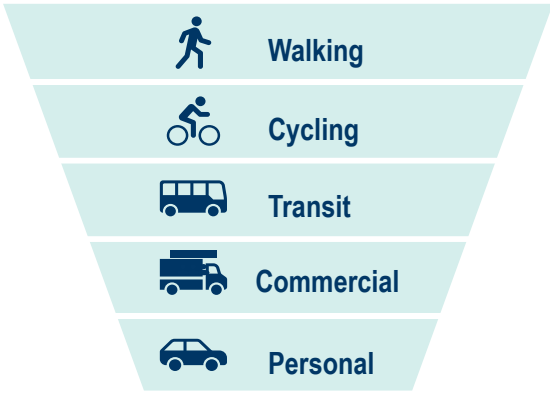


Figure 2. The mobility pyramid from Victoria's Official Community Plan

Although personal vehicle transportation is at the bottom of the hierarchy, it will remain an essential component of travel because walking, cycling and transit do not accommodate everyone's needs.

Victoria's Electric Vehicle and Electric Mobility Strategy supports the electrification of transportation while in alignment with the City's Go Victoria mobility strategy and its Climate Leadership Plan.

Victoria's Electric Vehicle and Electric Mobility Strategy

Victoria's Electric Vehicle and Electric Mobility Strategy (the "Strategy") was developed by Dunsky Energy + Climate Advisors in partnership with AES Engineering. It identifies actions to help the City of Victoria meet its *Climate Leadership Plan* goal of renewable energy powering 30% of passenger vehicles registered in Victoria in 2030. This is an ambitious goal – while it is directionally aligned with current provincial and federal government targets, it reaches beyond their commitments. It is unlikely that the City will reach this goal without significant financial and policy support. This Strategy also supports the *Climate Leadership Plan* goal of having residents choose walking, rolling, and cycling for 55% of all trips by 2030, with actions that encourage the electrified active transportation ecosystem.

Renewable-powered transportation requires a transition away from internal combustion engine (ICE) vehicles to low-emission vehicles that do not rely on gasoline or diesel to power their motors. Electric vehicles (EVs) are the most mature, readily available and energy efficient low-emission vehicle technology. This Strategy covers both plug-in hybrid EVs (PHEVs) and battery EVs (BEVs), as well as e-bikes and other electric mobility options. Leveraging these modes, this Strategy outlines a pathway towards *A Vision for 2030* for active, low-carbon transportation in Victoria, as described on the following page.

Why Drive an EV?

EVs reduce greenhouse gas emissions in two ways. First, electric motors are more energy-efficient, resulting in less energy being needed to travel an equivalent distance to an ICE vehicle. Second, the energy used for EVs (i.e., electricity) is almost 100% renewable in BC.

Beyond the climate impact, Victorians benefit from an improved urban environment. EVs improve air quality by reducing the localized emission of air pollutants through the elimination of tailpipe emissions. In addition, they reduce noise pollution due to the relatively silent electrical drivetrain – a particularly relevant feature for electric trucks and buses.

There are important local economic impacts of a transition to EVs. EVs cost less to operate and maintain than ICE vehicles, which means that EV owners have more disposable income for non-transportation needs. Further, EVs can help support the optimal use of electricity generation by leveraging vehicle-grid integration technologies. This can help reduce net electricity system costs in British Columbia, benefiting all residents. Aligning with Victoria's high-tech and innovation sector, a strong commitment to transportation electrification will signal that Victoria is a prime destination for innovative businesses.

The City of Victoria has the highest percentage of EV sales in Canada.

Source: Statistics Canada, 2021

A Vision for 2030

It's easy to smell the salt hanging in the air downtown without the nuisance of tailpipe emissions lingering along Government Street. Shops, patios, and sidewalks are humming with people arriving on foot and on wheels. Before joining the pedestrian bustle, people are locking up their e-bikes or dropping off and plugging in their EV carshare.

On Cook Street, three friends meet up for a coffee. Miguel arrives by foot after hopping off an e-bus, one that comes often and quietly. Sophie was just plugging her EV into the neighbourhood fast charging hub to charge up for the week while she has coffee and then runs a few errands. Ray runs into Beth at the mobility hub where he is also dropping off his e-kick scooter to charge.

Across the city, the passenger vehicles on the street are commonly electric. Most Victorians are choosing to replace their ICE vehicles with an electric one or none at all. Residents spend less time, and less money commuting, and enjoy quieter, safer streets.

Why Use an E-Bike or Other Electric-Mobility Device?

There are a number of reasons people opt to use an e-bike or e-mobility (e.g., electric wheelchairs, mobility scooters, kick-scooters, skateboards, etc.) device. For some, it is for the enhancement to mobility such devices offer, for others it is an affordable and easy form of transportation, no special license or registration is required, there is no parking to pay for and charging an e-bike battery costs only a few cents. Yet others choose e-bikes and e-mobility devices for health and environmental benefits.

Using an e-bike for commuting or recreation can introduce physical activity into an everyday routine and can contribute significantly to improved health. E-bikes can be especially empowering for those who would like to travel via sustainable modes of transportation, but who have conditions which limit their amount of physical activity. Riders can tailor the assistance level to meet their abilities. E-bikes can be used by people travelling for recreational purposes or daily trips to the grocery store, recreation centre or hardware store. For those that live further from their workplace or school than a comfortable bike ride, an e-bike can make commuting to work possible, even if there are no shower facilities at their destination.

Some riders choose e-bikes for the environmental benefits. While a portion of e-bike riders may come from a pool of existing cyclists, many people make the switch because they recognize that e-bikes are an opportunity to ditch the car, save money, save time, get exercise, and reduce their transportation emissions. In offering a new travel choice, e-bikes are displacing other transportation choices. Studies based in Europe estimate almost half of e-bike trips replace car journeys (**Figure 3**).[1]

Given the cost, health, and environmental benefits, e-bikes and other e-mobility devices can be a win for everyone.

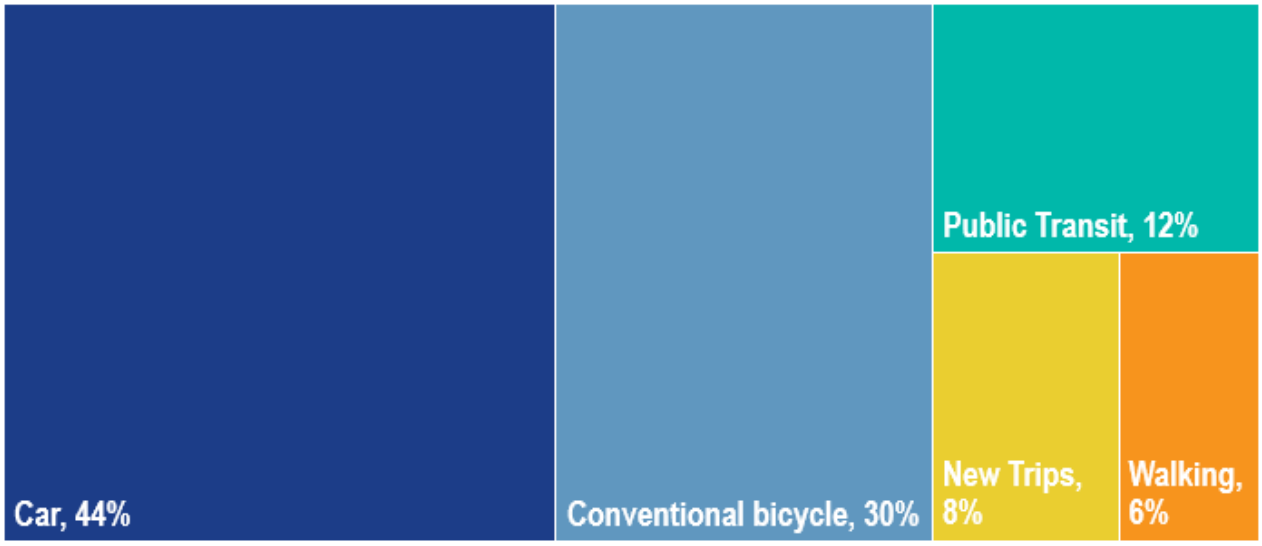


Figure 3: European mode substitution after e-bike adoption

[1] Bigazzi, A. and E. Berjisian, "*Electric bicycles: Can they reduce driving and emissions in Canada?"* Plan Canada, pp. 39-42, Fall 2019.

Developing the Strategy

This Strategy outlines a plan that will support electric mobility in the City of Victoria, identifying concrete initiatives that the City can take to support the adoption of electric mobility. The focus is on EV charging infrastructure as a principal pathway to encourage the adoption of passenger EVs as well as policy, advocacy, and educational actions. Dunsky's Electric Vehicle Adoption (EVA)™ model was used to assess EV charging infrastructure needs and costs to achieve Victoria's EV targets.

The Strategy was developed along with a Technical Report which includes the detailed methodology and analysis and provides additional context and support to the EV Strategy. It includes a detailed overview of the EV infrastructure best practices from leading jurisdictions, and the relevant technical and policy findings. The Technical Report also includes the approach, data, assumptions used in the EVA model and the resulting adoption scenarios and forecasts.

The Strategy was developed in collaboration with a broad array of stakeholders, with feedback collected on the key areas for action, barriers and opportunities, and pathways to achieving Victoria's EV targets. Details on the engagement process and a list of participating organizations are presented in Appendix A.

Building on Past City Efforts

The City of Victoria has supported mobility electrification as a tool to achieve its Climate Leadership Plan targets. Part of this effort is building a low-carbon fleet to power 80% of vehicles with renewable energy by 2040. The City has made progress by adding e-bikes, PHEVs, BEVs to its corporate fleet. Beyond its operations, the City has supported broader EV adoption by supporting EV charging infrastructure through investment and policy. This Strategy builds on past efforts and aims to support the adoption of electric mobility options.

Supporting a Regional Approach

Victoria is at the heart of the Capital Region. The City is an employment and entertainment hub, with roughly 39,000 commuters entering Victoria daily from across the region. Victoria's shift towards low-carbon mobility cannot be done in isolation. Victoria's EV infrastructure will serve vehicles both from residents and non-residents, just as the efforts of other municipalities will influence how well residents can move through the region. Therefore, the Strategy must align with the Capital Regional District's and other municipalities' EV planning and infrastructure efforts to ensure a cohesive and connected low-carbon transition.

"Sustainable, affordable transportation options will save people time and money, and make it easier and healthier to get to and from work."

From Victoria 3.0: Recovery, Reinvention, Resilience

Provincial Context

BC's Zero Emission Vehicle act mandates that 30% of new car sales will be electric by 2030 and 100% by 2040. The provincial target is on a similar, but slower trajectory as it is focused on new sales, in comparison to the City's target of all registered vehicles. To reach this target, the Province has a series of financial incentives and educational supports for EV purchases and charging

infrastructure. These supports have been considered within the Strategy. Higher provincial goals and accompanying supports in the future will benefit the efforts in this Strategy.

