Regional EV Charging Network Strategy

Summary Report

May 2022

Community Energy Association

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Acknowledgements

This strategic plan would not be possible without the input and guidance from the following:

Project Partners: County of Wellington, County of Perth, County of Dufferin, Bruce County, City of Guelph, City of St. Marys, City of Stratford, Huron County, Grey County and Nuclear Innovation Institute.

Study Area Municipalities: Town of Goderich, Municipality of Bluewater, Municipality of South Huron, Township of Ashfield-Colborne-Wawanosh, Municipality of Central Huron, Municipality of Huron East, Municipality of Morris-Turnberry, Township of Howick, Township of North Huron, Township of Wellington North, Town of Minto, Town of Erin, Township of Puslinch, Township of Guelph-Eramosa, Township of Mapleton, Township of Centre Wellington, Municipality of North Perth, Township of Perth East, Township of Perth South, Municipality of West Perth, City of Stratford, Town of St Marys, Township of Chatsworth, Township of Georgian Bluffs, Municipality of Grey Highlands, Town of Hanover, Municipality of Meaford, City of Owen Sound, Township of Southgate, Town of The Blue Mountains, Municipality of West Grey, Township of Amaranth, Township of East Garafraxa, Town of Grand Valley, Township of Melancthon, Town of Mono, Township of Mulmur, Town of Orangeville, Town of Shelburne, Town of Saugeen Shores, Municipality of Kincardine, Municipality of Brockton, Town of South Bruce Peninsula, Municipality of Arran–Elderslie, Township of Huron-Kinloss, Municipality of South Bruce, Municipality of Northern Bruce Peninsula.

Technical Advisory Group: Westario Power, EPCOR, Festival Hydro, Hydro One, Alectra, Centre Wellington Hydro, Wellington North Hydro, ERTH Power, Orangeville Hydro, Bruce Power, IESO

Project facilitator: Community Energy Association. CEA recognizes that communities play a critical role in addressing climate change and as a not-for-profit organization, we do what it takes to help local governments accelerate the transition to a low-carbon, resilient future. This includes identifying the sources of local greenhouse gas emissions, planning how to reduce emissions, and implementing the best solutions - all in ways that build local capacity and foster collaboration among governments, Indigenous communities, energy providers, and citizens.

This project was carried out with assistance from the Green Municipal Fund, a Fund financed by the Government of Canada and administered by the Federation of Canadian Municipalities. Notwithstanding this support, the views expressed are the personal views of the authors, and the Federation of Canadian Municipalities and the Government of Canada accept no responsibility for them.

SECTION ONE Executive Summary

Electric Vehicle (EV) ownership has grown considerably in Ontario, along with opportunities for rural communities to benefit from EV tourism. The partnership of County of Wellington, County of Dufferin, County of Perth, County of Huron, Bruce County, County of Grey, City of Guelph, and Nuclear Innovation Institute (hereafter referred to as "the Partners") – want to ensure residents and businesses in their collective region (hereafter referred to as the "Study Area") are afforded the opportunity to benefit from the transition to EVs. They are therefore collaborating to develop a regional EV charging network strategy. By working together and across boundaries, they can amplify success and gain more from their resources than they can alone. Specifically, the Partners realized that when they implemented stations independently, they had an insufficient network; by collaborating, they can leverage time and resources to build a cohesive charging experience that allows EV drivers to travel throughout the region. Currently, the region has 22 Level 3 (DC Fast Charging) and 145 Level 2 EV charging stations for public use.

Strategically designing an EV charging network that facilitates travel to and within a region is particularly important in rural areas where distances between communities are large, yet critical services often require travel to neighbouring areas. There are two key benefits of thoughtfully designing and implementing a charging network. First, it can make EV ownership more realistic for rural residents as well as urban residents who want the freedom to visit rural amenities. Second, supporting EV travel builds co-benefits. Beyond the driver experience, the Partners recognized that by strategically deploying fast charging stations throughout the Study Area, they ensure the communities in their region gain economic and environmental benefits from EV travel – enhanced tourism and lower pollution, respectively.

The Partners hired Community Energy Association (CEA), a non-profit with deep expertise in regional EV charging network planning and implementation, to develop this strategy. CEA created and facilitated a process to support the Partners to succeed in installing Level 3 (DC Fast Charging) and Level 2 charging stations that contribute to the network as a whole while offering benefits to the host community.

The following outcomes informed the strategy:

- the results of an EV driver and local resident feedback survey
- an assessment of the existing and planned EV charging stations and charging station gap analysis
- an assessment of options to address prolonged dwell time at charging stations
- the development of siting criteria to reflect both the local context and the Partners' goals
- an analysis of opportunities to incorporate renewable energy into station design

This regional EV charging network strategy proposes the installation of an additional seventeen Level 3 (DC Fast Charging) EV charging stations and 13 banks (at least four stations) of Level 2 EV charging stations across the Study Area. To ensure the network is constructed to meet current and future (>five plus years) demand and technology advances, this strategy proposes the installation of at least two >100kw Level 3 (DC Fast Charging) EV charging stations at each identified location.

Level 3 (DC Fast Charging) stations will primarily serve longer-distance travellers passing through a community. Banks of Level 2 charging stations will compliment these core fast charging stations because they service visitors who are coming to the community for a longer stay and as such must be sited strategically at destinations with a longer (2+ hours) dwell time. Increasing the number of Level 2 chargers across the region can also benefit residents who may not have access to home charging. This coordinated approach can reduce prolonged dwell time that some of the Partners identified as a challenge at locations where access to EV charging is limited. The strategy also explores potential solutions to further address dwell time.

Adoption of EVs can present significant environmental benefits to the Partners and their communities. A summary of the analysis and estimated emission reductions for 2030, 2040 and 2050 is included. Similarly, the Partners noted the opportunity to power charging stations with renewable energy. The strategy includes a guide for evaluating proposed sites.

There is significant federal funding available or coming available soon (Summer/Fall 2022) for EV charging network implementation. The strategy provides a discussion of implementation options for information as the Partners plan their next steps.

Benefits of EVs

1. You'll save on fuel costs
Electricity is not only cleaner than gas, it's also cheaper. Especially when you charge at home.

2. You'll save on maintenance
EVs have far fewer moving parts than gas vehicles, so there's a lot less that can go wrong. No transmission or exhaust system to maintain and no more oil changes!

3. You'll love driving it
Driving an EV is fun, fast and QUIET.

4. Breathe clean air
With no exhaust system, you won't be filling the air with pollution. Better for you and better for the planet.

5. Enjoy some perks
If you own an EV in Ontario you can apply for a HOV lane/EV permit and decal. This allows you to drive in HOV lanes even if it's just you.

6. Showcase your values
There are other social benefits to driving an EV. You're signaling that you and/or businesses value sustainability and this can inspire others to make low carbon choices too.

SECTION TWO Introduction

Background

The partnership of County of Wellington, County of Dufferin, County of Perth, County of Huron, Bruce County, County of Grey, City of Guelph, and Nuclear Innovation Institute (hereafter referred to as "the Partners") – want to ensure residents and businesses in their collective region (hereafter referred to as the "Study Area") are afforded the opportunity to benefit from the transition to EVs. The strategy provides the Partners with guidance on how to install EV chargers including a network of Level 3 (DC Fast Charging) and Level 2 EV charging stations thoughtfully and strategically. The following outcomes inform the strategy:

- results of an EV driver and local resident feedback survey
- an assessment of the existing and planned EV charging stations and charging station gap analysis
- an assessment of options to address prolonged dwell time at charging stations
- opportunity to harness renewable energy
- siting criteria developed by the Partners

The Partners understand that with EV ownership growing in the region, in Ontario, and in surrounding jurisdictions including neighboring provinces and states – Quebec, Michigan, Ohio, Pennsylvania, New York, their communities have much to gain from facilitating travel to and within their region.

Figure 1. Map of southwestern Ontario. Grey shape indicates boundary of project Study Area.

Over the past five years, the Partners have individually planned and implemented various local EV charging stations. The installation of this charging infrastructure has been in response to the acquisition of supportive funding and has not, to date, been informed by a comprehensive strategy. Many of the existing stations in the Study Area are located to support municipal staff and community members at Town Halls, recreational facilities, and in public parking lots. While this is a commendable first step to support EV adoption and travel, the growth of EVs now requires a more coordinated and holistic approach; a well-planned EV charging network can avoid challenges experienced in other jurisdictions (e.g., long dwell times) while acting as a catalyst to build economic and environmental benefits.

Rather than installing chargers one-by-one as the opportunity arises, a charging network strategy considers how each station is useful and beneficial on its own while contributing to the network. This includes evaluating the distance between chargers and connections along travel routes; strategically locating charging stations near tourist destinations (e.g., restaurants, attractions, shopping, etc.); and giving existing EV drivers the opportunity to lend their real-world experience. This final point, EV driver input, is an important tactic to consider so that future stations will, ultimately, be used! EV drivers can offer insights into preferred charging locations, perception regarding the ease of charging in the community and other factors that influence driver use of charging stations.

Further, there have been reports of local drivers using public charging stations as personal chargers, reducing their availability for visiting EV drivers and increasing demand for parking in high traffic tourist areas which the Partners wish to solve. The 2021 study *Plugging In, Why Bruce Grey and Huron must prepare for an Electric Vehicle Future* by Nuclear Innovation Institute and Plug 'N Drive revealed that EV drivers perceive charging in Grey, Bruce and Huron Counties as being difficult or very difficult.

Scope

Figure 1 depicts the Study Area for the EV charging network strategy. It encompasses the Counties of Grey, Dufferin, Perth, Huron, Bruce, Wellington and Cities of Guelph, Stratford, and St. Marys. Notably, the urban municipalities Kitchener &Waterloo are not included.

EV Charging Network

EV charging networks facilitate travel to and within a region. Designing and implementing networks thoughtfully can help a region's residents and visitors adopt EVs. By strategically deploying fast charging stations throughout the Study Area, the Partners will ensure that the rural communities gain economic and environmental benefits from EV travel all while supporting greater adoption of EVs across the province by enabling long distance travel. The decision to purchase an electric vehicle is driven by several factors; however, the ability to travel to desirable destinations reliably is a major factor. Regional connectivity to larger urban centres can drive electric vehicle adoption in those cities while also bolstering opportunities for economic development and tourism. The Study Area encompasses several significant destinations. By electrifying routes to and within the region, the communities within the region will have an opportunity to capture a significantly growing market of EV tourists from major drivable markets within Ontario and across the US border.

Level 3 DC Fast Charging station in a small BC community as part of Accelerate Kootenays

Strategic siting of the EV charging stations across the region can support network connectivity while also maximizing economic benefits to the region. It is important to site charging stations so drivers can easily access local amenities like shopping, restaurants, and cafes, as well as parks, museums and other local attractions. This integration of EV driver needs with local economic development opportunities ensures drivers will use the infrastructure while also leveraging investments to gain as many benefits as possible. Creating a base network across a region can bring confidence to the private sector and attract future investment to build and expand access to EV charging.

Previous EV charging networks that have resulted in a marked increase in EV visitors and local resident adoption of EVs has informed the approach to this regional EV charging network strategy. Specifically, Southern Alberta's Peaks to Prairies and Southeastern British Columbia's Accelerate Kootenays.

Deliverables & Outcomes

The following is a summary of the deliverables and outcomes of the regional EV charging network strategy:

- Collect public input via a survey and incorporate into proposed EV charging network design.
- A proposed network of Level 3 (DC Fast Charger) EV charger stations across the Study Area, including location, site and a preliminary desktop technical feasibility analysis.
- A proposed network of banks (e.g., more than four chargers and at one site) of Level 2 EV chargers across the Study Area, complimenting the proposed Level 3 (DC Fast Charger) network and addressing demand in high volume traffic corridors and destinations.
- A summary of optional pathways for implementation of the EV charging network strategy.
- A guide for assessing EV charging station sites for suitability for solar arrays.
- A summary of different methodologies for addressing extended dwell time at EV charging stations.

***Dwell time* is the amount of time an EV is plugged into a charging station. At busy charging stations, extended dwell times can inconvenience drivers who really need to charge to continue their travels. In the context of small communities, it has been observed that residents may occupy a charger even when they do not "need" the energy. If an EV is parked and occupying a charger because it's convenient, that long dwell time means a visitor may not have access.**

SECTION THREE Research & Analysis

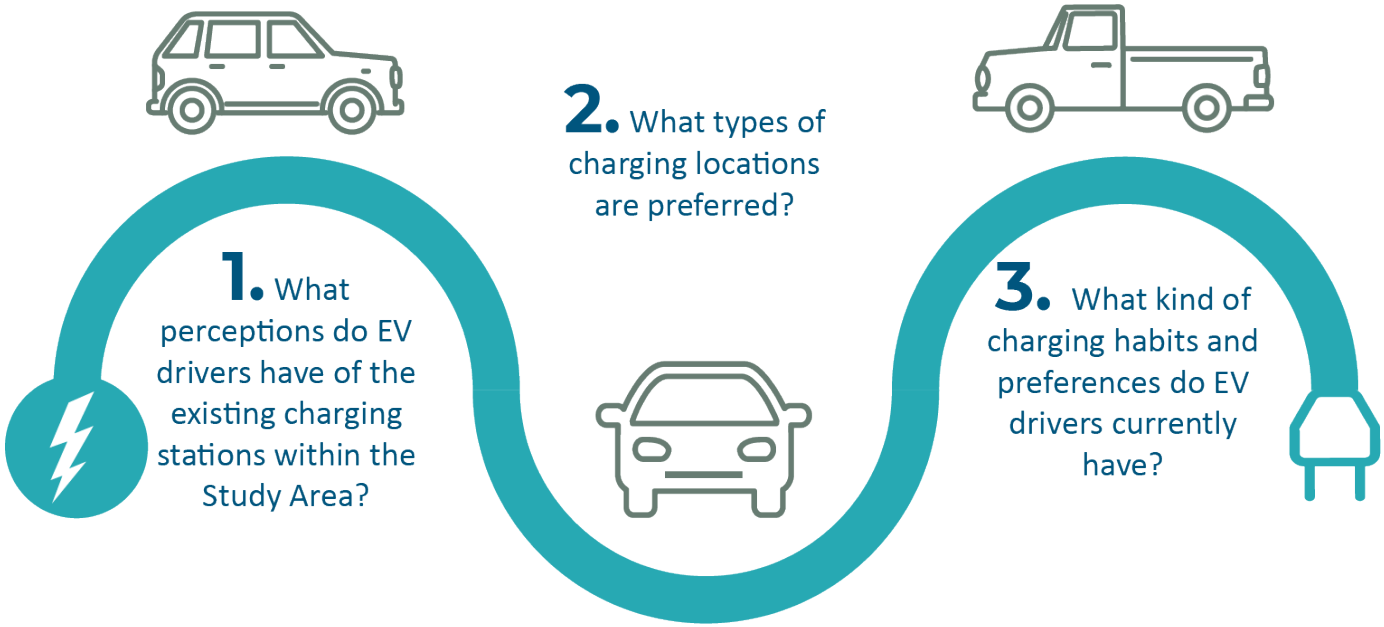
Public Surveys

At the project's onset, CEA developed a Resident and EV Driver survey. Previous work by CEA in B.C. and Alberta informed these surveys and the team adapted the questions to reflect the local context of the study area. The resident survey targeted individuals who reside in the Study Area, while the EV Driver survey sought input from drivers within and outside the study area. The intended reach included surrounding states in the USA and neighbouring provinces. This section summarizes the results of the surveys; for full resident survey results, see Appendix 1.

EV Driver Survey Analysis

Expanding upon the study completed by Nuclear Innovation Institute (NII) and Plug 'n Drive title, *Plugging In, Why Bruce, Grey and Huron Must Prepare for an Electric Future* (2021), the EV driver survey solicited input on the perceptions of charging within the study area, preferred charging locations and charging and driving habits. The research team also extended the driver survey to American EV drivers who have visited or intend to visit the study area.

The three main questions the EV driver survey sought to answer:



The survey had 330 responses. The dominant age group of responders being 45-54 (24%) (Figure 2). This is consistent with previous analysis of EV ownership. Specifically, the recent survey and analysis completed by Natural Resource Canada (November 2021).

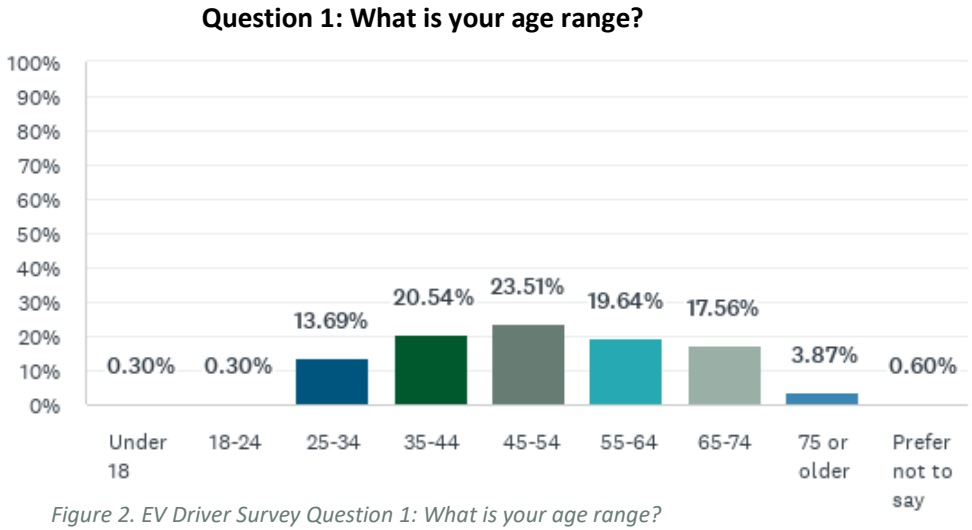


Figure 2. EV Driver Survey Question 1: What is your age range?

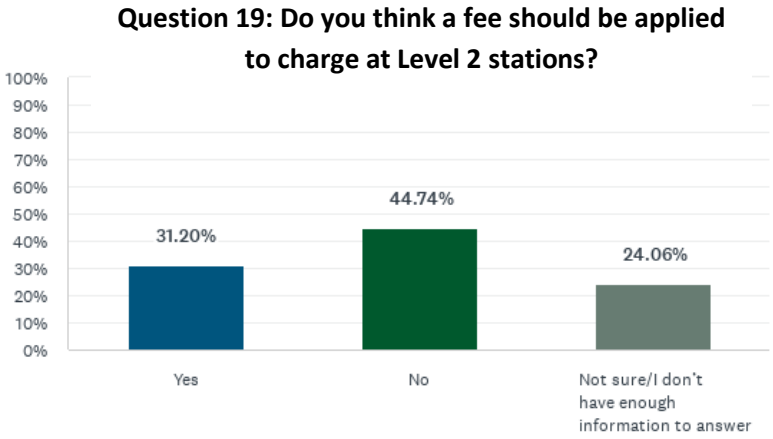


Figure 3. EV Driver Survey Question 19: Do you think a fee should be applied to charge at Level 2 Stations?

Most EV driver respondents indicated that they own their home (single or semi-detached house), but most do not have a charger installed. This is noteworthy because if the drivers cannot charge at home, they will make use of public infrastructure. This behavior leads to increased demand and potentially less opportunity for visitors to use public charging stations. To this point, survey respondents were asked if a fee should be applied to charge at Level 2 stations—only 30% said yes (Figure 3). However, most participants agree with a stepped fee to limit dwell time. A stepped fee is one that increases the longer an EV is plugged into a charger. For example, zero to two hours at a Level 2 charger costs $2/hr. but at set time intervals, the fee increases. The intent of a stepped fee is to discourage users from occupying a charging station when charging is not needed. The nature of the site and associated amenity should be considered when determining fees. For example, a stepped fee may not be appropriate at a location where dwell time is likely to be longer than 2 hours, and sufficient infrastructure has been installed to meet demand (for example, at a ski hill destination, where it is unlikely a driver would be able to return within 2 hours to move their vehicle).

Over 95% of respondents were from Ontario with a small number of Nova Scotia, Quebec, and Manitoba households. Of these Ontario residents, 79% indicated they live in the Study Area and 16% responded that they have visited for tourism and recreation.

Not surprisingly given the current low volume of public EV charging stations available in the region, respondents cited range anxiety as a significant barrier to owning an EV and 29% identified the challenge of EV chargers being in use when needed. However, 88% of respondents take their EVs for longer trips outside their communities. Notably, most survey respondents have a second car in their household and most of the second cars are internal combustion engine vehicles.

To accommodate the lack of EV charging stations, EV drivers alter their behaviours to ensure they can get to where they want to go (Figure 4). This is important data to support the concept of strategically creating a network of stations. There is opportunity to site stations so that they are convenient for drivers while also connecting them to amenities to visit while they charge.

As per Figure 5, while using a public charger, drivers tend to look for places to eat, shop, and exercise. This insight was helpful to the Partners when developing the siting criteria for new EV charging stations in the Study Area.

Survey respondents further indicated that the most important features of public EV chargers are reliability, charging speed, and proximity to a planned route. Additionally, and of significance to the Partners when it comes to planning for implementation, powering EV charging stations with electricity from renewable energy sources is also important to most survey participants.

Question 23: If you answered yes to the previous question, has owning an EV changed how you plan your trips? Specifically, in what ways do your behaviours change, if any?

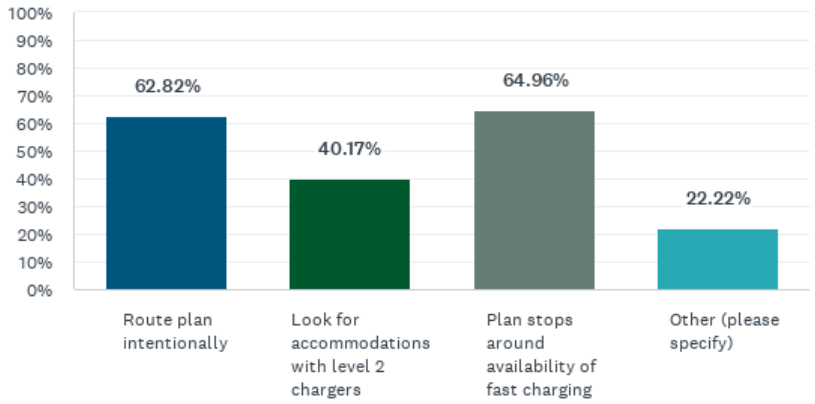


Figure 4. EV Driver Survey Question 23: If you answered yes to the previous question, has owning an EV changed how you plan your trips? Specifically in what ways do your behaviors change, if any?

Question 27: While using a public charger, how would you prefer to use your time while the car charges? Please check all that apply.

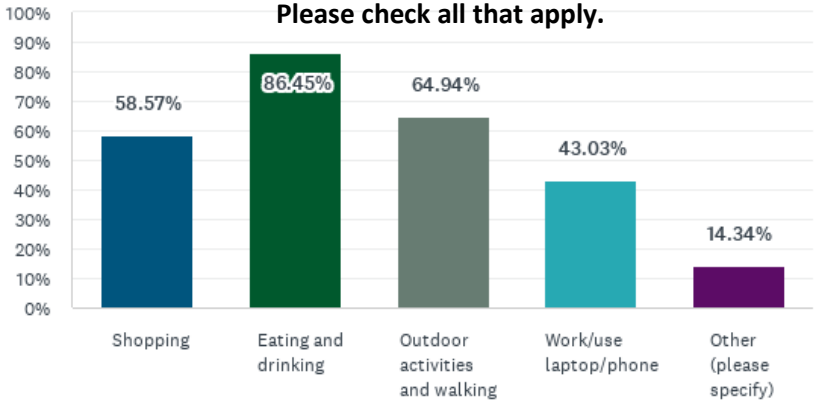


Figure 5. EV Driver Survey Question 27: While using a public charger, how would you prefer to use your time while the car charges?

Residents Survey Analysis

The audience of the second survey was residents who do not own an EV. This survey examined the barriers to EV adoption and sought to understand the impact a regional EV charging network may have on residents' future vehicle purchasing decisions including their likelihood to purchase an EV. In total, 1,015 individuals participated in the resident survey. The majority reside in (listed in descending order of number of responders per community) Guelph, North Bruce, Saugeen Shores, Center Wellington, St. Marys, West Grey, West Perth, South Bruce Peninsula, North Perth, Kincardine, Owen Sound, Brockton, Puslinch, Grey County, Goderich, Meaford, Arran-Elderslie, Bruce County, Mono, Dufferin County, Grey Bruce, Wellington County, Amaranth, Central Huron, Huron County, Huron Kinloss and Orangeville.

Interestingly, cars, not SUVs or trucks are the number one type of vehicle driven by those who responded. Currently, the majority of EVs available to consumers are compact cars. This bodes well for adoption of EVs in the Study Area because the models currently driven matches with the type of passenger vehicle currently available. This is a notable difference from some other rural areas like BC and Alberta where most households' own trucks and SUVs. Furthermore, the much-anticipated arrival of electric pick-up trucks and larger SUVs will provide consumers in the region with even more options.

Question 16: If you were considering buying an EV, which factors would motivate you? Please check all that apply.

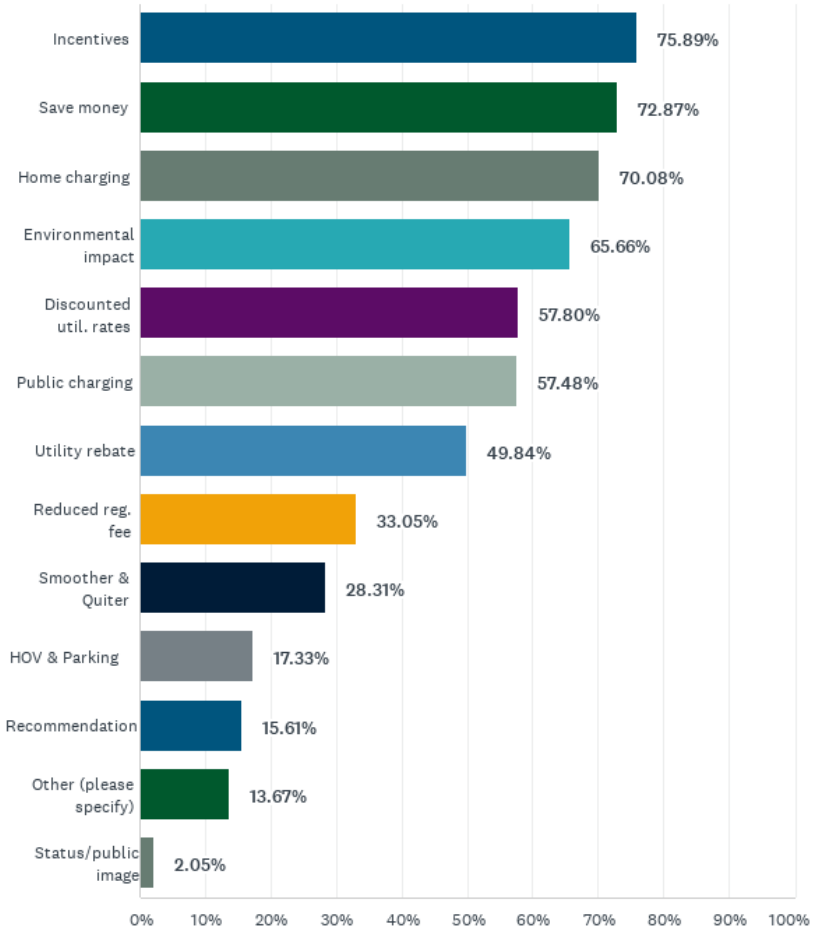


Figure 6. Resident survey question 16: If you were considering buying an EV, which factors would motivate you?

Sixty-seven percent (659 people) of respondents are planning to buy a new vehicle in the next two to five years and all indicated they are considering an EV, meaning there could potentially be 659 new EVs on the road in the Study Area in the coming years. Notably, the survey had a small sample size. If that same percentage (67%) were applied across the whole region the number is even larger, and if we assume even half of that it's still a significant growth as compared to today.

The biggest motivators for residents to buy an EV are receiving EV tax rebates and incentives, having access to home charging, and saving money (Figure 6).

Only about half of responders know someone who has an EV. Forty-eight percent of people said they would source information on buying an EV from friends and family and 48% said they would use consumer reports. The main source of information preferred by residents is internet search (90%).

Investigating barriers to purchasing an EV, 45% of responders believe a lack of charging for long trips is an extreme concern for owning an EV, and 25% indicated they felt “very concerned” about the lack of charging. Negative perceptions of EV driving range and EV performance in winter continue to be a barrier to EV adoption, like most jurisdictions across Canada.

A lack of at-home and workplace charging were not significant concerns of survey respondents, but this might be because most of the residents who responded live in single-family detached or semi-detached homes; challenges associated with charging at home are often bore by residents of multi-unit residential buildings where stratas may not be supportive of installing charging.

Finally, most participants in the resident survey agree that it is important that EVs are powered by renewable energy. However, they don't feel as strongly about this when compared to the EV driver survey responders.