Equity Considerations

A key consideration in developing the Strategy was how to promote equity. This approach begins with a vision where everyone has access to clean, affordable, quality transportation. The Strategy aims to understand how EVs can support and be integrated into that vision. Access to electric mobility should not be limited by income or housing type, and, therefore, an equity lens is applied to the adoption interventions and was considered in each of the stakeholder workshops.

The shift to electric vehicles will also have workforce impacts in the community which should be considered to ensure a just transition. New skillsets are required for EVs because they require different and less maintenance. Training and job transitions will be required to support the workforce in the shift towards low-carbon transportation.

E-bikes and e-mobility devices can also increase equitable access to clean transportation options. These types of technologies can support residents and can make connections easier for commuters in areas with limited transit service. These modes may also encourage increased diversity among active transportation users by reducing the physical effort required to travel or by introducing adaptive devices to meet the unique needs of people with disabilities. E-bikes and e-mobility devices are also more affordable than electric personal vehicles.

Victoria's Electric Vehicle Landscape

With the highest percentage of EV sales in Canada, Victoria and the broader region are leading the province in renewable-powered vehicle adoption.

Electric Vehicles in Victoria

In Victoria, there were 1,222 new EVs on the road in 2020, representing 12.9%[2] of new vehicles and approximately 2% of all vehicles registered in the City. And the pace of adoption is accelerating. From 2018 to 2020, Victoria saw many more EVs on the road, as shown in **Figure 4**[3].

The early adopters of EVs in Victoria typically live in single-family dwellings, as shown in **Figure 5**. As discussed in the next section, as more Victorians explore the possibility of buying an EV to enjoy their reduced operating costs, environmental and other benefits, finding a place to plug in and charge up is going to become a growing challenge given that most residents live in multi-residential buildings.

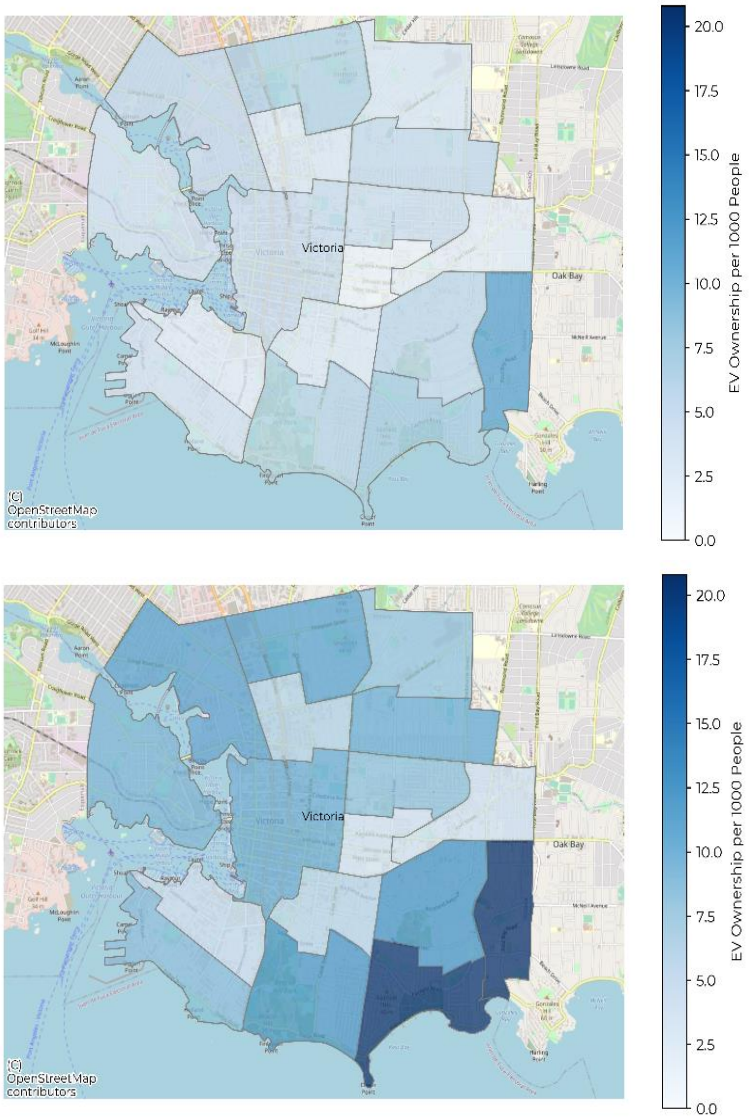


Figure 4 EV ownership per 1000 people by census tract in Victoria for 2018 (top) and 2020 (bottom). Source: Government of British Columbia Ministry of Environment and Climate Change Strategy, October 2020

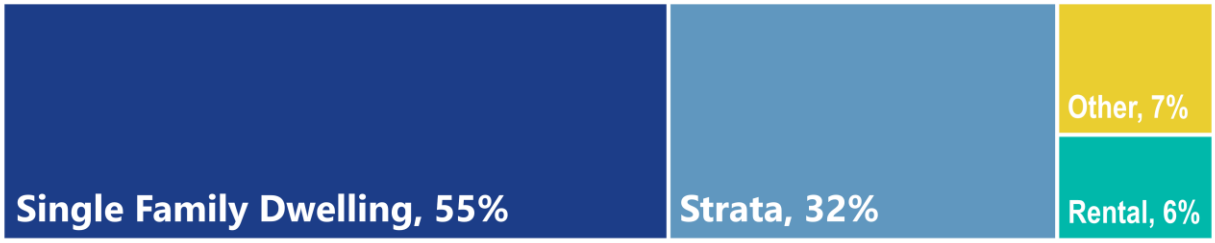


Figure 5 EV ownership by housing type (title) in Victoria. Source: Ministry of Environment and Climate Change Strategy, 2020 (City of Victoria, 2020)

[2] Statistics Canada (2021). *Zero-emission vehicles in British Columbia, 2020*. Available online: https://www150.statcan.gc.ca/n1/pub/11-627-m/11-627-m2021029-eng.htm

[3] BC Ministry of Energy, Mines, and Low Carbon Innovation. (2020). *EV vehicle registration data*. Personal communication, October 13, 2020.

Forecasting Future EVs

We used Dunsky's Electric Vehicle Adoption (EVA) model to explore different scenarios for EV adoption in the city and assess the impact of potential City-specific policies and actions.

Based on a business-as-usual scenario, with no additional investment in charging and other policies and incentives, Victoria would fall well short of its target of having EVs represent 30% of vehicles in circulation by 2030 as shown in **Figure 6**. In the following section, we explore why that is, and what barriers need to be overcome to speed things up and reach Victoria's targets.

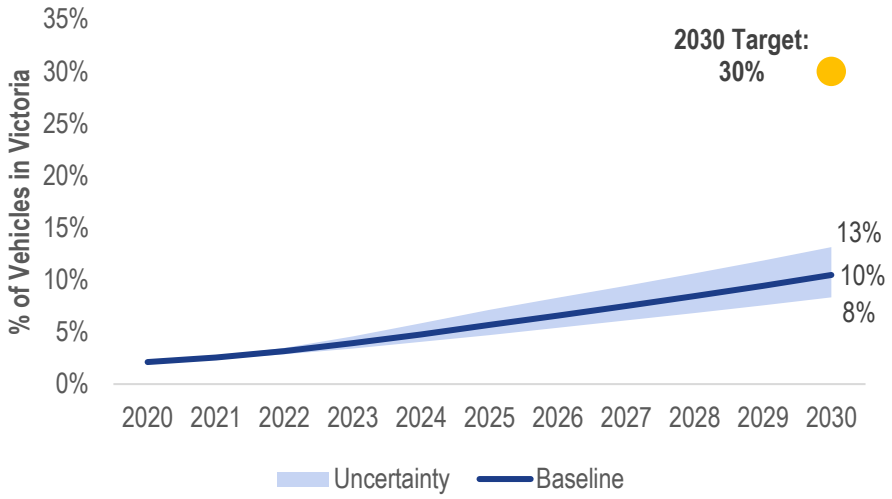


Figure 6 Victoria's business-as-usual EV adoption in comparison to the 2030 target

To develop this forecast, we populated the model with Victoria-specific housing and vehicle market data then calibrated it to historic EV uptake in Victoria. Once the model was calibrated, we developed forecasts that account for market constraints (including EV-specific barriers such as range limitations and access to charging infrastructure), forecasted market trends (such as EV model availability and prices) as well as market dynamics (incorporating technology diffusion theory and other market factors to determine rate of adoption and competition between vehicle types). The model includes assumptions regarding the growth of passenger vehicle ownership in the region and typical travel behaviour that depend on actions by the City and other local actors to support alternatives to personal vehicles.

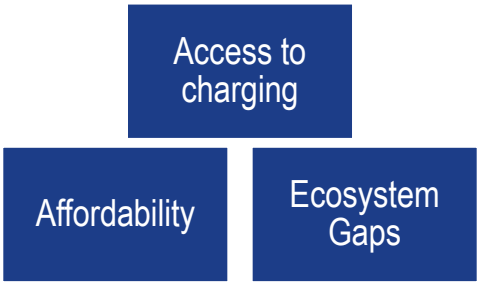
We developed ranges around our forecasts for all scenarios, including the baseline. These ranges reflect uncertainty around factors that are influenced by market conditions that are outside of the City's control, including vehicle prices, vehicle model availability, electricity rates, and gasoline prices.

Additional details on the EVA model and our approach can be found in the accompanying Technical Report.

Barriers

Victoria currently has more EVs on the road than anywhere else in the country. However, in the years ahead EV growth will be constrained by access to EV charging. Most Victorians live in multi-residential buildings and have limited options for charging at home. Public charging infrastructure can serve as a substitute for home charging access for many early adopters, however, for some potential EV drivers, the reduced convenience and potentially higher cost of charging at a public station compared to charging at home overnight may dissuade them from buying an EV.

The City's primary focus for this Strategy is improving access to charging while also addressing affordability and ecosystem gaps.



Access to Charging

Reliable and cost-effective access to EV charging, whether in homes, workplaces, or public locations is a critical component to enabling Victorians to choose, buy, and operate EVs. Unlike the traditional model of gas stations, EVs can 'fuel up' anywhere with the proper electrical access and charging infrastructure.

While public charging can serve the needs of many early owners, EV adoption for most drivers is best served by access to charging at home, which offers the highest level of convenience (**Figure 7**). In many jurisdictions, where EV owners live in single-family homes, this can be as simple as installing charging stations in driveways or garages. However, in Victoria, more than 80% of residents live in multi-residential buildings, where installing charging is much more complex and costly.

Based on housing types across Victoria, only 22% of residences have the potential to easily install home charging. **Figure 8** shows charging potential, overlayed with household income of each neighbourhood in Victoria. From an equity perspective, residents with lower income also have the most limited access to charging, pointing to the need for additional support.