Question 18: Listed below are some of the most common real and perceived barriers to EV adoption. How concerned would you be about the following when purchasing an EV?

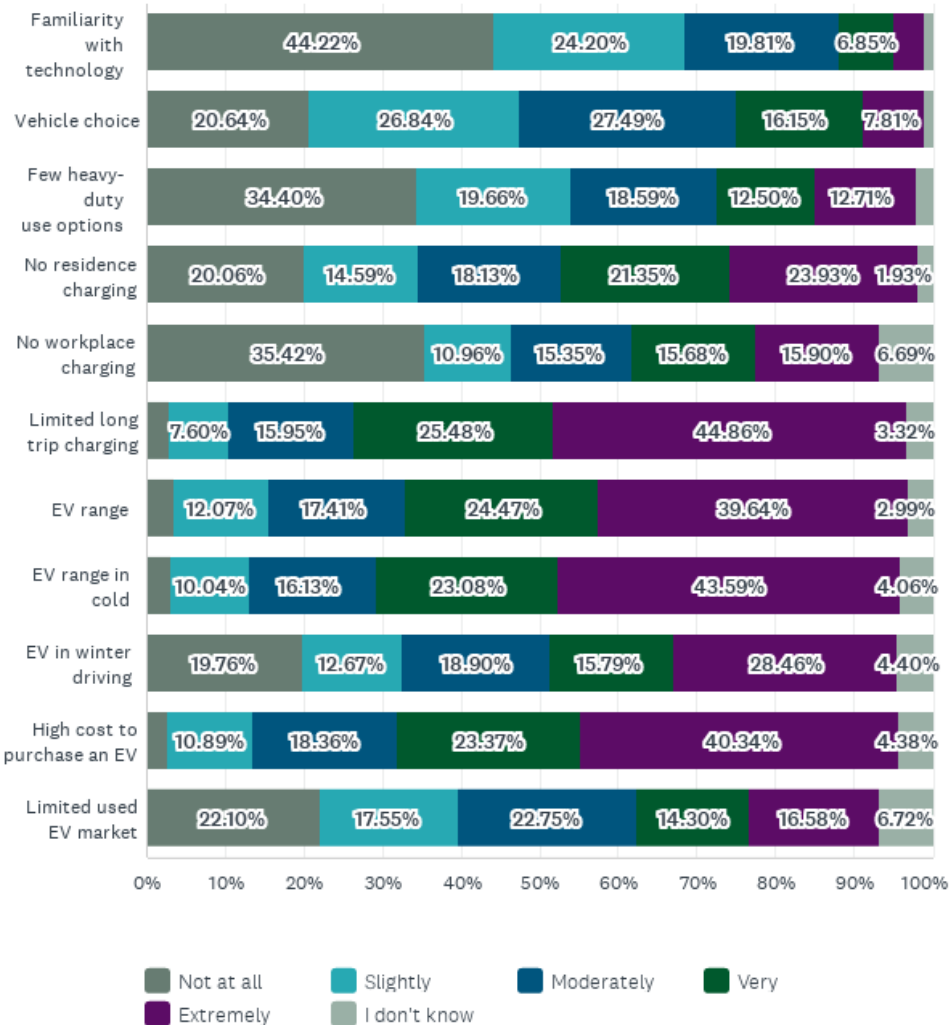


Figure 6. Resident survey question 18: Real and perceived concerns when considering purchasing an EV.

Additional Opportunities

When analyzing the survey, CEA flagged additional opportunities for partner communities to support EV adoption by expanding the places and spaces where charging infrastructure can be found in the Study Area. While these opportunities are out-of-scope for the present strategy – workplaces, residential or multi-unit residential contexts – opportunities include:

- Incentives and/or outreach and engagement to encourage businesses-owners/workplaces to install Level 2 chargers is key. Most of the EV drivers who responded do not have home chargers. EVs are typically parked at home and workplaces for extended periods (6-8 hrs. or longer), ideal for Level 2 charging. In the absence of provincial incentives, local governments may want to evaluate opportunities to support businesses to undertake these behaviours, especially where chargers can be accessed by both the public and staff.
- Incentives and/or outreach and engagement to support homeowners to install Level 2 chargers at home. Charging overnight during off-peak hours is a tremendous opportunity. Increasing the number of EV drivers who charge at home has the added value of freeing up public stations for visitors or those who strictly are not able to add a charger to their residence – renters, condo-dwellers, etc.
- Increased communications regarding existing EV charging network. While the current network is not robust, there are EV charging options in the Study Area that could serve the driving habits of several residents and visitors. A communications campaign in partnership with local governments and tourism agencies could help some residents see that the current charging options in fact meet their needs.
- Communication of available EV car models on the market today. The survey indicated that most residents currently drive cars and will replace like-for-like when their current car retires. Given that there are many EV car models on the market, and at least 659 people plan to buy a new car in the next 2-5 years, there is an opportunity for them to all be EVs. A collaboration with Plug N Drive and their Mobile Electric vehicle Education Trailer (MEET) could be a critical first activity. Additional engagement with local dealerships will further amplify the messaging.
- Add EVs to municipal/county fleets and create communications materials to address EV myths (e.g., reliable in cold weather). Through leading by example, counties and municipalities can help build confidence and normalize seeing EVs on regional roads.
- Survey responses of non-EV drivers indicate that many residents maintain misconceptions about the reliability of EVs. Outreach and engagement activities to address EV myths could help the EV-curious feel more confident in the technology.

Literature Review

The literature review provides a summary of published documents and information relevant to the Regional EV Charging Network Strategy for the Partners. The review serves to create familiarity with current thinking on EV charging in the project area, provincially, federally, and in neighbouring states. The scope of the literature review is to consider the future demand for EV chargers in the study area, and recent investments and commitments made by the Provincial and Federal governments regarding EV manufacturing and the goal to have all new vehicles be electric by 2035.

The review encompasses three sections:

- EV related policies, targets, infrastructure and zero emission vehicle (ZEV) mandates
- Current and forecasted electric vehicle registrations
- Co-Benefits of EV adoption

Current EV related policies, targets, infrastructure and zero emission vehicle mandates

EV related policies and targets locally, provincially, nationally and in neighbouring States as applicable

At the **local level**, none of the Partner communities have a policy requiring new buildings to be EV ready at the completion of construction. The definition of EV-ready is having capacity at the electrical panel for a Level 2 EV charger and the necessary conduit running from the panel to the parking space. Further, none of the Partner communities have a policy committing to purchase EVs as they retire vehicles within their municipal fleets. A handful of municipalities in and close to the Study Area, including Toronto, Owen Sound, Southgate, and The Blue Mountains, have committed to increasing the adoption of EVs by the municipality and its residents.

A review of the Partners municipal planning documents identified the following commitments regarding emission reductions in the transportation sector: (see over page)

Town of Goderich

Over the last few years, the Town has added two EVs to its fleet, and Public Works has started to replace certain types of machinery and equipment (e.g., weed whackers) with battery-operated. As a result of this awareness, at the August 16, 2021 Council meeting, Goderich Town Council adopted an amendment to the Town's Asset Management Policy, at the recommendation of the Environmental Action Committee, to require the consideration of electric, energy-efficient, or alternative fuel source fleet, machinery, and equipment at an affordable lifecycle cost at the time of an asset's replacement.[1]

Grey County

Grey County adopted their first Climate Change Action Plan, Going Green in Grey in 2022. It establishes a Net-Zero by 2050 community GHG emissions reduction target, and Action 7 identifies zero-emissions vehicle adoption as a priority next step. Grey County is also electrifying its Corporate fleet.

Dufferin County

The 2021 Dufferin Climate Action Plan commits the County to Net-Zero emissions by 2050 with an interim reduction target of 10% by 2030. To help achieve this, Dufferin has prioritized 'accelerating the transition to low-GHG transportation by developing an EV charging station network across Dufferin and neighbouring municipalities.'

City of Guelph

As per their Climate Action Plan, the City of Guelph is targeting GHG emission reductions to net-zero by 2050 . They have identified 20 priority actions; #17 states their objective to 'Electrify personal vehicles'.

Huron County

The County recently completed their Corporate Climate Action Plan, in which they identify several goals and supporting actions. Of interest for this Review is Action 14.1 *Apply for funding to install electric vehicle chargers across the County in partnership with local municipalities.*

Perth County

The County's (includes communities of Stratford and St. Marys) Corporate and Community Climate Action Plan outlines their Vision 'to mitigate climate change risks by ambitiously reducing local greenhouse gas emissions, and will ensure a more resilient and healthy future for our communities.' They specifically focus on decarbonizing vehicles via Action 3. *Install charging stations*

Wellington County

As per the 2021 Climate Change Mitigation Plan, the County committed to GHG emission reduction targets for the community of 6% by 2030 and 80% by 2050. The County is anticipating growing interest in EVs in forthcoming years and identified a suite of supporting actions (TS1 – TS5) to address growing interest and achieve GHG emission reduction targets.

Provincially, the Government of Ontario commits to reducing emissions to 30% below 2005 levels by 2030, a target that aligns with the Federal Government's Paris commitments.[1] However, there are no provincial policies regarding EVs or EV charging infrastructure. The forthcoming Provincial election (June 2022) may result in significant changes in this space and CEA recommends completing a follow-up review six months following the election. Notably, since coming into power in 2018, the government scrapped an existing buyer incentive program, which provided up to $14,000 on the purchase of an EV. For comparison, buyer incentives exist in eight provinces and territories. The government also removed a $2.5 million incentive program that helped homeowners install their own charging equipment. The government also removed EV charging station requirements in Ontario's building code. [2]

Federally, the Government of Canada's climate targets are to reduce GHG emissions by 40% to 45% below 2005 levels by 2030 and to achieve net-zero emissions by 2050.[3] The Government of Canada also remains committed to aligning with the most ambitious light-duty vehicle GHG regulations in the United States. Supporting a strong and unified North American automotive sector to transition towards zero-emission vehicles contributes to Canada's climate change goals. It positions Canadian and American workers alike to benefit economically from this global shift[4]. The Government of Canada is making investments to support the transformation towards electrification, including contributing $295 million to the Ford Motor Company of Canada's $1.8 billion project to build electric vehicles at its Oakville Assembly Complex.[5]

Across the border, several municipalities and states have communicated EV related policies and targets. For example, in September 2021, the Regional Electric Vehicle Midwest Coalition ("REV Midwest") established a Memorandum of Understanding between the five States of Illinois, Indiana, Michigan, Minnesota, and Wisconsin. The Coalition creates a regional framework to accelerate vehicle electrification in the Midwest. REV Midwest provides the foundation for cooperation on fleet electrification along key commercial corridors to safeguard economic security, reduce harmful emissions, improve public health, and advance innovation. REV Midwest will future-proof the region's manufacturing, logistics, and transportation leadership, and position the region to realize additional economic opportunity in clean energy manufacturing and deployment.

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[1] Government of Ontario. (2022). *Climate Change*. https://www.ontario.ca/page/climate-change

[2] Syed, F. (2021). Electric vehicles in Ontario: a look at Doug Ford's love-hate relationship. *The Narwhal*. https://thenarwhal.ca/ontario-electric-vehicle-policy/

[3] Government of Canada. (2022). *Net-Zero Emissions by 2050*. https://www.canada.ca/en/services/environment/weather/climatechange/climate-plan/net-zero-emissions-2050.html

[4] Transport Canada. (2021, June 29). *Building a green economy: Government of Canada to require 100% of car and passenger truck sales be zero-emission by 2035 in Canada - Canada.ca*. Government of Canada. https://www.canada.ca/en/transport-canada/news/2021/06/building-a-green-economy-government-of-canada-to-require-100-of-car-and-passenger-truck-sales-be-zero-emission-by-2035-in-canada.html

[5] Government of Ontario. (2021). *Driving Prosperity*. https://www.ontario.ca/page/driving-prosperity-future-ontarios-automotive-sector?utm_source=newsroom&utm_medium=email&utm_campaign=%2Fen%2Frelease%2F1001176%2Fontario-stakes-its-claim-to-compete-for-future-auto-sector-investments&utm_term=media

The Coalition will develop a coordinated approach to advance electrification that is informed by industry, academic, and community engagement. The Coalition will work together to enable an equitable transition to EVs for all with specific consideration for communities that are historically disadvantaged. REV Midwest will position states in the Midwest region to leverage and collectively increase public and private investment in EVs and EV infrastructure.[6]

Another example is the City of Pittsburgh. As per their Public Facility EV Charging Strategic Plan, the City of Pittsburgh has committed that every household be within a 10-minute walk of a public Level 2 EV charger or a 10-minute drive of a DC fast charger.[7]

The state of Michigan's Charge Up Michigan Program is an EV charger placement project that aims to build the infrastructure for DC fast charging stations in the state of Michigan to ensure the feasibility of all long-distance trips for EV users within the state, and to neighbouring states and Canada. To achieve this, the Department of Environment, Great Lakes, and Energy (EGLE) and partners (electric utilities and applicant) will provide funding for qualified DCFC EV charging equipment, site preparation, equipment installation, networking fees and signage.[8]

Zero emission vehicle (ZEV) mandates locally, provincially, nationally and in neighbouring States as applicable

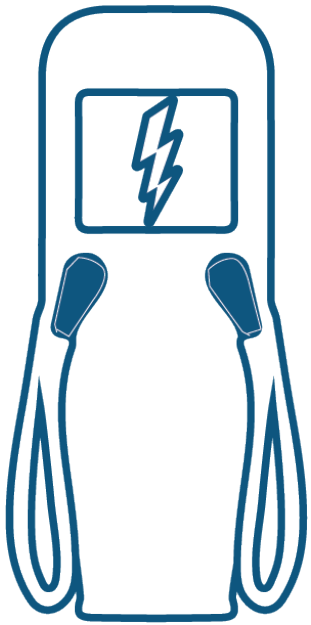
Zero emission vehicles (ZEVs) are vehicles that can operate without producing tailpipe emissions, such as battery-electric, plug-in hybrid electric, and hydrogen fuel cell vehicles.

Locally, none of the Partners has a corporate ZEV mandate at the time of the literature review nor does the Government of Ontario. Yet, the Government of Canada acknowledges light-duty vehicle (LDV) emissions account for approximately 50% of Canada's transportation-related greenhouse gas emissions and 12% of the country's total emissions. Decarbonizing these vehicles is critical to reducing overall emissions in Canada. To move towards the decarbonization of the transportation sector, the federal government has established Canadian LDV ZEV sales targets of 10% by 2025, 30% by 2030 and 100% by 2035.[9]

In the U.S., ZEV mandates are only issued at the state level. Currently, there are no mandates for low-density vehicles (i.e., personal use), and there is a multi-state medium and heavy-duty ZEV MOU. The goal is to ensure that 100% of all new truck and bus sales are ZEVs by 2050, with an

[6] U.S. Department of Energy. (2021). *Regional Electric Vehicle (REV) Midwest Plan*. https://afdc.energy.gov/laws/12708
[7] City of Pittsburgh. (2020). *Public Facility EV Charging Strategic Plan*. https://apps.pittsburghpa.gov/redtail/images/13902_FINAL_2021_PGH_EV_Strategic_Plan.pdf
[8] Government of Michigan. (2022). *Electric Vehicles.* https://www.michigan.gov/climateandenergy/0,4580,7-364-85453_98214_98294-521149--,00.html
[9] Transport Canada. (2021). *Zero Emission Vehicles*. https://tc.canada.ca/en/corporate-services/transparency/briefing-documents-transport-canada/20191120/20191120/zero-emission-vehicles

interim target of 30% by 2030. The 17 signatory states include California, Colorado, Connecticut, District of Columbia, Hawaii, Maine, Maryland, Massachusetts, New Jersey, New York, North Carolina, Oregon, Pennsylvania, Rhode Island, Vermont, Virginia, and Washington.[10]



EV charging infrastructure locally, provincially, nationally and in neighbouring States

Locally

Across the project Study Area (20,160 km^2) there are currently 22 Level 3 (DC Fast Charger) stations servicing a resident population of 755,483.

The County of Huron, along with the Town of Goderich, Municipality of Huron East, and the Township of North Huron recently received funding through Natural Resources Canada Zero Emission Vehicle Infrastructure Program (NRCan ZEVIP). Huron County will be receiving 14 Level 2 EV chargers with 26 individual charging ports distributed across various locations within the participating municipalities.[11] In Goderich, the EV charging stations will be installed at Bannister Park, the Cove Pavilion, and the parking lot on Lighthouse Street.

In Dufferin County, in addition to the 24 EV chargers recently installed (two are DCFCs, located at Museum of Dufferin and Orangeville Courthouse), 20 more Level 2 or Level 2 max chargers will be installed at workplaces by the end of 2022. This was made possible through a second phase of funding through the ZEVIP for $100,000 from the Department of Natural Resources Canada. This funding is in addition to $289,000 provided through ZEVIP to install the first 24 EV chargers. [12]

In the Town of Blue Mountains, Council approved the installation of 12 EV charging stations in six designated locations (generally described as Hester Street parking lot, Town Hall, Thornbury Post Office parking lot, Beaver Valley Community Centre, LE Shore Library, and Craigleith Heritage Depot Museum). The Town joined an application process to Natural Resources Canada (NRCan) ZEVIP with Ontario Power Generation (OPG) in 2019. The ZEVIP program was a pooled application including other Ontario municipalities. [13]

[10] Multi State Medium and Heavy Duty Zero Emission Vehicle Memorandum of Understanding. (2021). https://www.nescaum.org/documents/mhdv-zev-mou_12-14-2021.pdf

[11] County of Huron. (2021, July 20). *Making More Electric Vehicle Chargers Available in Huron County*. https://www.huroncounty.ca/news/making-more-electric-vehicle-chargers-available-in-huron-county/

[12] Odrowski, S. (2021, December 9). Dufferin County installs 24 electric vehicle chargers. *Shelburne News*. http://shelburnefreepress.ca/?p=29531

[13] Fletcher, J. (2021). *Staff Report Operations Department*. https://pub-bluemountains.escribemeetings.com/filestream.ashx?DocumentId=2716

In 2017, the County of Wellington installed three Level 3 (DC Fast Charger) EV charging stations at Arthur, Puslinch and Guelph thanks to funding from the Government of Ontario's Electric Vehicle Grant Programme (EVCO). [14]

Remainder of Ontario

Recently, the Ivy Charging Network, a joint venture of OPG and Hydro One, the province's largest distribution utility, was announced. IVY is funded in part by both companies, as well as $8 million from NRCan, with the goal of launching 160 Level 3 (DC Fast Charger) at 73 locations. Stations will be, on average, less than 100 kilometers apart. It will make Ivy the largest fast charger network in Ontario, connecting Kenora in the northwest to Cornwall in the southeast.[15] The agreements also include retailer Canadian Tire and Ontario's Ministry of Transportation. While the ministry offered no financial assistance, it owns the sites leased to ONroute, so its participation was needed for this agreement to move forward.

Neighbouring Provinces & States

In Ohio, the VW Mitigation Grants help fund the installation of publicly available DC Fast Charging EC stations in Ohio counties. In 2021, Ohio Environmental Protection Agency (EPA) awarded approximately $3.28 million in grants to support the installation of more than 600 publicly accessible Level 2 EV charging ports at over 170 locations in 22 counties.[16] In partnership with the Northeast Ohio Area Coordinating Agency (NOACA), the City of Cleveland applied for and received grant funding for two EV charging stations through the Ohio EPA's disbursement of the Volkswagen Mitigation Trust Fund. Across Cuyahoga County, 22 charging stations received funding through the OEPA grant program and will be implemented over the next two years. Along with a $3 million allocation toward regional EV charging stations from NOACA, Sustainable Cleveland is hopeful that residents, employees, and visitors to the city will continue to see accelerated development in robust EV infrastructure.[17]

In New York, the City of Rochester has installed 24 public EV charging ports at several City-owned facilities, including municipal parking garages, City Hall, the Public Market, and the Port of Rochester. Placing additional charging stations at locations where people work, shop and recreate will further encourage the adoption of EVs. Installing the charging stations in conjunction with public education and awareness provides an

[14]Wellington County. News and Notices. https://www.wellington.ca/Modules/News/index.aspx?feedId=44678d8e-66d0-4745-9af9-31ac1a8c708d&newsId=d2e84ce0-ca9a-4bac-9d24-37452788b6dd

[15] Syed, F. (2021). Electric vehicles in Ontario: a look at Doug Ford's love-hate relationship. *The Narwhal*. https://thenarwhal.ca/ontario-electric-vehicle-policy/

[16] Ohio Environmental Protection Agency. (2022). *VW Mitigation Grants.* https://epa.ohio.gov/divisions-and-offices/environmental-education/grant-programs/vw-mitigation-grants

[17] City of Cleveland. (2021, April 6). *City of Cleveland Daily News Updates*. https://www.clevelandohio.gov/04.06.21GeneralUpdates

opportunity for synergy between implementation actions. Potential partners include large employers, institutions, businesses and apartment buildings/complexes.[18]

In Quebec, there are approximately 450 public Level 3 (DC Fast Charger) stations and 1,700 Level 2 stations, with the highest concentration of DCFCs in and around Montreal (130) and Quebec City (30). There are also DCFC stations strategically placed along major highway arteries including the A15, Trans-Canada, Hwy 40, and around the Gaspe Peninsula, with distance between stations ranging from 20-50 km. The provincial utility, Hydro-Québec, has installed most of the charging infrastructure. Quebec currently has the largest incentives for EVs: $7,000 for new EVs and $3,500 for used.[19] There are currently over 130,000 battery and plug-in hybrid EVs registered in Quebec, and they also accounted for 43% of all new ZEVs registered in Canada in 2021.[20,21] Despite this progress, there are no DCFC stations, and only two Level 2 stations, in the northern half of the province[22]. This presents an opportunity to facilitate province-wide network development. This is further justified by the Province's mandate to have Hydro-Québec increase the number of DCFCs to 2,500 by 2030. In addition, Hydro-Québec will be constructing 4,500 Level 2 charging stations in collaboration with relevant municipalities and municipal organizations, mainly in city centres.[23]

Current and Forecasted Electric Vehicle Registrations

Our approach focused on the data compiled by NII, as well as making use of the information available through Natural Resources Canada for provincial EV adoption, and working with the Ministry of Transportation, Transportation Safety Division, Drivers & Vehicles Services Branch of the provincial government to obtain light duty vehicle registration data.

Battery electric vehicle (BEV) and Plug In Hybrid Electric Vehicle (PHEV) registration data disaggregated by postal code (first 3 digits only) was obtained from the Ontario of Ministry of Transportation for the years 2018 to 2021. As per Figure 7, BEV registrations[24] in the Study Area increased from 1,155 to 3,476 during that time, with a compound annual growth rate (CAGR) of 48% in 2019, 35% in 2020, and 51% in 2021. This, despite the provincial EV rebate being eliminated in 2018, and the effects of the pandemic in 2020, and to a lesser extent, 2021. Of note, PHEV registrations in 2018 were similar to BEV (1,329), however their CAGR has been significantly lower, with a maximum of 24% in 2021. As a result, there are only 2,229 PHEV registrations as of the end of 2021. Note that since data was requested for 2018 on, no CAGR rate was available for 2018 as it required 2017 data for use as a baseline.

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[18] City of Rochester. (2021). *Rochester Climate Action Plan.* https://www.cityofrochester.gov/climateactionplan/
[19] Government of Quebec, 2022. *Government Rebates.* *https://vehiculeselectriques.gouv.qc.ca/english/rabais/rabais-offert-gouvernement-du-quebec.asp*
[20] Government of Quebec, 2022. Electric Vehicles and Charging Stations. https://vehiculeselectriques.gouv.qc.ca/english/decouvrir/decouvrir-ve-recharge.asp
[21] Statistics Canada, 2022. *Automotive Statistics.* https://www.statcan.gc.ca/en/topics-start/automotive
[22] Plugshare, 2022.
[23] Government of Quebec, 2020. A Win-Win for Québec and the Planet – 2030 Plan for a Green Economy, Framework Policy on Electrification and the Fight Against Climate Change.
[24] Registrations includes all vehicles fit to be on the road (does not include inactive vehicles); it is not referring to new registrations only

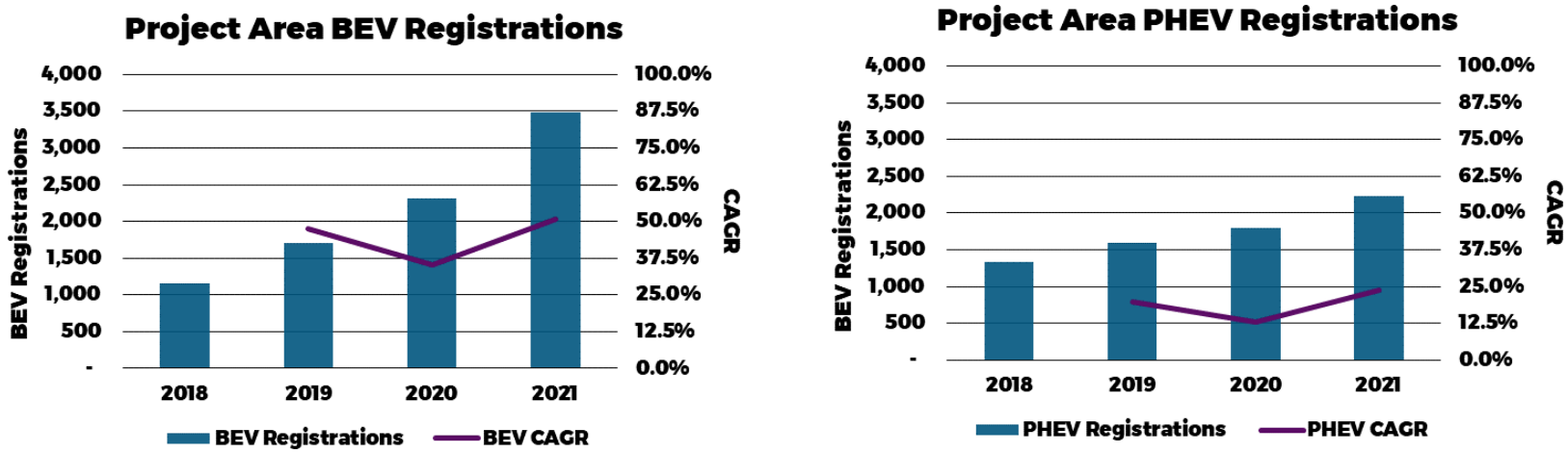


Figure 7. BEV and PHEV Registrations and CAGR in Project Area from 2018 to 2021

As an example of the effects of a community-led EV infrastructure project on BEV registrations, the Accelerate Kootenays project in southeastern BC, a collaboration of three BC regional districts resulted in the installation of 13 Level 3 (DC Fast Charger) stations and 30 Level 2 stations in 2018. BEV registrations, according to data obtained by the Insurance Corporation of BC, have risen over nine-fold since 2017, from 44 to 410. The CAGR grew from 69% in 2017, to 98% and 114% in 2018 and 2019, respectively.

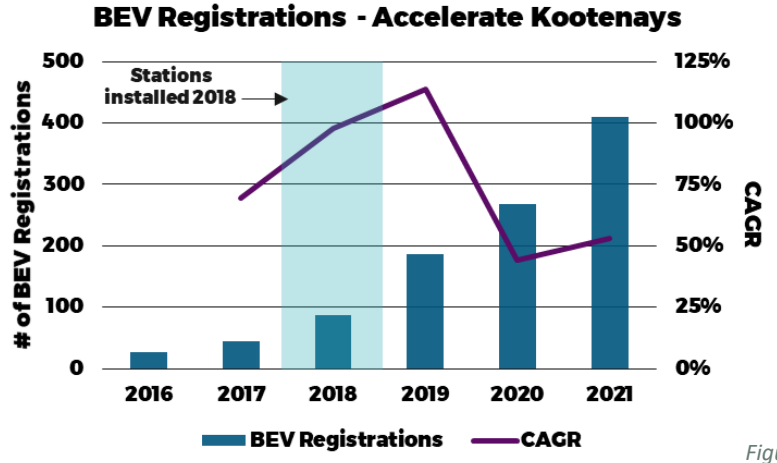


Figure 8. Accelerate Kootenays BEV Registrations

The project was also a key precursor to additional EV infrastructure from electrical utilities operating in the area (FortisBC, and BC Hydro). There are now 34 Level 3 (DC Fast Charger) stations and 67 Level 2 stations throughout the Kootenays,[25] much of which would not have been possible without Accelerate Kootenays to catalyze infrastructure development.

With respect to forecasted EV adoption, the Government of Canada has mandated that 100% of new vehicle sales be zero-emission by 2035. For the purposes of this Project, it is assumed that 100% of those sales will be BEVs. As a result, the number of BEVs on the road within the Study Area will rise accordingly at a CAGR of 30-35% per year to 2030 and tapering off by 2035 as they reach 100% of new sales. Total BEVs will continue to rise beyond 2035 as fossil fuel vehicles are retired, eventually reaching 99% of the overall fleet by 2045,[26] and a projected maximum of 520,000 by 2050 as per Figure 9. This forms the Business-As-Usual (BAU) Forecast from which the Project will be compared against.