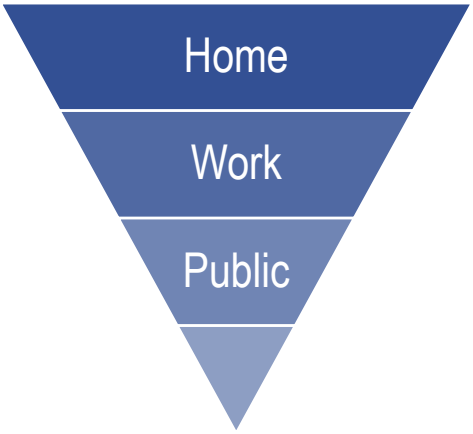


Figure 7 EV charging location preferences

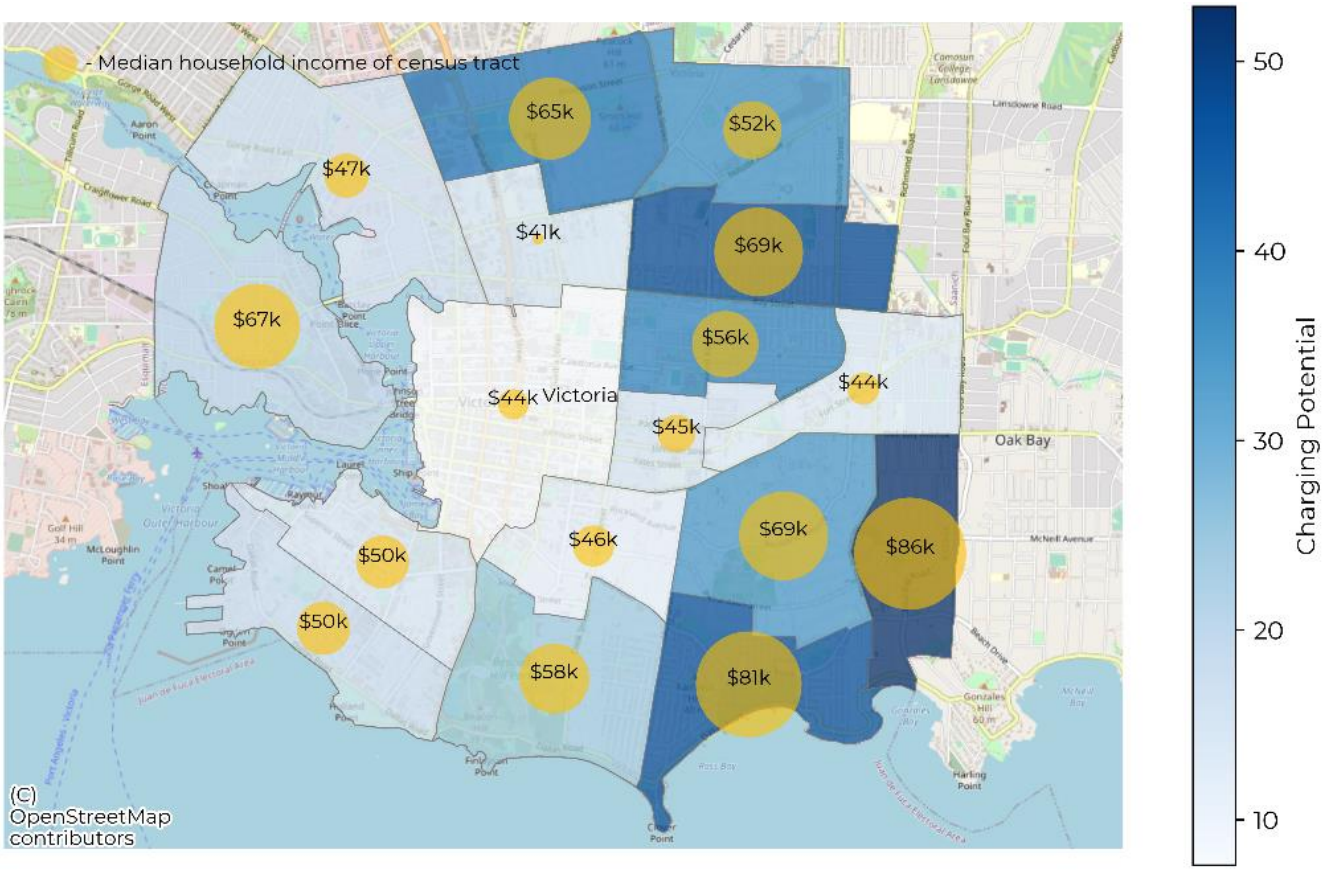


Figure 8 Home charging potential in Victoria, with median household income indicated by circle size. Source: Statistics Canada.

Charging at Home

To help future EV drivers plug in at home, on October 1, 2020, Victoria introduced a requirement that all parking stalls in new multi-residential buildings and certain commercial buildings are equipped to support charging infrastructure. As a result, reliable access to EV charging infrastructure will be provided for residents of the City's future multi-residential buildings.

However, the same will not be true for residents in existing multi-residential buildings, where access to charging is a much bigger challenge. It is estimated that fewer than 5% of stalls in existing apartment buildings provide residents with access to EV charging. Retrofits are costly and stratas often have long and complex approvals processes and restrictions on how capital can be allocated to building improvements.

Current funding programs for existing buildings are primarily focused on installing charging at a limited number of parking spots – typically in visitor parking. The B.C. Government provides an EV Charger Rebate

What we heard

Stakeholders indicated that at-home charging is the most preferable option. Incentives, from the City and other levels of government, will be important to drive retrofits and should be designed for the long-term.

program through Clean BC Go Electric which offers $2,000 for the installation of a Level 2 charging station designed for multiple users in existing multi-residential or commercial buildings with workplace parking. The City provides an additional $2,000 for residential buildings choosing to install this infrastructure.

Although adding EV charging to one or two parking stalls in the shared visitor parking of an existing building is an important first step, it has significant drawbacks:

Unreliable access to charging

- As more residents buy EVs, competition for limited charging spots will increase. Furthermore, parking in a shared stall typically means that you must move your vehicle after a certain number of hours. Most residents will want to be able to charge in their own parking stall before considering an EV.

Costly to homeowners

- The cost of retrofitting one or two parking stalls at a time, compared to the whole parking lot at once, is significantly more expensive on a per stall basis.

Complex approvals and lengthy timelines

- Getting approval from the building owner to add EV charging one parking stall at a time fast enough to support Victoria's 2030 targets is also a challenge.

Although the Province has introduced a rebate of up to $3,000 to prepare EV Ready plan and an implementation rebate of up to $600 per stall, current levels of funding and support are insufficient to provide access to charging in existing buildings to the same level as other building types. In addition, as many of the residents in these buildings are renters, additional support is required to ensure equitable access.

Charging at Work & On-the-Go

Even with retrofits to existing buildings, at home charging will not always be an option. Not all residents who own a vehicle have the space to park it at their home. Multi-residential buildings, both traditional multi-storey buildings and house conversions, may have limited onsite parking areas. In the future, more residences will be built without onsite parking, to encourage modal shift and more beautiful urban design.

For EV owners without access to charging at home, the next best option is to plug in at work, at public neighbourhood charging stations or fast charging hubs. In addition, on-street Level 2 and DCFC can support on-the-go charging, particularly for ride-hailing, taxis, and other high-mileage vehicles where limited infrastructure can slow EV adoption within these sectors. Access to these charging stations is also important for commuters into Victoria, who may want to charge up while at work or on-the-go.

However, Victoria only has 74 Level 2 public charging stations to meet the needs of the close to 38,000 households (and even greater number of parking stalls) estimated to not have home charging access, and two fast-charging station ports. The following map shows where they are, what type they are and the total number of stations in each area (**Figure 9**).

What we heard

Stakeholders emphasized the importance of user experience for on-street charging to ensure charging access is fair and convenient. Car-sharing was considered a high-value use.

In addition, on-street Level 2 and DCFC can support on-the-go charging, particularly for ride-hailing, taxis, and other high-mileage vehicles where limited infrastructure can slow EV adoption within these sectors. Access to these charging stations is also important for commuters into Victoria, who may want to charge up while at work or on-the-go.

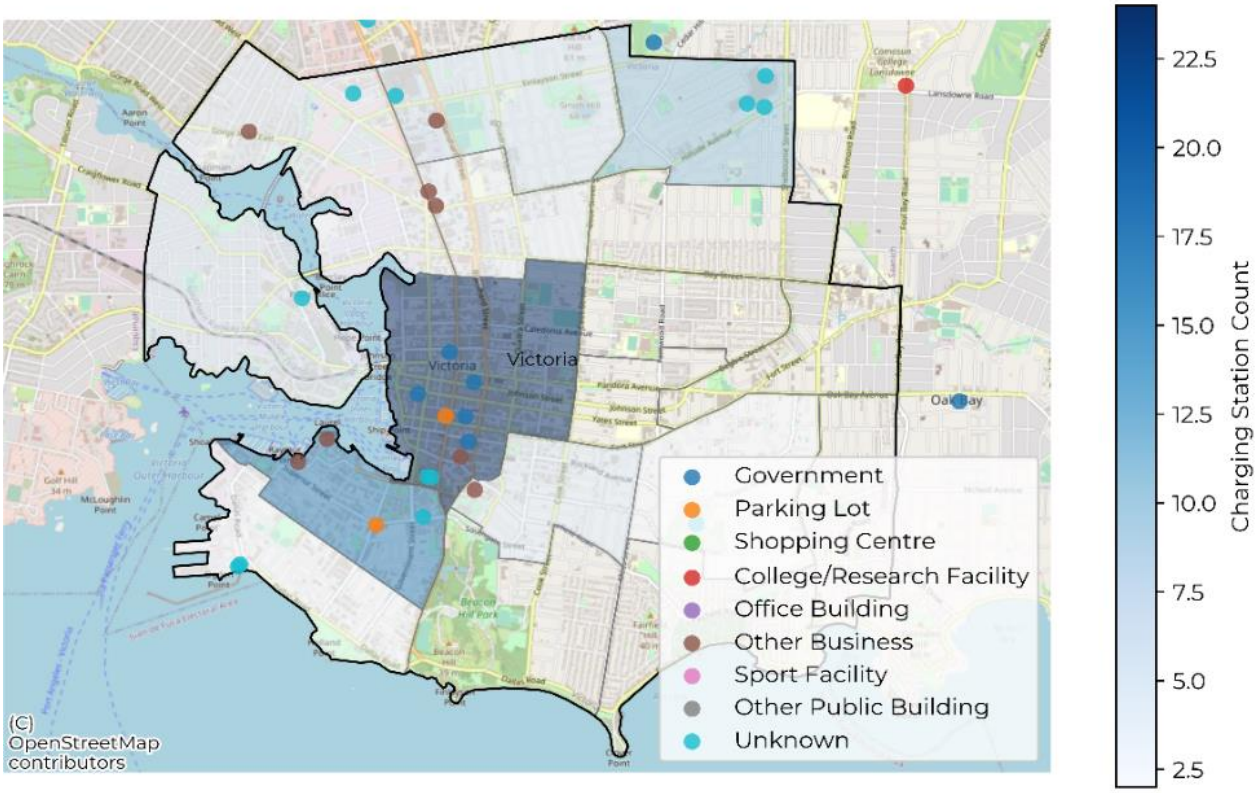


Figure 9 Public Level 2 charging stations by location type, with total number of charging stations shown with shading. In addition, a DCFC station has been installed at Store Street. Source: Natural Resources Canada, Statistics Canada.

Several of Victoria's charging stations are operated by the City, including 13 Level 2 chargers at five parkades (**Figure 10**), with most of the charging happening at the View Street and Broughton Street Parkades. The City recently opened its first on-street infrastructure with six new charging stations installed on Broad Street.

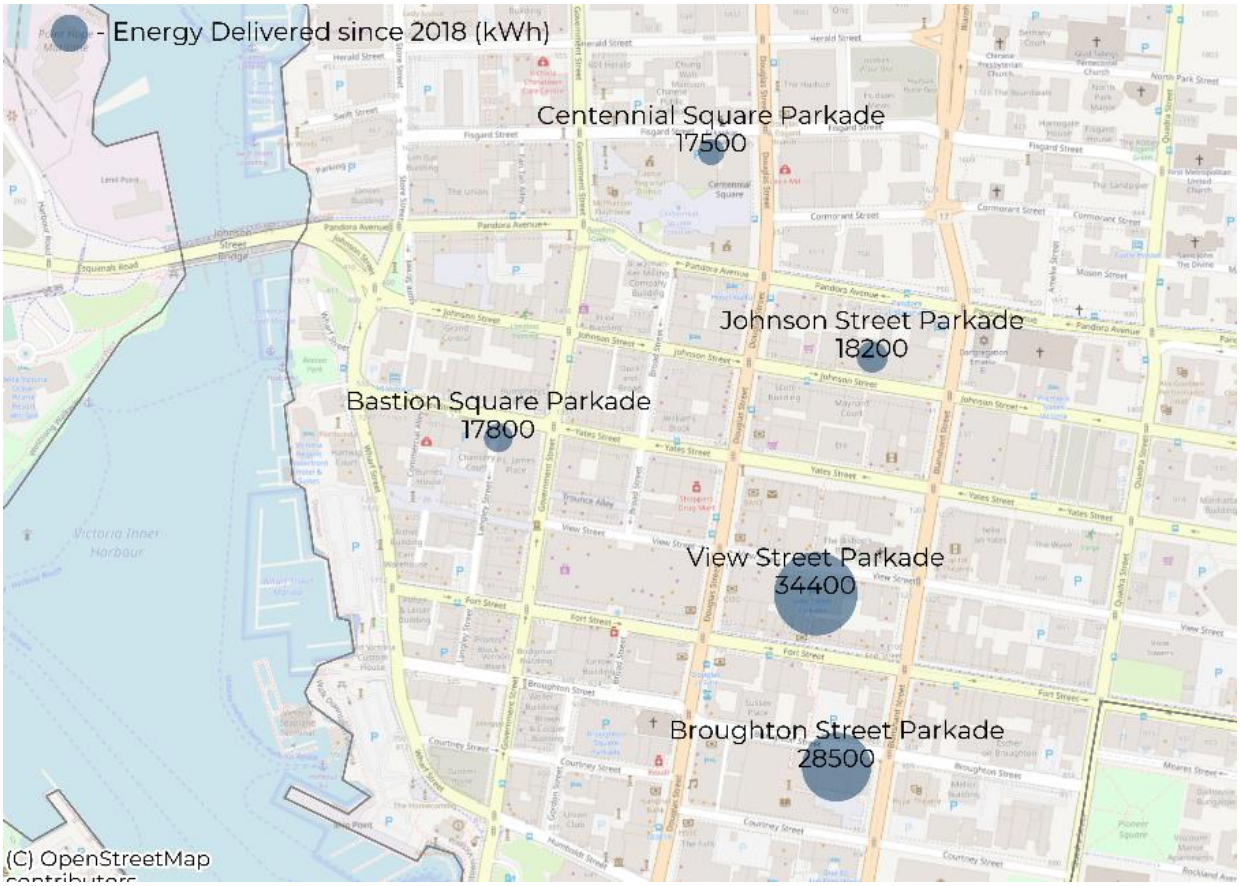


Figure 10 Map of City-operated EV Charging Stations with usage from 2018 to 2020 indicated in the size of the circle. Number of stations vary by parkade. In addition, a DCFC station has been installed at Store Street. Source: City of Victoria, Charger Stats, Victoria, 2020

Types of Chargers

Direct Current Fast Charging (DCFC)
charges a vehicle to 80% in 15 to 25 minutes and is typically used in public spaces and major roads.

Level 2
charges a vehicle in 4 to 8 hours, and typically use in homes, workplaces, and public spaces.

EV Charging Barriers Snapshot

Hunting for a New Car and a Charge

Sophia loves living in Fernwood and her cozy apartment in a converted heritage home. Her work in health care requires her to commute to homes across the region so she relies on her car, which she typically parks just down the block. Her car has seen better days and she's looking for a new vehicle with better fuel efficiency to keep her monthly costs down. Sophia came across a second-hand EV in her research and thought that it would be such a great fit for her commute and budget. However, she knows she wouldn't be able to access the property driveway to install or access a charge. She started looking for nearby chargers and found the closest ones were all the way downtown. Without a closer charger, she put aside EV ideas and set her sights on ICE options only.

Workplace Connection

Miguel lives in Rockland and commutes to his tech job downtown. His early-morning schedule means that he chooses to take his car, though he will sometimes bike on nice days. Being tech-minded, he loves new technology and has been watching the rise of EVs. He is certainly considering one for his next car. He is doubtful that his older apartment building is equipped to install charging in the parkade. He would be just as happy to charge his at work. However, he's not seen EVs or signs of chargers in the office parkade and is uncertain if charging at work is a possibility.

Ready for a Change, but not a Charge

Ray and Michelle live in a three-storey strata building in James Bay. They love how they can explore and do most of their errands on foot. For work, Ray walks to his office, while Michelle commutes by bicycle. Their crossover SUV often sits in the parkade, but they use it for their monthly visits to Ray's elderly parents in Courtenay, and for exploring the coastline. Ray and Michelle don't feel great about polluting every time they drive and discussed getting an EV for a while now. They've viewed some interesting options at the dealers and were keen on buying one until they investigated the charging options. No one in their strata has an EV, and while the strata is supportive, the logistics of electrifying a parking spot for charging are daunting. The couple has pressed pause on getting an EV until they can figure out how to charge at home.

Affordability

In addition to access to charging, cost is commonly identified as a barrier to EV ownership. Although EVs can cost more upfront than ICE vehicles, they typically have lower total cost of vehicle ownership due to reduced operations and maintenance costs. However, for many EV buyers, the upfront purchase cost is still a barrier even if the lifecycle costs are less.

The business case for owning an EV is more challenging in Victoria than in other jurisdictions. Although electric vehicles currently cost more upfront than internal combustion engine vehicles, electric vehicles often have lower total cost of vehicle ownership due to reduced operations and maintenance costs. Victorians drive relatively few kilometres per year, and therefore do not experience the same financial benefit of EV fuel cost savings and operations and maintenance as drivers who travel further.

Limited availability of second-hand EVs also stands in the way of getting more affordable EVs on the road. This pool of vehicles will be small until the new vehicle stock turns over for second-hand markets, limiting the number of affordable options to the market.

Long wait times and limited vehicle choice are also a barrier for some potential EV buyers. B.C.'s zero-emission vehicle act is expected to largely address this barrier; however, it will take some time before supply catches up with demand. For example, fewer than 1/3 of dealerships in BC had at least one EV available in inventory in Q1 2020[4]. If too few EVs are in stock at local dealerships, potential adopters have little choice in their purchase options and pricing and may opt for the readily available ICE vehicles.

Ecosystem Gaps

EV adoption can be inhibited by a lack of information as well as misinformation (e.g., knowledge of charging availability, knowledge of home charging options, range anxiety, lifecycle costs, model availability, vehicle stock at local dealers, and model features). Consumers may not have enough awareness, confidence, or understanding of EVs to be comfortable deciding to switch.

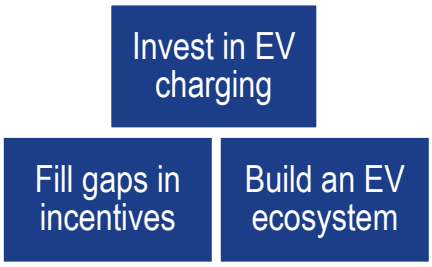
The provincial and federal governments are developing educational materials and programs, alongside financial incentives, to support EV adoption in line with their zero-emission vehicle goals. These efforts are important to build momentum for vehicle purchasing and charging, but local action is required to help residents navigate the process to access home or neighbourhood charging. Local organizations, such as EV clubs and regional non-profits, offer educational materials to promote zero-emission transportation. Similarly, EV manufacturers and technology companies are developing marketing materials to promote their products in the marketplace.

Despite current programs and tools in place, a much broader effort is required to reach more potential EV drivers and support the pace of adoption. A large gap remains in terms of local charging logistics and information. Residents, particularly for those without a private driveway or garage, can have difficulty understanding how and where to charge their EV.

[4] Dunsky (2020). *Plug-in Electric Vehicle Availability: Estimating PEV Sales Inventories in Canada: Q12020 Update*. Available online: https://www.dunsky.com/wp-content/uploads/2020/07/DunskyZEVAvailabilityReport_Availability_20200805.pdf

The Path Forward

Addressing EV adoption barriers requires a comprehensive solution tailored to Victoria. Our modelling shows that strategic investment in charging infrastructure is the key to supporting adoption, along with targeted financial incentives and building a supportive EV Ecosystem.



To fully address market barriers to adoption, all infrastructure interventions outlined below need to be deployed. No one investment area will reach the 2030 target in isolation and, in fact, the infrastructure investments alone are not expected to achieve the City's ambitious goal. To achieve the 2030 target, financial incentives in line with what is currently available will also be needed through to 2030. With these investments and incentives, EV adoption should reach 17% to 31%, depending on market conditions, as shown in **Figure 11**.