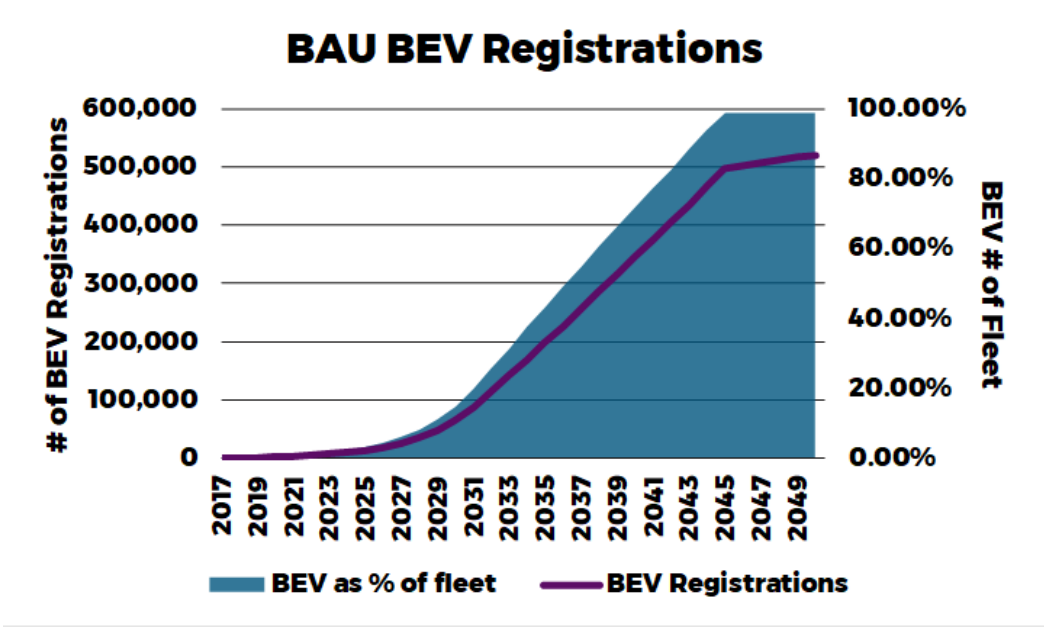


Figure 9. BEV Projections to 2050 under BAU Scenario

[25] Plugshare, 2022. https://www.plugshare.com

[26] A maximum threshold of 99% of vehicles as BEVs (1% as ICEs) has been assumed to account for some vehicle owners retaining their ICEs.

Co-benefits of EV adoption

The installation of an EV charging network can bring additional benefits to a region including bolstering economic development opportunities for local businesses in rural communities and enhancing tourism experiences.

1. **Local – residents**

As evidenced by the resident survey, there are several residents in the Study Area who simply aren't confident in EV technology yet to transition to an EV. And yet, owning and operating an EV can be much cheaper than driving a gas car. EV drivers can save money on fuel and maintenance. EVs have far fewer moving mechanical parts than gas-powered vehicles, so there's a lot less to go wrong. Braking is different in an EV, with the vast majority of slowing and stopping performed by regenerative braking. So, an EV's traditional friction brakes are used much less. Anecdotal evidence from drivers suggests those friction brakes can last up to 300,000 km or more before requiring replacement.

2. **Local - tourists**

A testimonial from a café in a small town in rural BC attests to the economic benefit that can come with facilitating more EV travel in a region:

> ***"I've noticed A LOT of drivers who stop to charge will come into the Dragonfly Cafe for breakfast, lunch or coffee and snacks, and as a small business owner in a small community, I'm thrilled the charger is here. I think many drivers are happy to have a reason to stop in our great town, and we're grateful for the additional business these travelers bring."*** **~Lamiah, Owner, Dragonfly Cafe, Salmo**

EV ownership is growing exponentially, and federal targets for ZEV sales will prop up this growth even more. So, it follows that many tourists will be looking to travel to and within the Study Area in their primary vehicle, an EV. It is therefore critical that when they are planning their trip, they see several options to charge. Many EV drivers acknowledge that when they plan a road trip, they look at charging options first, and build the experiences around that.

3. **Environmental**

The environmental legacy of an EV charging network like the one proposed in this strategy will continue to be realized post-implementation as more residents and visitors adopt EVs. The implementation of even Phase 1 of the Level 3 (DC Fast Charger) stations will create immediate environmental benefits through reduction in gasoline consumption and reduction of GHG emissions because of adoption of EVs locally. Fewer gasoline cars driving through the region means better air quality[27]. In addition, as EV adoption grows, so too might interest and investment in renewable energy.

[27] WDG Public Health report Climate Change and Health Vulnerability Assessment

SECTION FOUR Regional EV Charging Network Strategy

Objective

The Partners set out to develop a regional EV charging network strategy for both Level 3 (DC Fast Charger) and Level 2 EV chargers. The scope includes 'universal' chargers (those accessible by most types of EVs) and does not include proprietary chargers and charging infrastructure (namely, Tesla vehicles and equipment).

EV Chargers 101

Level 2 EV Charger

Level 2 chargers are very common and can be found at community centres, parks, shopping malls, hotels, parkades and rest areas. Electric vehicle owners typically install one in their home garage using a 240v connection.

These charging stations use the J1772 plug except for Tesla versions, which of course use the Tesla plug. They provide more power than a regular household outlet and most vehicles will gain 20-40km of range per hour of charging.

Level 3 EV Charger

Level 3 charging is better known as Direct Current Fast Charging (DCFC) or simply 'fast charging'. These charging stations enable most EVs to charge to 80% in under an hour, making road trips easier and quicker.

Current EV charging stations in Study Area

The following image (Figure 10) summarizes the existing electric vehicle charging stations (location, type, and ownership) in the Study Area. There are 22 Level 3 (DC Fast Charger) and 145 Level 2 EV charging stations currently available. Table 1 provides a summary of the location and site where the current Level 3 (DC Fast Charger) EV chargers are installed. Table 1 – Location of Existing DCFC Chargers

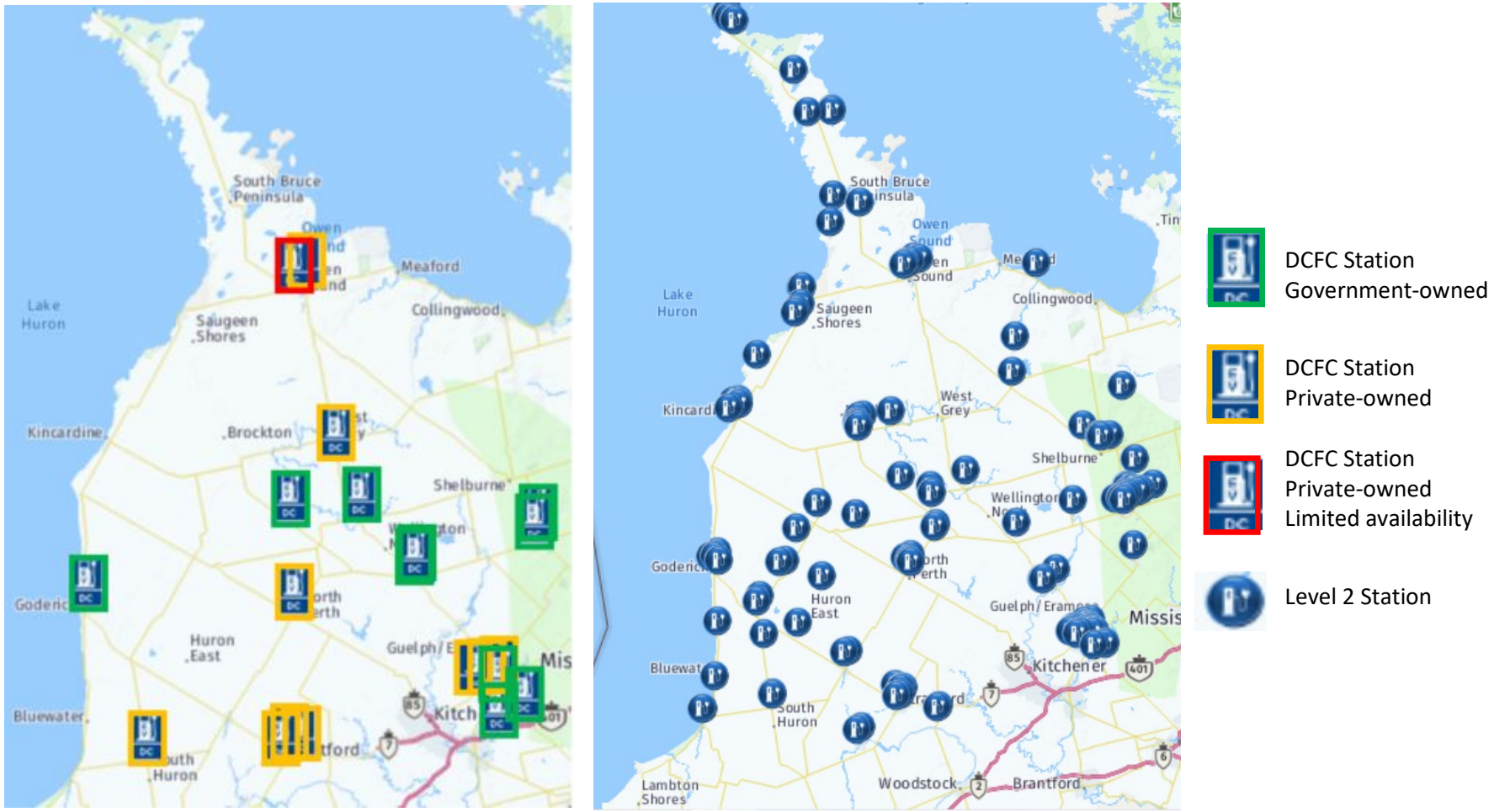


Figure 10 – Existing Level 3 and Level 2 EV charging stations in Study Area.

Table 1 – Location of Existing DCFC Chargers

Community	Station
Owen Sound	Hal Wright Chevrolet Cadillac GMC Buick
Owen Sound	Comfort Inn Owen Sound
Durham	Pebbles Restaurant
Goderich	Goderich Tourist Information Centre
Listowel	Scotiabank
Arthur	Arthur Library and Medical Center
Arthur	Arthur Arena & Pool
Mount Forest	Mount Forest Downtown Parking Lot
Clifford	Clifford & Community Arena
Exeter	Tim Hortons
Stratford	Scotiabank
Stratford	Bank of Nova Scotia - Retail Service Centre
Stratford	Canadian Tire
Guelph	Barry Cullen Chevrolet Cadillac
Guelph	Guelph VW
Guelph	Denny's
Guelph	County of Wellington
Wellington County	ONRoute Cambridge North
Wellington County	ONRoute Cambridge South
Puslinch	Puslinch Library
Orangeville	Dufferin Courthouse
Orangeville	Orangeville VW

Approach & Methodology

Siting Criteria

The first step in developing a regional EV charging network strategy was a CEA-facilitated workshop with the Partners to develop siting criteria. The workshop expanded on the outputs of the Resident and EV Driver surveys and allowed the Partners to jointly develop criteria for site selection, ultimately with an emphasis on tourism, economic development, and optimization of co-benefits to site hosts. The following image (Figure 11) is a summary of siting criteria developed by the Partners for this project and is applicable to both Level 3 (DC Fast Charger) and Level 2 EV chargers. Siting criteria serves as a guide to the Partners to evaluate proposed charging station locations. The Partners can choose to require all, most, or some of the criteria be met when evaluating potential locations.