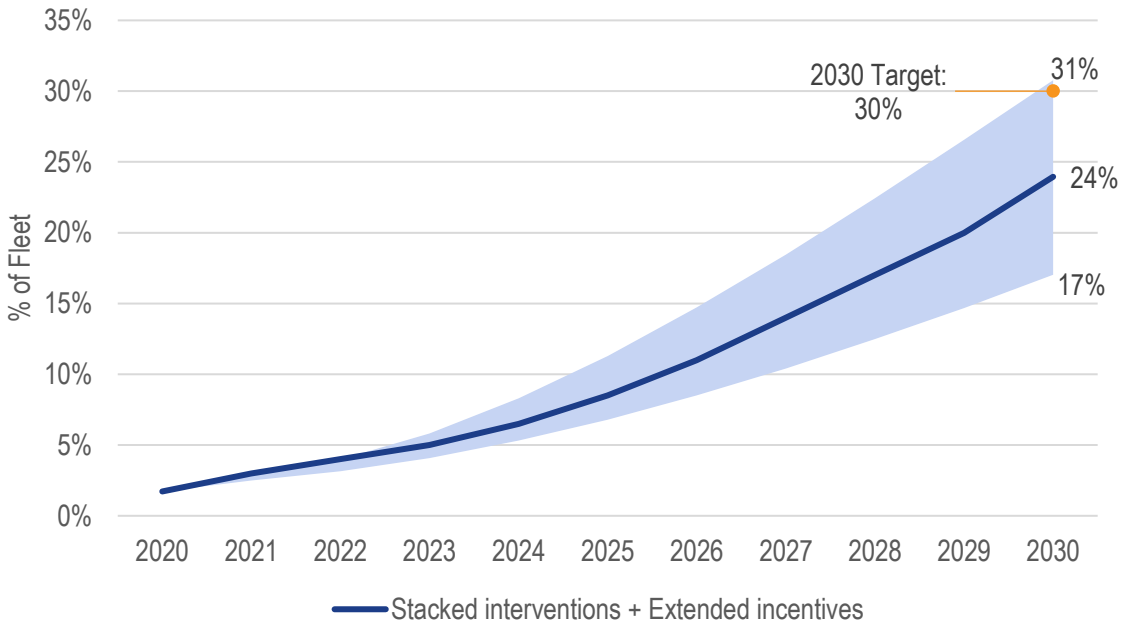


Figure 11 Electric vehicles as a percentage of total fleet following infrastructure investments and extended incentives

Invest in Charging Infrastructure

The City of Victoria can play a significant strategic role in supporting EV adoption by investing in charging infrastructure. The municipality's role in development, parking, and urban infrastructure design and investment positions the City in a prominent location to directly influence EV adoption behaviour.

We used Dunsky's Electric Vehicle Adoption model, local data, stakeholder feedback, and market trends to assess the impact of various City actions to reduce barriers and support EV adoption.

Future scenarios were iterated and optimized to produce a suite of recommended actions that are the most cost-effective combination to reach Victoria's 2030 goal.

To remove the infrastructure barriers that will prevent the City from reaching its renewable transportation target, a total investment of $60.6 M in charging infrastructure is forecast to be required between 2022 and 2030, with the City's recommended contribution totalling $15.7 M. An annual overview of City contributions by investment area are presented in **Figure 12**.

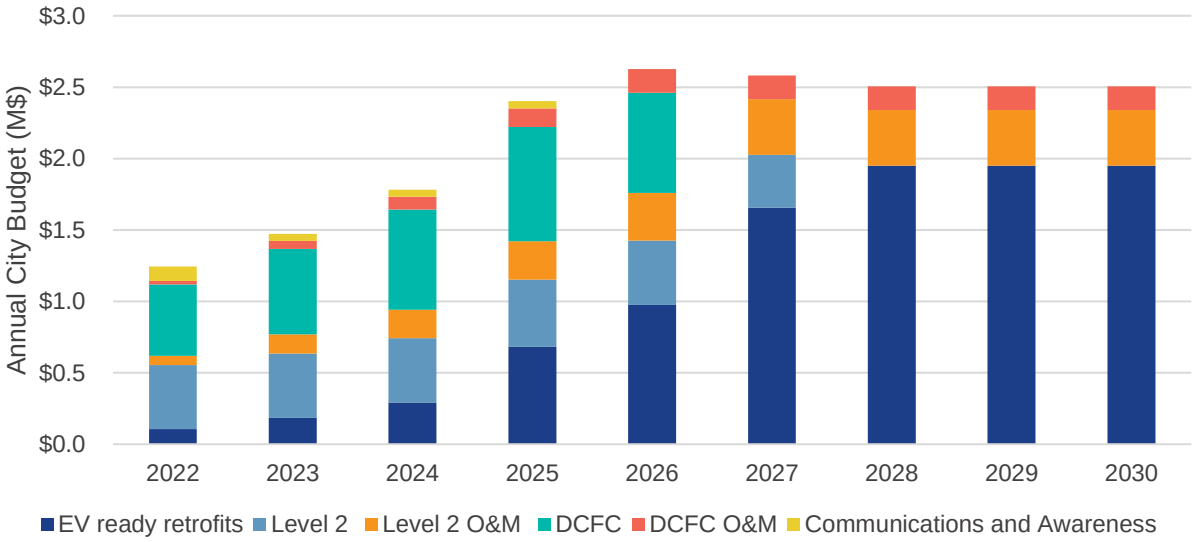


Figure 12 Annual City budget by investment area, 2022-2030

The figure also includes budgets for operations and maintenance (O&M) of chargers and communications and awareness. We assume communications and awareness costs to be $100,000 for the first year, and $50,000 for the next four years representing ongoing implementation and awareness costs. These costs do not include project management costs. We do not include communications and awareness costs for years 2026-2030 – this budget should be developed after analyzing actual spend over the initial program years. O&M for level 2 is assumed to be $600/port/year and $5,000/port/year for DCFC.

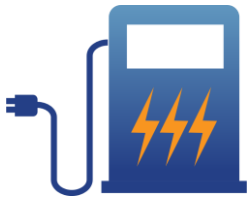
The corresponding number of charging ports and EV-Ready retrofits required in each year is outlined in **Table 1**.

Table 1 Summary of the number of ports and retrofits completed annually.

	2022	2023	2024	2025	2026	2027	2028	2029	2030
DCFC ports	5	6	7	8	7	0	0	0	0
Level 2 ports	110	111	111	116	111	91	0	0	0
EV-Ready Retrofit stalls	445	772	1,219	2,844	4,062	6,906	8,125	8,125	8,125

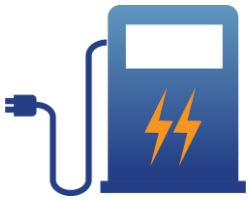
2022-2025 Budget – Focus on Public Charging

Although charging at home is the preferred option for most drivers, ramping up EV ready retrofits in existing multi-residential buildings where most Victorians live will take time. New programs and funding initiatives will need to be developed and industry capacity and expertise increased. In the interim, the City can support EV drivers by expanding access to public charging. Therefore, initial deployments and City spending focus on public charging, with most Level 2 and DCFC charger installations planned for the first half of the decade. A summary of the installations and retrofits in this period is outlined in **Figure 13.**



DC Fast Charging

$2.6 M in 26 ports



Level 2

$1.82 M in 448 ports

EV Ready Retrofits

$1.27 M in 5,280 stalls

Figure 13: Summary of City investment 2022-2025

DCFC infrastructure is a key focus for the first five years of the investment plan. DCFC public charging infrastructure provides rapid, on-the-go charging residents without at-home charging. These rapid charging stalls can serve a large number of vehicles and a broad range of public needs. They can centre around local amenities that align with residents' regular travel behaviour and connection with community amenities. By creating a hub where people naturally gather, DCFC infrastructure can enhance EV adoption. For long-distance travel by Victorians, commuters and tourists, DCFC can provide fast charging in high-traffic locations, such as major roads or village centres.

DCFC installations are spread across five years. A staged approach to installations helps to ensure charger roll-out keeps pace with EV adoption by ramping up over time as EV fleets grow. This also avoids overbuilding and, as a result, low levels of charger utilization.

What we heard

There was support for public charging locations to align with community hubs (e.g., schools, grocery stores, parks) that would be a natural fit with typical in-City travel behaviour or accessing underutilized spaces. These spaces were seen to be used as 'mobility hubs', not simply EV stations.

The need for the City to invest in public charging infrastructure is more certain in the first four years given ongoing barriers to private sector investment. Because some portion of the charging infrastructure would be installed in advance of market needs in order to encourage adoption of EVs, there is potential for lower utilization in early years. This results in an unattractive business case for private market actors, and a low likelihood that chargers will be installed without government support.

The annual City budget for charging infrastructure for 2022 to 2025 is provided in **Table 2**.

Table 2: City Annual Budget 2022 - 2025

	2022	2023	2024	2025
EV Ready Retrofits	$107,000	$185,000	$293,000	$683,000
Level 2	$446,000	$450,000	$450,000	$471,000
DCFC	$500,000	$600,000	$700,000	$800,000
Communications and Awareness	$100,000	$50,000	$50,000	$50,000
Level 2 O&M	$66,000	$133,000	$199,000	$269,000
DCFC O&M	$25,000	$55,000	$90,000	$130,000
Total	$1,244,000	$1,473,000	$1,782,000	$2,403,000

Values are rounded to nearest $1,000

Plugging-in at Work to Unplug on the Weekend

Miguel is leaving the office for a weekend away in Sooke Potholes Provincial Park. He was able to plug into a Level 2 charger in the office parkade. He now has a full charge and can take off to for some hiking and camping without having to worry about charging again until he's back to the office on Monday.

Happy to find a Hub

Sophia was walking home with her groceries and was passing by Victoria High School. Near Fernwood Square, she spotted two EVs plugged into a DCFC station with four spots. The sign highlighted how quickly the station could charge an EV. She realized she could charge up for a few days while she was waiting for her takeout order, or for the full week while in her yoga class. With a reliable fast-charging station so close to her apartment, she decided she would put that second-hand EV back on the test drive list.

2026-2030 Budget – Ramp up EV Ready Retrofits

By 2026, there will be growing demand from drivers to plug in at home and the industry will have had time to ramp up and build capacity. Therefore, EV-ready retrofits are the primary focus of investment for this period (Figure 14).

Figure 14: Summary of City Investment 2026 - 2030

In this study, we assumed that 90% of parking stalls in existing buildings would require retrofits before chargers could be installed – an estimated 40,600 stalls in total by 2030. If we assume, for illustrative purposes, that the average multi-residential building has five storeys and six units per storey, 40,600 stalls equates to approximately 2,000 multi-residential buildings over 10 years.

The most cost-effective way to accomplish these updates, according to recent analysis by AES Engineering, is to perform a comprehensive retrofit where energized circuits are provided to every parking stall during a single renovation. Once this one renovation is complete, Level 2 EV charging stations can be easily installed by building or unit owners at any stall when required at a future date.

EVA modelling suggests that this approach is scalable to enable EV adoption among most multi-unit building residents with access to parking. Investment by the City in EV Ready retrofits is required to fill gaps in provincial and federal funding and ensure equitable access to charging across different housing types and different types of residents (renters, low-income etc.).

Based on anticipated funding programs from other levels of government and expected demand from building owners, we estimate that a City-funded top-up of up to 20% of retrofit costs would be sufficient to generate strong retrofit uptake depending on the shortfall in provincial or federal support. The investment recommended represents the costs associated with retrofitting all stalls that do not have the appropriate electrical infrastructure across Victoria's multi-residential buildings.

This investment would enable home charging access for 91% of Victorians, compared to today's 22%.

The EV market is evolving rapidly, so the total required City investment is less certain in the latter half of the decade (Table 3). Program and market progress should be assessed on an ongoing basis to ensure City spending, including for communications and awareness, covers unmet needs in the market.

Table 3: City Annual Budget 2026 - 2030

	2026	2027	2028	2029	2030
EV Ready Retrofits	$975,000	$1,657,000	$1,950,000	$1,950,000	$1,950,000
Level 2	$450,000	$369,000	$0	$0	$0
DCFC	$700,000	$0	$0	$0	$0
Communications and Awareness	TBD	TBD	TBD	TBD	TBD
Level 2 O&M	$335,000	$390,000	$390,000	$390,000	$390,000
DCFC O&M	$165,000	$165,000	$165,000	$165,000	$165,000
Total	$2,625,000	$2,581,000	$2,505,000	$2,505,000	$2,505,000

Values are rounded to nearest $1,000

Energizing the Board

Ray and Michelle left the strata meeting jubilant because the residents voted to move ahead on the EV Readiness retrofits. Some residents were hesitant due to the price tag, but the costs made sense with the incentives and City top-ups, as well as the property value considerations. Plus, it is far more cost effective to energize all the stalls at once, rather than for the complete, Ray and Michelle will be able to install the charger at their stall and plug-in at home.

Provide Financial and Policy Support

The City can support the deployment of charging infrastructure through investment and policy tools to ensure effective and equitable charging access.

For charging at work and on-the-go, the City should:

Provide financial support by:

- DCFC Hubs, mostly centred on current City amenities: 33 ports
- On-Street Level 2 (powered from streetlight infrastructure and stand-alone): 125 ports
- Comprehensive retrofits for Level 2 infrastructure in City-owned parkades and parking lots: 125 ports
- Exploring partnerships to locate City-owned and -operated infrastructure on private property, as well as private infrastructure located on City property.
- Investing in EV infrastructure deployment in existing workplace and fleet parking areas (e.g., City-owned parkades).

City-owned Level 2 infrastructure should be distributed throughout the city, taking into account equitable access as well as the following placement criteria:

- Proximity of available electrical power
- Close to retail
- Close to multi-family buildings
- Close to parks
- Visibility and prominence
- Ease of access
- 24/7/365 availability
- Safety and security

Provide policy support by:

- Instituting requirements for a portion of non-residential parking to be EV Ready (20-50% for workplace parking, 10-20% for visitor parking).
- Allocating dedicated stalls in City-owned parkades for car-share vehicles to support shared electric vehicle choices.

Every day, almost 38,000 people commute to Victoria for work, and 24,000 Victoria residents commute within the City. Workplace charging is a valuable resource because it acts as a reliable alternative to home and public charging. Residents who regularly commute using a personal vehicle could opt to charge during their working hours, rather than at home. In commuter-focused analysis, Victoria is estimated to need 400 of the recommended 650 Level 2 ports installed in City-owned parkades to meet the needs of those commuting from Saanich, Langford, Esquimalt, Oak Bay, Colwood, Central Saanich, and View Royal.

Recommended initiatives:

- ☑ Invest in public Level 2 on-street and in parking facilities: $2.64 M for 650 ports
- ☑ Invest in public DCFC hubs: $3.3 M for 33 ports
- ☑ Expand *EV Readiness in New Construction* by-law to cover additional commercial buildings.

For charging at home, the City should:

Provide financial support by:

- Offering top-up incentives, as well as education on additional financial and technical supports available from other levels of government, for comprehensive retrofits to existing multi-residential buildings. Early adopters of the retrofit program are likely to be strata buildings. As the second-hand EV market matures, the City should focus its efforts on rental properties to support EV adoption for lower-income earners.
- Continuing the existing top-up incentives to the Clean BC Go Electric funding for one-at-a-time installations in multi-residential buildings while the comprehensive retrofit program ramps up.
- Provide policy support by:
- Adopting stronger EV Readiness requirements for workplace and visitor parking in new developments, to complement the City's existing 100% EV Ready residential parking requirements.
- Developing pathways to allow public on-street Level 2 charging that is deployed and managed by private residences. These efforts could include lease agreements, access safety guidelines (e.g., City of Vancouver's curbside EV charging guidelines) or revisions to other applicable by-laws.

Recommended initiatives:

- ☑ Invest in residential EV Ready retrofits: $9.75 M for 46,000 stalls
- ☑ Develop Comprehensive EV Ready Retrofit pilot to provide top-up incentives.
- ☑ Continue existing top-up incentives for one-at-a-time retrofits in multi-residential buildings while the comprehensive program ramps up.
- ☑ Revise parking regulations to allow public on-street Level 2 charging deployed and managed by private residences where appropriate.

Fill Gaps in EV Incentives

In addition to investing in charging infrastructure to meet its Climate Leadership Plan target, the City may choose to provide financial incentives to EV drivers if levels of EV adoption are not accelerating fast enough or if current provincial and federal incentives start to drop off. Provincial and federal financial supports play a key role in supporting EV purchases, and work in combination with City efforts to support EV charging to residents. However, if these incentives diminish in the future, our analysis identified that it would be difficult to meet the City's ambitious adoption target.

Modelling shows that the current level of incentives will need to be maintained for the 2030 target to be met. Incentives could be offered by the City through several different approaches such as in parking regulations or zero-emission zones.

Recommended initiative:

☑ If current provincial and federal incentives are reduced or removed, explore options for City-led incentives, such as zero emissions zones and parking regulations, to maintain the overall cost-benefit of EV ownership.

Build a Supportive EV Ecosystem

The City has an important role in influencing external players and aligning its work to develop a supportive environment for EV adoption.

Develop a Municipal EV Charging Program

It is recommended that the City establish EV charging as a municipal program to roll out the activities outlined in this Strategy. This program would require appropriate City Staff allocation and funding and would deploy City-owned and operated infrastructure for the public and for its own employees and fleets.

Annual or bi-annual usage reports for City chargers should be prepared and reviewed, with the results used to validate or update installation plans.

Recommended initiatives:

- ☑ Develop EV Charging as a municipal program to support and facilitate adoption.
- ☑ Monitor City charging station usage and adjust implementation plans based on usage or geographic trends.

What we heard

There was strong support for City-owned infrastructure, to ensure equitable access, leverage existing assets, and enhance EV visibility. Stakeholders recognized that significant investment and scale are required to ensure equity.

Enable Private Investment

The private sector is a valuable partner for accelerating EV infrastructure installation, whether through direct investment in EV infrastructure deployment, leading the operation and maintenance of EV charging, or by providing valuable host sites for deployment by other actors.

While business models to support private investment in EV infrastructure are still emerging, the City can help to facilitate this investment through partnerships and maximize overall deployment. The City should explore innovative pilot and partnership opportunities to deploy infrastructure on both private and City-owned property. These partnerships can reduce the cost and risk of infrastructure deployment to the City for sites with strong business cases, leaving the City to focus on the gaps where the private sector is unlikely to deploy.

To facilitate private sector investment on City property, the City should identify appropriate locations to install on-street charging infrastructure through a detailed analysis, considering competing demands for parking, future plans for bike infrastructure and other improvements, future plans for utilities and civil works, accessibility, equity considerations, and other factors. Similarly, the City should identify key locations for public EV charging that exist on private land and explore partnership opportunities.

The City should also determine contractual structure for these partnerships. For private operators on City-owned sites, the agreement should define long-term (5-10 year) control and considerations for excellent customer experience (e.g., speed and quality of repairs, minimum number of stalls).

Recommended initiative:

- ☑ Identify appropriate locations for private sector investment in on-street charging and develop contractual framework.

Build Capacity and Expand Education Initiatives

Many consumers and businesses are unaware, misinformed, or uncomfortable with EVs, charging infrastructure, and incentive programs. On the other hand, there are also many residents who are interested in actively promoting an EV transition. An organized network of residents, supported and engaged by the City, would help provide an avenue for engagement.

What we heard

EV infrastructure deployment should go beyond installation. The City's EV service should be oriented to customer education and experience.

We recommend that the City play a role in electric mobility transportation by acting as a centralized information hub to support residents and businesses preparing for or deploying EV infrastructure. The City could leverage the strong existing network of engaged residents and association resources. The City could also utilize Go Electric BC and Plugin BC as a guide for residents and businesses, while assessing and filling any local information gaps.

We recommend the creation of an EV industry stakeholder network that would support the implementation of this Strategy and ensure alignment within the local market. Working with local dealerships and EV charging infrastructure companies can ensure the availability of models, materials, and expertise needed to support adoption.

Recommended initiatives:

- ☑ Develop educational materials for comprehensive multi-unit building retrofits and engage with multi-residential building residents, owners and managers to facilitate retrofits.
- ☑ Develop educational materials for commercial buildings and workplaces to support retrofits.
- ☑ Work with local dealerships and EV charging infrastructure companies to ensure the availability of models, materials, and expertise needed to support adoption.

Advocate for Supportive Policies

While the federal and provincial governments have strong EV programs and targets in place, the City has committed to pursuing higher levels of EV adoption in support of meeting its climate commitments. This position was further consolidated with the approval of Climate Emergency Actions in 2019. Advocacy to other orders of government is a key action in the Climate Leadership

Plan and of particular value in support of the EV strategy. The City should actively seek to influence policies outside the scope of municipal authority to drive or support EV adoption.

Requirements and incentives provided by the Provincial and Federal governments can play a large role in advancing the EV market in the City. It is recommended that the City advocate for Provincial and Federal policies to encourage the transition to EVs, including:

- rebates for new and used vehicles
- incentives for comprehensive EV Ready retrofits
- non-financial incentives for EV drivers (e.g. HOV lane access on provincial highways)
- regional mobility pricing that favours EVs
- provincial Right-to-Charge legislation to provide appropriate timelines considering individual or comprehensive retrofits
- Strengthening the provincial zero-emission vehicle act and/or introducing a national mandate

At the regional level, the City should advocate for EV supportive policies, as well as play a role in supporting the coordination and alignment of regional efforts to invest in infrastructure.

Similarly, we recommend that the City advocate and work with the province's electricity and natural gas utilities to encourage adoption. The City should encourage beneficial policies (e.g., demand charge reform) and continued or enhanced incentives. The City should encourage the development of electrical resource education and availability of local electrical resource information. This information sharing could be particularly useful for City or private implementation of on-street (streetlight) charging infrastructure.

Recommended initiative:

☑ Advocate utilities, regional, provincial, and federal governments to maintain and expand supportive incentives and policies.

Victoria's Electric Mobility Landscape

Making active transportation options safer, more comfortable and convenient is a part of established objectives under both Go Victoria, the City's Mobility Strategy, and the Climate Leadership Plan. Go Victoria also identifies the importance of leveraging new technologies to support personal and commercial transportation needs. Supporting widespread adoption of electric mobility, including e-bikes and other e-mobility devices, will be required to achieve future mode share targets and support reductions in GHG emissions.

E-Bikes and E-Mobility in Victoria

E-bikes have become a ubiquitous form of transport in Victoria over the past five years. The surge in e-bike use and ownership can be related to several factors including increased market penetration, introduction of a wider variety of bike styles (such as conventional, cargo, long-tail bikes), as well as an expanding network of safe and comfortable cycling infrastructure. E-bikes are quickly being adopted by people travelling with young families, women, and older adults.