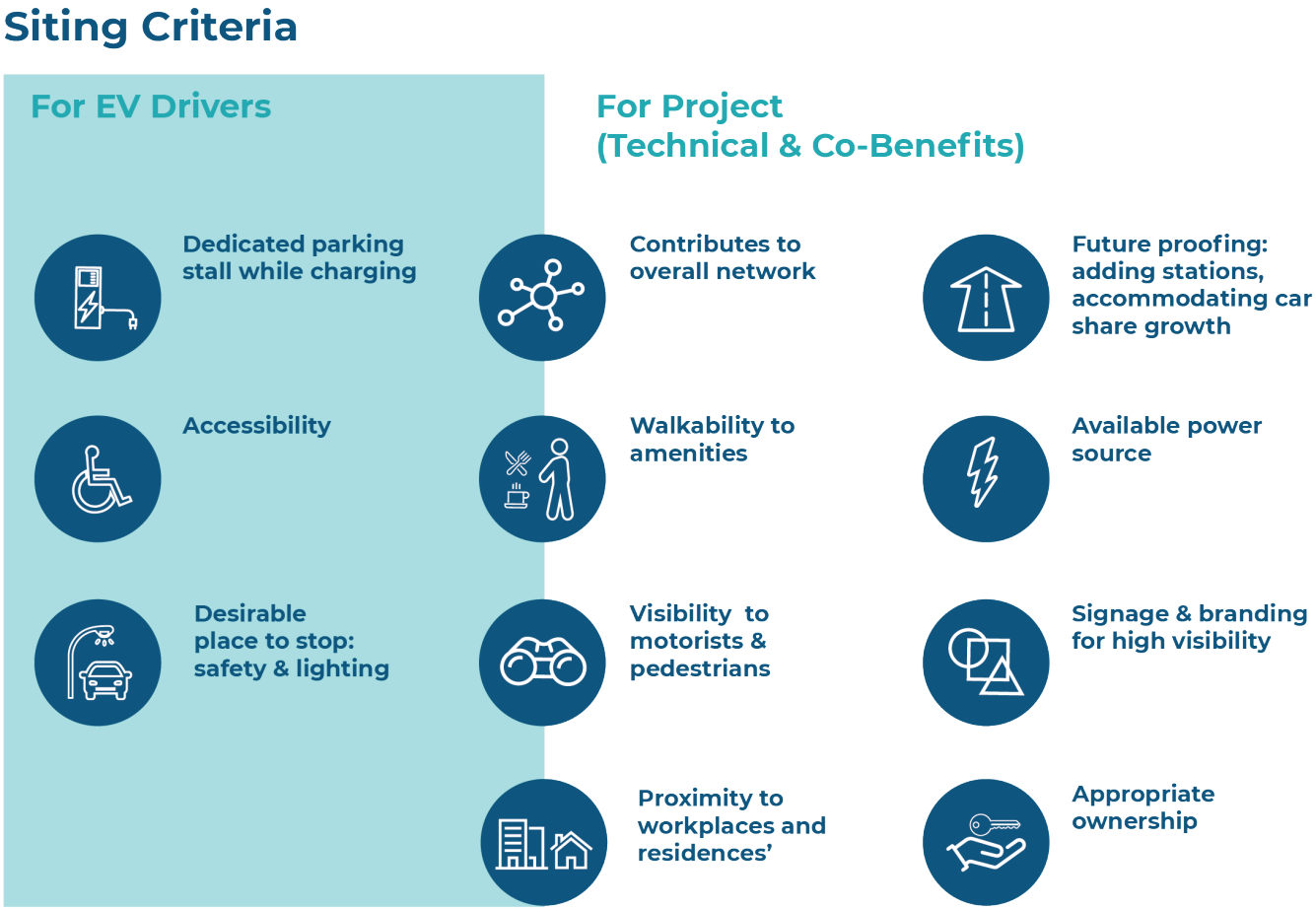
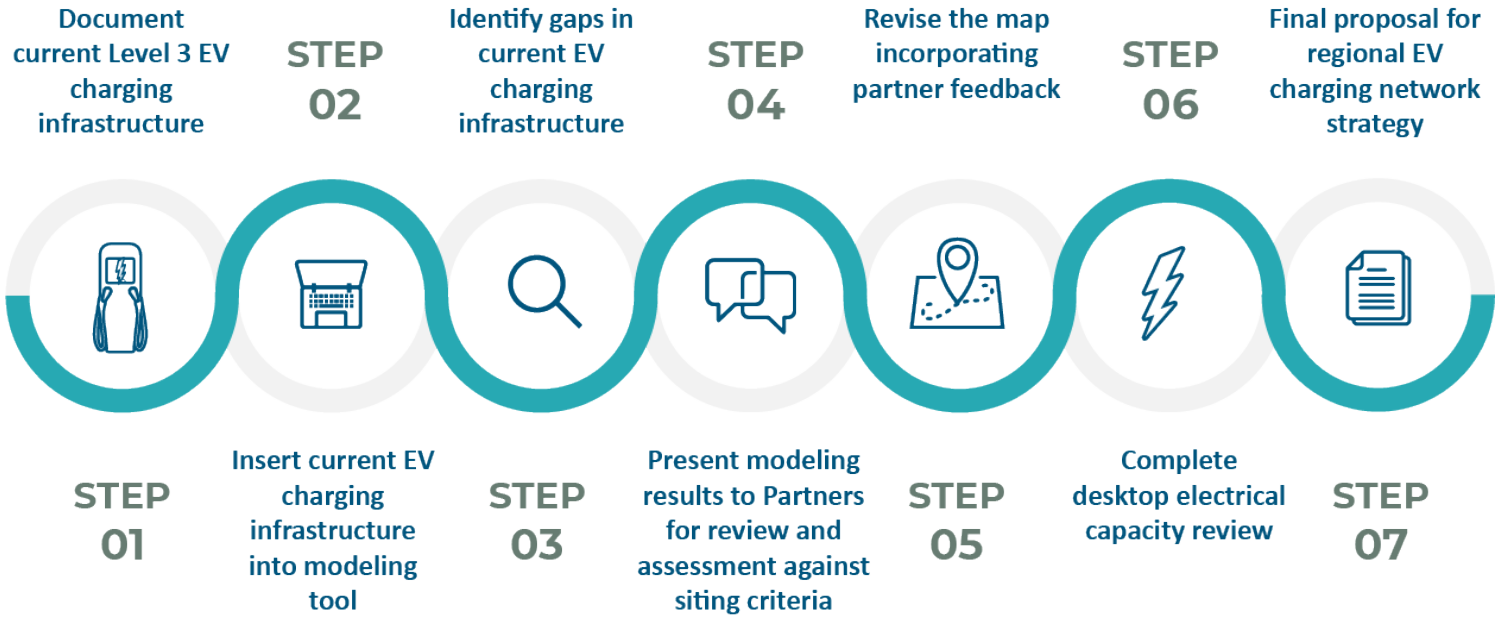


Figure 11. Partner developed siting criteria for regional EV charging network Applicable to identifying locations for Level 3 and Level 2 EV charging stations. The criterion in the left column is focused to EV drivers, the criterion in the right column is focused to the Project.

Level 3 Charger Network

The following is a summary of the process completed by the Partners to identify the proposed Level 3 (DC Fast Charger) EV charging station locations.



- **Document current Level 3 EV charging infrastructure.** For the analysis of existing charging stations in the study area, CEA reviewed publicly available datasets such as those provided by PlugShare, ChargePoint, and Ontario's Ministry of Transportation.
- **Insert current EV charging infrastructure into modeling tool.** CEA employed the BC Institute of Technology (BCIT) proprietary modelling software which can be customized to consider different vehicle types, climate, number of passengers and terrain.
- **Identify gaps in current EV charging infrastructure.** CEA analyzed outputs from the BCIT modelling software to determine where current gaps in charging infrastructure preclude drivers from moving across the region. This is shown in Figure 12: with the current infrastructure, EV drivers can only travel along the routes highlighted in blue. Traveling outside of these routes would be beyond the car

battery range and the driver may become stranded. This means the businesses and tourist attractions along those routes cannot participate in the EV driver economy.

- **Identify new EV charging station locations to close gaps.** The model CEA created represents a reliable network layout that can inform the number and general location of stations. Standard practice is to identify EV charging infrastructure and overall network design assuming a cold-weather climate (0ºC) with multiple passengers (2), to ensure we are designing to the lower end of expected EV range.
- **Present modeling results to Partners for review and assessment against siting criteria.** Using the initial output from the model, CEA convened a workshop with the Partners to refine the proposed network design and leverage their local knowledge and context. Local input is key at this stage as it allowed CEA to adjust proposed locations to reflect local priorities and consider real-world travel patterns. This balances convenience to drivers while maximizing benefits for communities and the region as a whole.
- **Revise the map incorporating Partner feedback.** CEA updated the BCIT model to reflect local priorities and opportunities.
- **Complete desktop electrical capacity review.** At the onset of the project, the Partner established a Technical Advisory Group (TAG). The TAG included representatives from utilities and electrical distribution companies servicing communities across the project Study Area. The role of the TAG was to review the proposed Level 3 (DC Fast Charger) station locations and provide feedback to the Partners as to the electrical capacity of proposed sites. At a minimum, Level 3 (DC Fast Charger) stations need access to 3-phase power. Appendix 2 is an excel spreadsheet and provides a summary of proposed sites including street addresses as well as the outcome of the desktop technical feasibility assessment completed by the TAG.

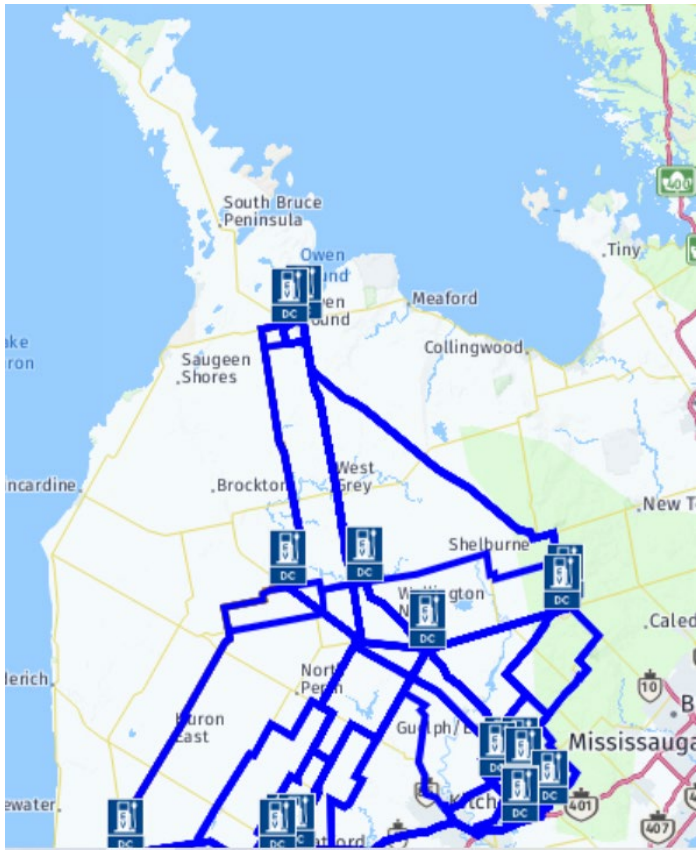


Figure 12. Map of existing Level 3 charging stations in Study Area. Blue lines indicate the feasible highways/routes that an EV driver must travel to ensure they arrive at their destination.

- **Final proposal for regional EV charging network strategy.** CEA updated the strategy to incorporate TAG review findings and then presented the findings to the Partners.

Level 2 Charger Network

The process for identifying locations for banks of Level 2 EV chargers was very similar to the approach for determining Level 3 (DC Fast Charger) EV charging locations. This process was completed after the Level 3 (DC Fast Charger) EV charging locations were identified, as the goal for the banks of Level 2 EV chargers is to support and complement the proposed Level 3 (DC Fast Charger) EV charger network and target locations that are appropriate for a longer dwell time. These locations are typically destinations, attractions, recreational areas, and accommodations. Potential locations for banks of Level 2 chargers were identified via input from:

- Partners
- Review of regional tourism association reports
- Tourism association representatives
- Noteworthy attractions and destinations
- Popular travel routes

Of note, a desktop electrical review of proposed Level 2 EV charger banks was not completed. Key next steps in advance of installation are:

Further engagement with utilities and electric service providers to confirm electrical capacity for banks of Level 2 EV chargers (install will require 40amps per charger).

Further discussion with regional municipalities to confirm proposed sites both satisfy siting criteria and are fit-for-purpose given local context.

Regional EV Charging Network Strategy

The regional EV charging network strategy proposes the installation of a minimum of two Level 3 (DC Fast Charger) stations (100kW or greater) at each identified location and a 'bank' (four or more charging stations at one location, see image to the right) of Level 2 chargers (<20kW) at each identified location. The current iteration of the strategy does not have Level 3 (DC Fast Charger) stations and banks of Level 2 chargers installed at the same location. Given the volume of amenities, services, attractions, businesses etc. available across the Study Area, banks of Level 2 chargers will ensure there is sufficient infrastructure to support the growing demand for public charging and reduce volume on Level 3 (DC Fast Charger) EV charging stations which have been intentionally sited to facilitate cross-regional travel.

Bank of Level 2 charging stations installed in Toronto Zoo carpark.

Level 3 (DC Fast Charger)EV Stations

Modeling results indicate the Study Area requires 17 additional Level 3 (DC Fast Charger) sites distributed across the region to create a complete charging network. This number of charging stations will ensure the majority, if not all the highways (primary, secondary and tertiary) across the Study Area are travelable for EV drivers. For ease of reference, we have identified potential locations using the name of the community; the final EV charging station location could be sited within the municipal boundary or in the surrounding county. The 17 locations are:

1. **Bluewater**
2. **Durham**
3. **Ferndale**
4. **Flesherton**
5. **Kincardine**
6. **Lion's Head**
7. **Listowel**
8. **Lucknow**
9. **Mitchell**
10. **Paisley**
11. **Seaforth**
12. **Shelburne**
13. **Southampton or Saugeen Shores**
14. **Thornbury**
15. **Tobermory**
16. **Wiarton**
17. **Wingham**

Level 3 (DC Fast Charger)EV Stations

The proposed locations are visually summarized in Figure 13 along with the 22 existing Level 3 (DC Fast Charger) stations across the region. Stations with green boxes are those that will be added in Phase 1, while orange boxed stations will be added in Phase 2. Those without a colored box are already existing.

As discussed, there is currently minimal EV charging infrastructure in the Study Area. The modeling process identified the need for 17 additional DCFC charging station locations to ensure connectivity across all major routes and travel corridors in the region. This is a significant amount of infrastructure (estimated cost of $130K+ per install) and may not be achievable in a single phase, though joint procurement can be an effective and efficient approach if the appropriate funding opportunity arises. CEA has proposed two phases of implementation. Phase 1 will build the baseline network (Figure 14) required to facilitate travel from corner to corner across the Study Area. Phase 1 stations include Tobermory, Wiarton, Durham, Kincardine, Shelburne, Wingham, Listowel, Bluewater, Flesherton, Thornbury, Lucknow, and Paisley. Phase 2 will increase the EV charging locations across the Study Area and is dubbed the 'Robust' network (Figure 15). Phase 2 stations include Mitchell, Seaforth, Southampton or Saugeen Shores, Lion's Head and Ferndale. The following images (Figure 14 and Figure 15) show the difference in connectivity across the region at the completion of the two phases. See Appendix 3 for an image summarizing connectivity across the Study Area at completion of Phase 2 and how the proposed network will connect to the existing Level 3 EV charging infrastructure outside the Study Area.

Figure 13. Study Area map including existing and proposed (17) Level 3 EV charging stations.

*Figure 14. Regional EV charging network (including existing stations) after installation of **Baseline/Phase 1** (12) Level 3 EV charging stations. Blue lines indicate which routes are travelable by an EV without any range limitations.*

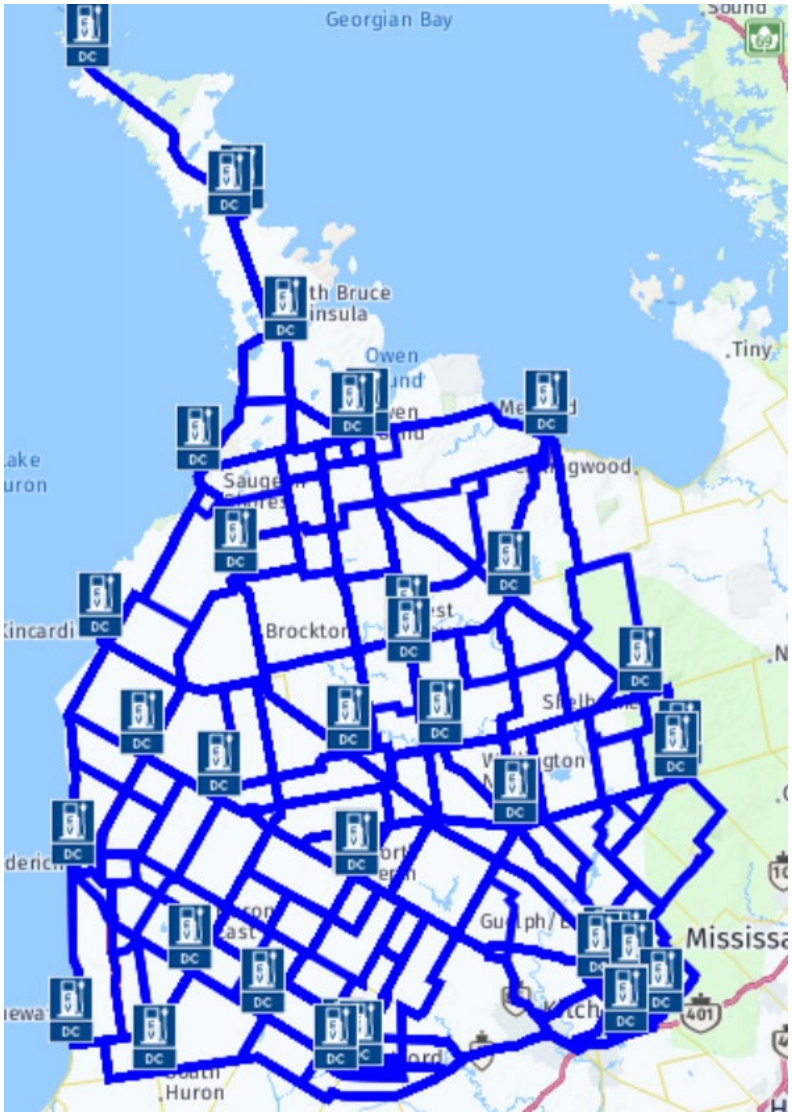


*Figure 15. Regional EV charging network (including existing stations) after installation of **Robust/Phase 2** (5) Level 3 EV charging stations. Blue lines indicate which routes are travelable by an EV without any range limitations.*

As part of the development of the regional EV charging network strategy, the Partners, in collaboration with representatives from all municipalities in the Study Area had an opportunity to collaborate and identify potential sites within each location to host the Level 3 (DC Fast Charger) EV station. Appendix 2 provides a summary of proposed sites including street addresses as well as the outcome of the desktop technical feasibility assessment completed by the TAG.