Other e-mobility devices, such e-kick scooters, electric wheelchairs, e-skateboards, and e-mobility scooters, are also increasing in popularity and use and present a significant opportunity to transform urban mobility in Victoria in the coming years, especially with an aging population.

Some of these technologies require modernization of legislation and other regulatory frameworks to clarify standards, rules, roles, and responsibilities. New infrastructure, along with education, evaluation and enforcement support programs will play an important role in attracting new users to e-mobility and ensuring that devices are being operated safely in the community.

Globally, e-bike sales are forecast to grow at a rate of 5-10% per year to 2026. In some markets however growth is higher. In 2019, e-bike sales in Europe grew by 23%[5]. In 2020, e-bike sales in the United States grew by 190%[6].

[5] Forbes (2020). *E-Bike Sales To Grow From 3.7 Million To 17 Million Per Year By 2030, Forecast Industry Experts.* Available online: https://www.forbes.com/sites/carltonreid/2020/12/02/e-bike-sales-to-grow-from-37-million-to-17-million-per-year-by-2030-forecast-industry-experts/?sh=607e7d92876b

[6] NPD Group (2020). *U.S. Performance Bike Sales Rise in June*. Available online: https://www.npd.com/news/press-releases/2020/plot-twist-u-s-performance-bike-sales-rise-in-june-reports-the-npd-group/

There is limited localized data available to describe growth trends in Victoria and the region. The 2017 CRD Origin and Destination Survey included bike ownership rates, however, e-bikes or other shared e-mobility devices were not specifically broken out into surveys. The CRD has confirmed that 2022 regional data collection efforts will include these new mobility options.

In 2018, a sample of local bike shops was contacted to better understand regional demand for e-bikes (**Table 4**). The majority reported sales higher than the global forecast, and some indicated sales could increase further with a decrease in the cost of e-bikes. In 2021, e-bike sales as a percentage of total bike sales rose, with two stores reporting e-bikes representing 40% of their total sales. The average local shopper is paying $4,000 for their e-bike.[7]

Table 4 Summary of E-bike Sales at Select Bicycle Shops in the Capital Region (Capital Region Local Government Electric Vehicle (EV) and Electric Bike (E-bike) Infrastructure Backgrounder - 2018)

BICYCLE SHOP	MOST POPULAR MODELS	PRICE RANGE	E-BIKE SALES AS A % OF TOTAL BIKE SALES
Fairfield Bicycle Shop	Electra Townie Go!, Surface 604	$2,000 - $6,000	33%
Fort Street Cycle	Cannondale Quick	$3,600 - $8,000	1 – 2%
Goldstream Bicycles	Devinci e-griffin, OPUS WKND, Del Sol LXI	$3,000 - $3,600	Unsure
North Park Bikes	Opus Connect, Electra Townie Go!	$2,500 - $5,000	5%
Oak Bay Bicycles	"Cube Touring Hybrid One 500, Trek Verve Plus	$2,800 - $6,600	20%

New forms of mobility will require adaptation of local and provincial regulations to ensure that devices have a designated place on the roadway and can operate with standardized safety features. End-of-trip amenities and secure parking options can also encourage e-mobility users.

Anecdotal evidence indicates there is no typical purchaser for an e-bike or e-mobility device. Initial sales were predominately to an older demographic for leisure purposes, but today an e-bike purchaser in the region could be a commuter, a family looking for a cargo bike to replace a second car or a senior.[8]

While strong growth in e-bikes is evident, quantifiable information on the numbers of riders, their demographics, data on the type of trip, length of trip and greenhouse gas emissions avoided are lacking. Similarly, little information is available that quantifies the cost and other barriers identified to

[7] The five bike stores listed in Table 4 were re-interviewed and updated figures collected.

[8] *Personal communications* from local bicycle retailers.

define the pool of potential riders and forecast future growth in Victoria. Collecting this data in the region can inform the e-mobility supports and assess the scale of the emission and mode share impacts.

Barriers

While the City of Victoria is experiencing healthy growth in the use of e-bikes and other e-mobility devices, there are constraints and barriers to their adoption and use. In 2018, a CRD survey asked residents of the region to identify their barriers to owning an e-bike (**Figure 15**)[9]. Challenges to owning and operating an e-bike include cost, secure and accessible storage, weight, and public charging.

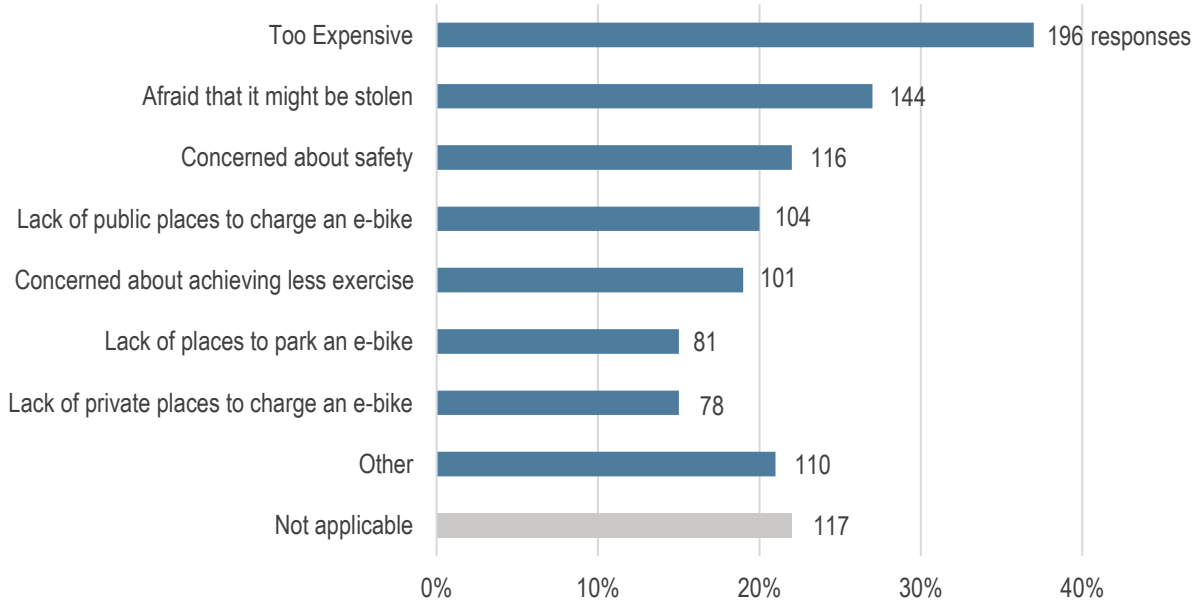


Figure 15 Summary of Barriers to E-Bike Ownership (Source: *Capital Region Local Government Electric Vehicle (EV) and Electric Bike (E-Bike) Infrastructure Backgrounder* - 2018)

[9] The survey covered only e-bikes and, therefore, the adoption barriers for other forms of e-mobility are not covered.

Cost

E-bikes come at a significant cost premium over conventional bikes. To support the affordability of e-bikes, the Scrap-It Program offers rebates of $750 towards the purchase of an e-bike (funded through CleanBC) when a BC resident scraps a vehicle.[10] Rebates of $1,700 are also available for e-cargo bikes through the Specialty Use Vehicle Incentives Program (SUVI) for businesses. The District of Saanich recently launched their E-bike Incentive Pilot Program, providing a range of purchase rebates from $350 up to $1,600, the latter for income-qualified individuals. The District of Saanich incentive is proving to be extremely popular, indicating that cost is a significant barrier for some residents of the region that wish to enjoy the advantages of e-bikes.

Security and Storage

E-Bike owners may have hesitancy to use on-street parking due to risk of theft or risk of damage. When it comes to storage, weight and size are additional factors that limit options. Some e-bikes or other e-mobility devices do not fit in traditional bike rack designs. Carrying an e-bike up stairs or across a lobby for storage in an apartment building is challenging, so e-bike users are more likely to require secure bike lockups, and particularly value a lockup with a power receptacle nearby in order to facilitate charging. Similarly, some users with disabilities may have no other options available and require at-grade parking. The District of North Vancouver and the City of New Westminster both require electrical receptacles to be provided in new buildings with bike lockups. Destinations that do not offer secure parking suitable for an e-bike can lead to alternative means of travel being chosen.

Safety

Potential riders may have concerns about the safe operation of an e-bike given the increased speed and controls needed to operate the bike. Some users are concerned about where and how to safely ride an e-bike or use an e-mobility device, highlighting the need for safe and connected infrastructure.

[10] Depends on vehicle age and fuel efficiency.

Charging

Unlike EVs and mobility scooters, e-bike batteries are removable for both security and ease of charging. Their chargers are separate units, which are typically rated only for use indoors and conventional 15-amp receptacles. Currently, there is no standardized charger for e-bikes. Battery voltages vary, as do connectors and charging rates. Support for public charging of e-bikes is typically achieved through the provision of a 15-amp receptacle, ideally in an environment suitable for the charger with appropriate theft prevention measures in place. While these constraints make provision of public e-bike charging challenging, the level of flexibility through use of a portable battery and charger, especially when combined with the travel range available from e-bike batteries – most will last longer than a typical rider would want to spend on a trip – means finding a convenient place to charge an e-bike battery isn't a constraint for a typical trip.

Weight

Due to the addition of batteries, motors and controllers, e-bikes are heavier than conventional bikes. This can make their handling more difficult, particularly for inexperienced or lighter riders. Heavy batteries are often detached from the bike to facilitate charging or for security. Carrying heavy batteries or charging equipment to enable charging can also be a barrier to some potential users of e-bikes.

The Path Forward

The widespread adoption of e-bikes and other e-mobility devices, particularly when displacing fossil fuel vehicle trips or sales, will support reaching community greenhouse gas reduction targets and urban mobility goals. The actions proposed below seek to support existing and potential e-mobility users while gathering information to better refine and scale future actions. The total budget for these Actions is **$2.1M** from 2022 to 2026, with $500K for enhanced public parking solutions already allocated.

Support E-Mobility Adoption with Financial and Legal Supports

The City can leverage lessons learned from other pilot projects to design local incentives to encourage ridership and uptake. For example, the City could launch its own incentive program based on the outcomes of the District of Saanich's pilot or contribute to a regional incentive program in the CRD. The efforts in City of Vancouver and City of Montreal to establish e-cargo delivery hubs can also inform pilot projects to support goods and service delivery. Recent advocacy efforts have also emphasized opportunities to further support people with disabilities with adaptive e-bikes.

Recommended initiatives:

- ☑ Work with partners in the region to develop and launch a regional equity-based E-Bike Incentive Program in 2023/2024: $750,000
- ☑ Work with the private sector to pilot an e-cargo delivery hub by 2024: $350,000
- ☑ Introduce new bylaws and/or permit programs to regulate businesses renting shared e-mobility devices, such as e-bikes and e-scooters by 2023: $10,000
- ☑ Explore new ways to support people with disabilities by allowing electric wheelchairs and e-mobility scooters to operate in designated bike lanes and/or routes

Build Infrastructure and Capacity

Safe and connected infrastructure with clear guidance is important to ensure users feel safe using e-bike and e-mobility modes. Along with the building infrastructure, local knowledge and capacity building is needed on using, supporting, and interacting with these modes.

The City can work with regulator and Regional partners to regulate and allow the use of e-mobility devices such as a e-kick scooter pilot project.

To build public acceptance, the City can promote e-mobility, such as e-kick scooters, electric wheelchairs and scooters devices, as a healthy, affordable, and clean way to travel and educate users on safe operations, roles and responsibilities through events and programming. To emphasize charging accessibility, the City can develop a voluntary window sticker program with support from local organizations and business associations indicating that e-mobility customers have access to a receptacle for battery charging.

Recommended initiatives:

- ☑ Work with regulatory partners and the CRD to deliver a Motor Vehicle Act pilot project to allow the use of e-kick scooters on City streets: $400,000
- ☑ Pursue opportunities to work with businesses, non-governmental organizations, and enforcement partners to promote e-mobility through events and programming: $25,000
- ☑ Develop a voluntary window sticker program indicating e-mobility customers have access to a receptacle for battery charging in 2022: $2,500

Increase Parking Solutions and Charging Access

Enhanced parking and charging access ensures that users can feel confident that they can safely and securely complete e-bike trips.

To improve public e-device parking, the City can continue the expansion of enhanced public e-bike and e-mobility device parking in the downtown core, transit hubs and village centres.

Private e-bike parking is a new area that can benefit from City support and guidance. To ensure new buildings accommodate e-bikes, the City can update Zoning Bylaws and Off-Street Parking Regulations to enhance secure storage and charging options for e-bikes in new residential and commercial multi-unit buildings.

Existing buildings can be challenging to retrofit to accommodate e-bikes. Therefore, the City can also work with community organizations (e.g., non-profits, libraries, community centres, etc.) and public housing providers to pilot incentives to retrofit existing buildings to support secure e-bike and e-mobility parking, charging and other amenities. To support other multi-unit residential buildings, the City can develop and provide best practices on design and information to building owners to encourage retrofits to support e-bike and e-mobility parking, charging and other amenities. These best practices should align with the level of service outlined in the new building requirements while supporting the unique challenges of retrofitting existing spaces.

To ensure a regional approach, the City can collaborate with Capital Regional District (CRD) and other municipalities, investigate options for standardized public e-bike charging stations to promote inter-municipal travel and support cycle tourism.

Recommended initiatives

- ☑ Expand public e-bike parking in 2022 and 2023: $500,000 (previously allocated)
- ☑ Initiate an update of Zoning Bylaws and Off-Street Parking Regulations in 2022 to enhance storage options for e-bikes and e-mobility devices in new multi-unit buildings to support their secure storage and charging
- ☑ Offer incentives for provision of e-bike parking in existing public community spaces and public housing by 2026: cost to be determined
- ☑ Develop and provide best practices for e-bike parking in existing buildings in 2023: cost to be determined
- ☑ Collaborate on regional e-bike charging standards in 2024: cost to be determined

Advocate for Supportive Policies

Advocacy by the City can ensure the broader policy landscape supports safe and accessible e-bike and e-mobility adoption. A core policy is BC's *Motor Vehicle Act*. The City can advocate for the policy to regulate, modernize and support the safe operation of emerging e-mobility devices beyond the pilot stage.

Recommended initiative

- ☑ Advocate to the Province to continue to modernize the *Motor Vehicle Act* to regulate new e-mobility devices

Monitor, Evaluate and Adjust

Monitoring local e-bike and e-mobility trends supports continuous program improvement. The City can work with partners to develop the data sources. The City can work with the CRD in the 2022 and 2027 Origin and Destination Studies to include ownership rates and trip information for e-bikes, electric kick scooters and/or other e-mobility devices to better understand the prevalence and use in Victoria households. The City can also work with local municipalities to complete a local survey to better understand the modes that are being displaced by e-bikes.

Following the receipt of data, the City can evaluate and adapt the Actions to evolve with adoption and to accurately quantify benefits.

Recommended initiatives:

- ☑ Enhance data collection in CRD Origin and Destination Study to include e-mobility data in 2022 and 2027
- ☑ Develop and implement a survey with regional partners to gain quantitative insights into the ability of e-bikes to displace light-duty vehicle use by 2026: $10,000
- ☑ Complete an internal evaluation of Actions based on survey results

Strategy Map

The City of Victoria's Electric Vehicle and Electric Mobility Strategy is summarized in the following strategy map. Each objective is linked to a local opportunity area and specific recommended initiatives for the City to act on. These outcomes are the result of the local and best-practice research, a thoughtful stakeholder engagement process, and tailored modelling and analysis.

	OBJECTIVES *To achieve the 2030 target*	OPPORTUNITY AREA *To address barriers and enable adoption*	RECOMMENDED INITIATIVES 2022 to 2030 *City actions designed to support adoption*
Electric Vehicle Actions	**Expand Access to EV Charging**	Invest in City-Owned Charging Infrastructure	1. Invest in public Level 2 on-street and in parking facilities: $2.64 M for 650 ports a. 2022-2025: $1.82 M b. 2026-2030: $0.82 M 2. Invest in public DCFC hubs: $3.3 M for 33 ports a. 2022-2025: $2.6 M b. 2026-2030: $0.7 M 3. Invest in residential EV Ready retrofits: $9.75 M for 46,000 stalls a. 2022-2025: $1.27 M b. 2026-2030: $8.48 M *In addition: $1M for O&M in 2022-2025 and $2.7M in 2026-2030 and $250,000 for communications and awareness, including education and capacity building, program monitoring and evaluation in 2022-2025.*
		Expand EV Charging Policies	4. Develop Comprehensive EV Ready Retrofit pilot to provide top-up incentives 5. Continue existing top-up incentives for one-at-a-time retrofits in multi-residential buildings while the comprehensive retrofit program ramps up 6. Expand *EV Readiness in New Construction* by-law to cover additional commercial buildings 7. Revise parking regulations to allow public on-street Level 2 charging deployed and managed by private residences where appropriate 8. Develop EV Charging as a municipal program to support and facilitate adoption 9. Identify appropriate locations for private sector investment in on-street charging and develop contractual framework 10. Advocate utilities, regional, provincial, and federal governments to maintain and expand supportive incentives and policies
	Monitor Affordability	Introduce Targeted Financial Incentives, if needed	11. If current provincial and federal incentives are reduced or removed, explore options for City-led incentives, such as zero-emissions zones and parking regulations, to maintain the overall cost-benefit of EV ownership
	Build Victoria's EV Ecosystem	Build Local Awareness, Capacity and Market	12. Develop educational materials for comprehensive multi-unit building retrofits and engage with multi-residential building residents, owners and managers to facilitate retrofits 13. Develop educational materials for commercial buildings and workplaces to support retrofits 14. Work with local dealerships and EV charging infrastructure companies to ensure the availability of models, materials, and expertise needed to support adoption
	Evolve with Adoption	Monitor, Evaluate and Adjust	15. Monitor City charging station usage and adjust implementation plans based on usage or geographic trends

	OBJECTIVES *To achieve the 2030 target*	OPPORTUNITY AREA *To address barriers and enable adoption*	RECOMMENDED INITIATIVES 2022 to 2026 *City actions designed to support adoption*
Electric Mobility Actions	**Increase Mode-shift from Personal Vehicles**	Support E-Bike Adoption	1. Work with partners to develop and launch a regional equity-based e-bike Incentive Program a. $750,000 2. Work with the private sector to pilot an e-cargo delivery hub a. $350,000 3. Introduce new bylaws and/or permit programs to regulate businesses renting shared e-mobility devices a. $10,000 4. Explore new ways to support people with disabilities by allowing electric wheelchairs and e-mobility scooters to operate in designated bike lanes and/or routes
	Build Victoria's E-Bike & E-Mobility Ecosystem	Build Local Infrastructure and Capacity	5. Work with regulatory partners and the CRD to deliver a Motor Vehicle Act pilot project to allow the use of e-kick scooters on City streets a. $400,000 6. Pursue opportunities to work with businesses, non-governmental organizations, and enforcement partners to promote e-mobility devices and educate users through events and programming a. $25,000 7. Develop a voluntary window sticker program indicating e-mobility customers have access to a receptacle for battery charging a. $2,500
		Increase Secure Parking and Charging Access	8. Expand public e-bike parking a. $500,000 (previously allocated) 9. Initiate an update of Zoning Bylaws and Off-Street Parking Regulations in 2022 to enhance storage options for e-bikes and e-mobility devices in new multi-unit buildings to support their secure storage and charging 10. Offer incentives for e-bike parking in existing public community spaces and public housing 11. Develop and provide best practices for e-bike parking in existing buildings 12. Collaborate on regional e-bike charging standards
		Advocate for Supportive Policies	13. Advocate to the Province to continue to modernize the *Motor Vehicle Act* to regulate new e-mobility devices
	Evolve with Adoption	Monitor, Evaluate and Adjust	14. Enhance data collection in CRD Origin and Destination Study to include e-mobility data 15. Develop and implement a survey with regional partners to gain quantitative insights into the ability of e-bikes to displace light-duty vehicle use a. $10,000 16. Complete an internal evaluation of Actions based on survey results

Appendix

To ensure the Strategy is grounded in the local context, a wide selection of stakeholders were consulted in October 2020. Stakeholder feedback was collected in a series of three workshops: One workshop was held with City staff and two workshops were held for external stakeholders.

The objective of these workshops was to:

- Gain staff perspectives on the local context for EVs and potential opportunities, roadblocks, and key considerations for implementation;
- Gain community, business, and industry perspectives on the local context for EVs and potential opportunities, roadblocks, and key considerations for implementation; and
- Share preliminary EV adoption modelling scenarios and gain insight into the likely impacts of those scenarios and understand which scenarios are most realistic and achievable.

	EXTERNAL WORKSHOP #1	EXTERNAL WORKSHOP #2
Organizations represented	BC Sustainable Energy Association Bluebird Cabs Capital Regional District Current Taxi District of Saanich Downtown Victoria Business Association DriveElectricVictoria Electrify Canada FleetCarma Flo/AddEnergie B.C. Ministry of Environment – Climate Action Secretariat Grok Energy Island Health Kia Leading Ahead Energy Modo Mogile Tech / ChargeHub Motorize New Car Dealers Association of BC Natural Resource Canada PetroCanada/Suncor Porsche Canada SWTCH EV Toyota University of Victoria Urban Development Institute - Capital Region Vancouver Island Strata Owners Association Victoria Chamber of Commerce Victoria EV Association	Victoria EV Association SWTCH EV BC Sustainable Energy Association Capital Regional District DriveElectricVictoria FleetCarma Greenlots Grok Energy Modo Motorize Vancouver Island Strata Owners Association

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