Environmental Benefits of Level 3 EV charging network

Calculations and modeling were undertaken based on the proposed EV charging stations of phases 1 and 2 to demonstrate the environmental benefit of the charging network. This modeling includes forecasted local adoption of EVs because of the project as well as use of the network by visitors. Calculations included greenhouse gas (GHG) emissions and air pollutants avoided due to fuel switching. These results were compared against a business-as-usual (BAU) case where the project does not go ahead, as per Figure 16. However, the BAU case does include the Federal mandate that 100% of new passenger vehicles sold will be zero-emission by 2035. This is reflected by the gradual decrease emissions after 2030 in the BAU scenario (blue line).

The results indicate a positive outlook from a GHG emission perspective and cost savings for fuel consumption. For specific outputs from the model for the years 2025, 2030, and 2040, as well as other environmental benefits, see Appendix 4.

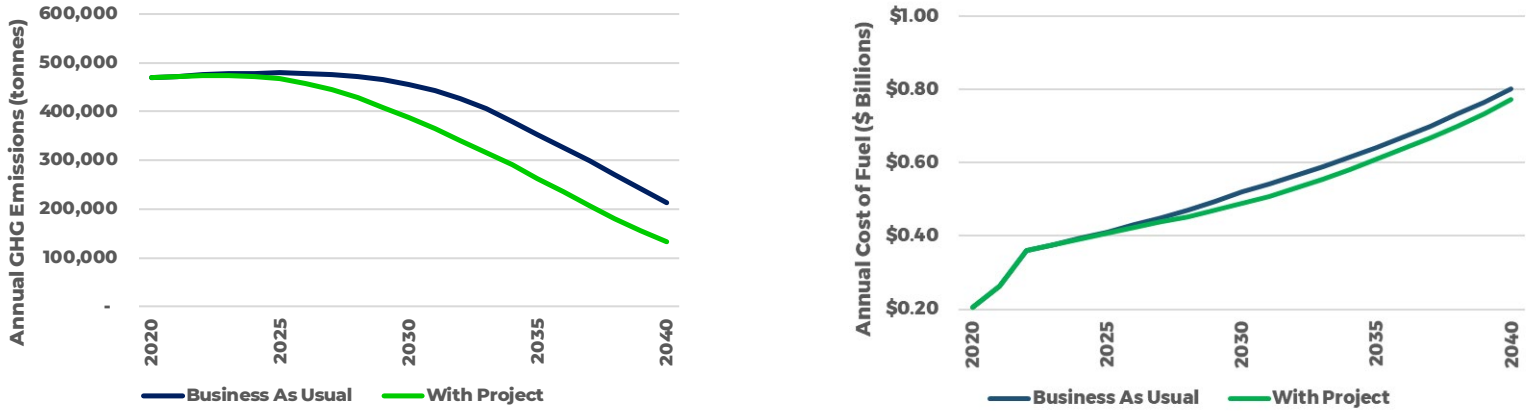


Figure 16. GHG Emissions Reductions (left) and Energy Costs (right) of Project vs. BAU

Level 2 EV Charging Stations

In addition to the 17 proposed Level 3 (DC Fast Charger) EV stations, this strategy presents a ranking of priority locations for banks of Level 2 EV chargers. The priority ranking results from a review of each location against the siting criteria and as compared to the proposed locations for Level 3 (DC Fast Charger) EV stations (e.g., proximity to nearest existing or proposed Level 3 EV charger). Appendix 5 provides the full list of identified locations and sites for Level 2 EV charger banks as well as the priority ranking for implementation.

The priority ranking and proposed sites for Level 2 EV charger banks are provided to inform further discussion amongst the County, municipality, and community stakeholders.

Nature Appreciation Assessment

Of the number one priority ranking proposed Level 2 EV charger station locations (13 locales), which are summarized in Appendix 5, all of the proposed locations are noted for the opportunity of the EV Driver to participate in nature appreciation be it through close access to trails, natural spaces, parks etc.

33 Victoria St N, Southampton, ON N0H 2L0	11 Lakeshore Blvd N, Sauble Beach, ON N0H 2G0	5 Lakeshore Blvd N, Sauble Beach, ON N0H 2G0
12 Nelson St E, Meaford, ON N4L 1N6	80 Dundalk Street, Dundalk ON	341 10th Street, Hanover ON
377 Gypsy Ln, Blyth, ON N0G 2W0	9 Huron Road, Mitchell, ON	5 James St N, St. Marys, ON N4X 1B1
386 Church St S, St. Marys, ON N4X 1C2	51 Main St, Erin ON	6 The Square, Bayfield, ON N0M 1G0
14 Main Street West, Drayton ON		

Level 2 EV Charger Costing

The cost of a Level 2 EV charger varies from manufacturer to manufacturer. As of 2022, networked charging stations range in value from $4,500 - $6,500. Prices vary depending on manufacturer.

In addition to the equipment cost, additional costs that need to be accounted for when budgeting for Level 2 EV charger installation includes equipment shipping, station cable management, electrical cabling, trenching, line painting, signage and protective posts plus install etc. These costs are highly variable and difficult to estimate without accounting for the specific context of the chosen site. CEA's experience with several dozen Level 2 EV charger installations estimates this cost to range from $15,000 - $25,000.

When contemplating Level 2 EV charger purchase and installations, costs savings and efficiencies can be realized by installing multiple chargers at one location. This way, the costs for electrical cabling, trenching, etc. are shared amongst the many units.

In addition to initial implementation costs, there are operating costs such as warranty and networking fees. CEA's previous experience with equipment operation estimates these costs to range from $300 - $700 annually.

CEA has supported several communities with Level 2 EV charger station implementation and has developed the Level 2 Owner's Toolkit to support municipalities and ensure they have all the information necessary (e.g., FAQs and responses, EV 101, EV Charging 101) to benefit from electric travel.

SECTION FIVE Options for Implementation

The following is a discussion (i.e., pros and cons) on the various approaches to implementation from CEAs perspective and experience with implementing EV charging station networks beginning with a discussion on different types of collaboration models.

Collaboration Models

Regional Collaboration

Regional scale deployment of EV charging infrastructure has proven successful in several regions across Canada, particularly in locations where private sector is less inclined to invest (dispersed small to medium and rural communities and regions). There is an opportunity for local and regional governments to support early adoption of electric vehicles locally and promote EV tourism through the facilitation of regional network development. Regional collaborations have been an effective way to streamline procurement, maximize leveraged funding and ensure consistency in the technology, operations, and maintenance of a network. For small to medium sized communities, managing the procurement, funding, reporting, project management and on-going operations and maintenance for Level 3 (DC Fast Charger) equipment in particular can be a significant burden, from both a staff capacity and financial perspective. If there is a desire to continue a collaborative approach in the deployment of an EV charging network across the Study Area, it is recommended that a lead community be identified, and that either a dedicate staff or a contracted external project manager support the process of applying to funding and overseeing the procurement and project management process. With a collaborative model, there are two options:

1. **Install all stations. through a single procurement and funding process**

   There is benefit in preparing a funding application on behalf of all sites, as long as each site location is confirmed to meet all criteria and specifications, and that the landowner for the site has confirmed willingness to enter into a license of occupation. There can be cost efficiencies in a major infrastructure project, and potential opportunity for proponents to offer competitive pricing and value add. Construction costs can be minimized through pre-fabrication and effective deployment scheduling. The primary challenge with this approach is the securement of sufficient funding to offset the capital cost of the project. Funding opportunities are discussed in the following section. This approach may be of interest to utility and distribution companies, as there may be opportunity to optimize load management. Typically, funders like to see approaches that are collaborative and demonstrate maximized benefit for their investment. Deploying a complete network to connect a dispersed region in a collaborative manner maximizes impact and provide immediate benefit to the region.

2. **Install stations in multiple phases.**
   In cases where sufficient funding is not available, or regional nuances in utility and distribution companies requires a more localized approach to deployment, it may be necessary to facilitate a phased deployment approach. Or the Partners may determine that a sub-regional approach is more appropriate. Phasing the deployment would be most effective if priority locations still supported broad regional connectivity, building and densifying stations with each phase. This approach may result in opportunities to split ownership and long-term operation (see options for ownership and operation below). The timeline for deployment will be significantly longer, as there will be multiple procurement rounds, and construction is typically limited to months outside of November – March due to the incremental cost of working in the winter.

Individual approach

The output of the model can be used to inform individual site host installations. This approach would require that each site host/community secure the funding and manage the procurement, installation and coordination of operations and maintenance individually. This option is less desirable due to the already constrained capacity of local governments.

Hybrid approach

There may be situations where certain communities are ready to proceed with an installation sooner than others, which may warrant an approach whereby some communities proceed independently of a coordinated procurement approach. Communities are encouraged to consider the site criteria and specifications identified by the Partners to ensure consistency in the experience, quality and long-term operations and maintenance of the infrastructure.

Models for ownership, operations and maintenance

The following summarizes, at a high-level, the options available to the Partners for ownership, operations and maintenance.

Third-Party Ownership and Operations

When it comes to ownership and long-term operations of Level 3 (DC Fast Charger) infrastructure, it is strongly recommended that small to medium sized local and regional governments identify opportunities for external ownership and management of the asset. Level 3 infrastructure has a high replacement and operational cost. Local and regional governments should play an enabling role in the deployment of Level 3 infrastructure, including securing capital funding. The Partners have confirmed the preference of external ownership and operation for Level 3, though all options are explored in a high level of detail below.

There is precedent for this approach. With funding confirmed for implementation of the full network, the Peaks to Prairies partners in southeast Alberta sought to identify a partner to install, own and operate the charging equipment at all twenty of the stations identified through the development of their plan. Such a partnership would lift the burden and liability from small communities to own and maintain the charging equipment while allowing them to gain maximum co-benefits from the investment.

A competitive Request for Proposal (RFP) process was developed and managed by project partners, and ultimately ATCO, an Alberta-based utility and energy company was selected as the successful proponent. ATCO would become the long-term owner and operator of the equipment, and Quebec-based FLO the network operator. The final siting and technical confirmation, equipment selection and procurement, construction, commissioning and operations and maintenance was all managed by ATCO. Service level agreements (i.e., the minimum expected operational standard) were adopted through the licenses of occupation. The Partners managed funding applications, the RFP process and supported the site selection, working with communities to identify the best location.

As similar approach could be taken by the Partners for the Study Area, streamlining the procurement and deployment of the network. It is recommended that the Partners aim to have sites selected and be in an advanced state of readiness. Specific to the NRCan ZEVIP opportunity, the partners may wish to consider issuing a call for partners and identifying a preferred implementation partner to submit a ZEVIP application on behalf of the collaboration. The business case for private sector or utility ownership improves when funding is secured to cover capital costs.

Municipal Ownership and Third Party Operations

Though a less desirable structure from the perspective of the Partners, should the communities feel comfortable with the ownership of Level 3 (DC Fast Charger) equipment but wish to not own and operate the equipment, a structure could be established whereby the operations and maintenance of the infrastructure is managed by a third-party. The burden of demand charges, asset replacement and repair and networking fees would remain with the local government. The local government would also have to pay for the operations and maintenance service, though this could be structure on a regular maintenance program, or as needed basis.

Funding options for implementation

Funding opportunities for EV charging stations are continually coming available. The following is a summary of what is available to the Partners as of the writing of this report.

NRCan ZEVIP

Natural Resources Canada will be launching a Request for Proposals (RFP) under the **Zero Emission Vehicle Infrastructure Program**(ZEVIP) on May 5, 2022. This RFP will target electric vehicle charging and hydrogen refuelling infrastructure projects in public places, on-street, workplaces, multi-unit residential buildings (MURBS) and for vehicle fleets. Funding is available for 50% of total project costs up to a maximum of $5 Million per applicant.

The ZEVIP is a $680M initiative that supports the deployment of a network of zero emission vehicle charging stations (Level 2 and higher) and hydrogen refuelling infrastructure in more localized areas where Canadians live, work and play.

Provincial partnership

Present strategic plan to regional MPP as an initial first step. Await outcomes of June 2022 election.

Private Funding

Approach private sector operating throughout the region, for example, Westario and Bruce Power turnkey Level 2 EV charger funding opportunity and EPCOR funding.

Municipal Funding

The site host funds each station.

Combination of Above

Each of the above funding options could be combined to full fund the network.

SECTION SIX Other Considerations

Solar PV Opportunities for Co-Location with EV Charging Stations

This briefing provides a summary of opportunities for integration of solar photovoltaic (PV) at electric vehicle (EV) charging infrastructure sites. Because there are so many variabilities to consider in planning solar integrated charging, this is a high-level summary of the context, options and considerations that should be made in the planning phase. Further engineering and detailed planning must be completed prior to any scale of solar PV installation.

Context

Local governments are often interested in exploring opportunities to integrate solar PV with electric vehicle charging infrastructure deployments. There are a variety of motivations for exploring solar PV, and some key considerations that need to be made to ensure the intended purpose is met.

Very generally, the study area has promising photovoltaic potential, assuming a south-facing aspect. The map below (Figure 17) indicates *annual average* photovoltaic potential. There is significant seasonal variability, and in the Study Area the months of November – February is limited in their photovoltaic potential, but still producing between 600-900 kWh/kWp. Solar PV is often installed with the knowledge that summer production offsets the lower production during the winter. Seasonal production for the study area can be explored at this link.

Ensuring solar is grid-tied with the ability to net meter or monetize the energy produced will improve the business case, given that depending on the size of the installation, more energy may be generated during peak months than consumed (variable according to the size on installation and demand of associated charging infrastructure). Solar installations can also integrate battery technology as an intermediary between the solar panel and grid, buffering demand charges and optimizing solar storage.

The following sections explore the motivations for integrating solar PV into an EV infrastructure deployment, and some of the key considerations when determining whether it is applicable to a specific location.

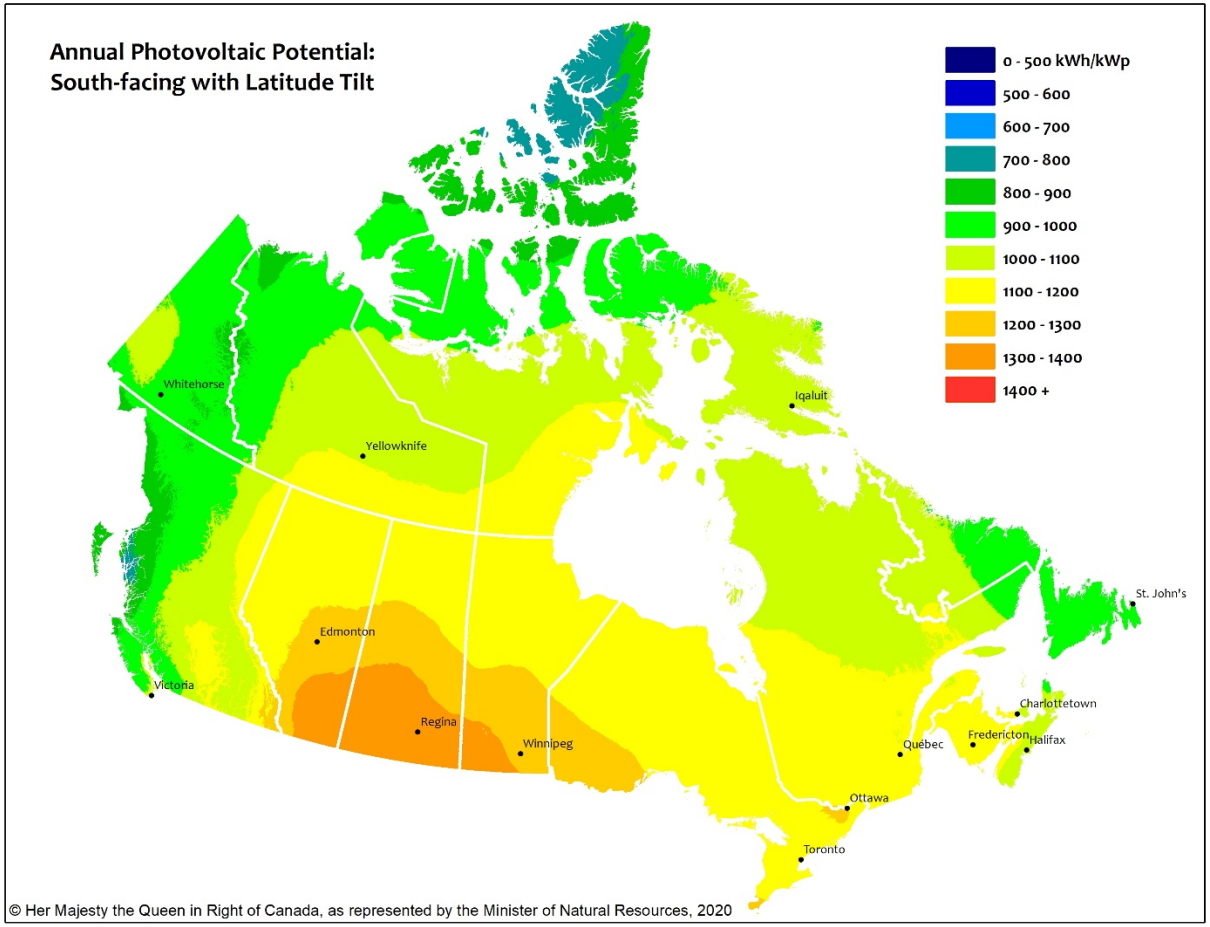


Figure 17. Annual average PV potential summary map of Canada, source - Source: https://www.nrcan.gc.ca/our-natural-resources/energy-sources-distribution/renewable-energy/solar-photovoltaic-energy/tools-solar-photovoltaic-energy/photovoltaic-potential-and-solar-resource-maps-can

Solar PV + EV Charging Infrastructure: Confirming the Purpose

There are a variety of reasons that a local government may pursue the integration of solar PV into a charging infrastructure deployment. The purpose will determine scale and budget and may also clarify the intended co-benefits of the installation. The location, siting, size, and number of charging stations will be affected by the intended purpose of co-located solar PV.

1) Small-scale Demonstration Solar PV

Solar PV array installed atop car park cover at Kimberly Platzl

The most cost-effective application of solar PV associated with municipally owned or supported EV charging infrastructure is a small demonstration installation associated with the charging unit. EV charging infrastructure is a perfect co-located technology for solar PV, as there is an opportunity to share a narrative with the public around electric mobility and clean energy. The intent of a small-scale solar PV installation is primarily about education and demonstration of emerging technology, less so about energy production to offset or support the electrical demand of the co-located EV charger. The City of Kimberley in British Columbia has an excellent example of a demonstration installation in their downtown core, integrating elements of local design and situated over a Level 2 charger.

2) Energy production/offset of grid electricity

A solar PV installation capable of producing sufficient electricity to offset or supplement an EV charging station would require a significant scale of deployment, and as a result, significant physical space for the installation. The scale of solar PV required would depend on the type of charger (Level 2 vs DC fast charger), however the primary barrier to meeting or supplementing the energy demand of the stations (independent of cost) is space. In a study done out of the University of Calgary, an assessment was completed on a single DC Fast Charging station in Red Deer. The researcher assessed the scale of solar required to offset the energy demand and found that solar arrays would need to cover significantly more spaces in a parking lot than the single space dedicated to the fast charger.[28]

A partnership with a utility or co-located building may be an opportunity to increase the scale of a solar installation associated with an EV charger, but it is not practical for a local government to provide exclusive solar energy for EV charging due to cost and space required.

[28] https://prism.ucalgary.ca/handle/1880/108761.

3) Integration with co-located building

To address a number of co-benefits, local governments may consider the strategic siting of EV charging near buildings where solar installations would be appropriate and provide both demonstration and energy production opportunities. The intent would not be to dedicate solar power to the charging infrastructure, but to promote co-benefit of solar on an adjacent building. This approach demonstrates a holistic approach to decarbonization and energy resilience, by promoting electric mobility and building application of solar.

4) Energy storage and load management

Battery-supported solar installations can be an effective way to manage load and demand chargers at EV charging sites. Like a demonstration install, this approach could be scaled to a size appropriate for the specific site. A battery would then be installed as primary energy storage, with excess going into the grid. There are examples of this approach in both large- and small-scale applications. The Oasis Project at the British Columbia Institute of Technology was an early example of battery supported solar PV with integration of EV charging infrastructure. [29]

More information about the options for integration of battery storage is explored and compared to traditional grid-tied deployment in this local government guide (Page 8).

Siting Solar PV: Primary considerations

As a community considering integration of solar PV into EV charging infrastructure deployments, there are several considerations that need to be made. Ideally, if the intent is to integrate solar on-site, the final site selection for the EV charging should be made to optimize the solar component of the site.

It is the assumption that a local government in the Study Area is mostly like to support a small-scale demonstration installation associated with an EV charger installation, potentially integrating battery storage. The considerations summarized below reflect that scale of installation. Should a unique partnership or funding opportunity arise to increase the scale of a solar PV installation, further considerations must be made and assessed with respect to local regulations around grid-tied systems. Further, significant engineering and site-specific plans must be completed to ensure the design is conducive to the intended use of the site (e.g., If using as a parking lot cover, how does snow shed? Does the design allow for continued parking lot maintenance, etc.?)

[29] https://www.bcit.ca/applied-research/smart-microgrid/projects/energy-oasis/.

Siting for Solar + EV Charging

While the concept of installing a single-stall car or EV charger solar PV cover may appear straightforward, to maximize the benefit of the solar, the siting and aspect is critical. At the same time, assuming the solar is co-located with the EV charging infrastructure, it is important to ensure that the site selected has all the technical specifications required for that infrastructure (access to appropriate power, site free of any subsurface utilities, proximity to amenities, etc.). It is not straightforward to identify sites that support criteria and specifications perfectly for both solar PV and EV charging. The following siting specifications are important to consider:

1) Solar aspect

   Solar panels should be installed to face south or just west of south to maximize solar gain. The location should be free of shading year-round, by either trees or buildings. Consider any future development in the vicinity.

2) Site Specifications + Vicinity

   Acknowledging the requirement for the solar PV to be south/southwest facing, consider the vicinity of the site to ensure there are no unintended interferences with surrounding assets or infrastructure. For example, where would snow shed from the panels? Is there a walking path, sidewalk or roadway onto which snow would shed, creating barriers and interference with movement of people, bikes, and cars? Is there potential for damage to the installation? Is there sufficient space for the charging infrastructure and associated transformers or other ground mounted equipment? Is there opportunity to expand off the site in the future?

3) Site Design

   Designing the infrastructure should consider year-round maintenance and access to the site. Ensure that there is sufficient space to access, maintain and replace (as necessary) the co-located EV charging equipment. Can snow and other debris be easily removed from the site? Can all sizes of vehicles access the EV charger? Consider whether the solar will be installed to cover just the EV charging infrastructure, or the vehicle stall(s) as well. The design of a stall cover should consider accessibility of equipment, and placement of any beams vs cantilevered design to keep the stall free of barriers.

4) Local electrical utility/provincial regulations

   Grid-tying the solar PV will maximize the benefit of the installation, and depending on local regulations, allow for net-metering. Integrating a battery as an intermediary could be beneficial, particularly where DC fast charging equipment is installed and will have associated demand charges.

Concluding Recommendations

For small local governments installing a base network of EV charging stations to benefit tourism and connectivity across a dispersed area, integrating solar PV should be considered as a value-add where the siting provides a natural opportunity. Ensuring the EV charging infrastructure siting is optimized for cost and co-benefits to the community should be the primary focus of the local government, with the application of solar considered where the specifications allow.

If there is opportunity to partner with a utility, distributor, or private sector partner to secure additional funding and expand a solar PV installation associated with EV charging, a larger scale deployment may be a viable option, assuming the site specifications are conducive to the infrastructure.

It is recommended that the local governments in the study area prioritize first the siting of EV charging infrastructure to areas that support the technical specifications while maximizing local community co-benefits. A scan can then be done on those sites across the region to determine if the siting would be appropriate for a solar installation.

Addressing Dwell Time

The Challenge

Parking demand and availability of chargers for EV drivers in need of energy is a growing concern for municipalities in the Study Area. In some locales, the demand for parking is exceeding availability. In addition, some charging stalls are used as personal parking and charging spaces in lieu of at-home charging, reducing their access for visitors and other users. The recent study by Nuclear Innovation Institute and Plug N Drive revealed that EV drivers perceive charging in Grey, Bruce and Huron Counties as being difficult or very difficult. This is an emerging challenge as EV adoption grows, especially in areas around urban centres. As urban EV drivers embark on road trips to their favourite destinations, they rely on public charging to 'energize' their travel. But if public charging spaces are occupied for extended amounts of time by EV drivers for whom the charging instance is merely convenient, not necessary, that location isn't available for someone who needs it to travel to the next destination. The amount of time an EV driver spends at a charging station is commonly referred to as 'dwell time'. Notably, Level 3 (DC Fast Charger) EV stations aren't often challenged by prolonged dwell times as EV drivers are in transit and typically looking to charge then move one. Dwell time is longest at free public Level 2 stations where someone may simply be plugging in for convenience while they shop, eat, etc.

There have been app and non-app-based solutions implemented in other jurisdictions across Canada to overcome dwell time challenges to varying degrees of success. CEA has compiled and evaluated some potential solutions relevant to the local context of the Study Area including dynamic pricing, permitting, etiquette signage and education, contracted parking arrangements, new construction requirements, apps etc.

Potential Solutions

'Refueling' an EV is fundamentally different from filling up the gas tank in an internal combustion engine (ICE) vehicle. Refueling an ICE vehicle typically occurs when the tank is near empty. However, EV drivers are more likely to charge, or "top up" their vehicle battery even if they are not near empty. This difference needs to be considered into the planning of charging infrastructure[30].

4. Dynamic Pricing

"Proper pricing can increase overall productivity by motivating drivers to only consume the resources they require when they need them. Resources include not only the energy required to recharge a vehicle, but also the time needed, and physical space occupied during the charging session. These space and time elements must be considered when determining a site's pricing policy to curb excessive usage, which can impose a physical constraint on the number of vehicles serviceable per day." – Ryan Winn, author of Electric Vehicle Charging at Work.

For reference, BC Hydro recently implemented base pricing at all their station in British Columbia, effective April 1, 2022, the cost to charge at BC Hydro EV stations is:

- **12.07 cents per minute for 25 kW charging (+5% GST)**
- **21.13 cents per minute for 50 kW charging (+5% GST)**
- **27.17 cents per minute for 100 kW charging (+5% GST)**

Winn's analysis of EV charging behaviours across workplaces in southern California concluded:

- Dynamic or graduated pricing (where the hourly rate increases after the first few hours) effectively curbs excessively long stays.
- On average, paid charging sessions result in shorter session durations by 9 minutes, longer active charging times by 20 minutes, and shorter post-charge dwell time of approximately 29 minutes across the entire day. The largest effect is on the post-charge dwell time as this metric decreases by 29 minutes for paid transactions, when the overall duration only decreases by 9 minutes, on average. This demonstrates that charging stations are utilized in a more efficient manner when the driver is required to pay for at least part of the transaction.
- Pricing policies should be based on a parking model to incorporate all resources consumed (i.e., time, physical space, and energy)
- Hourly then Penalty approach encourages the most efficient usage of the EVSE and generates the most revenue for the site host.
- Minimum activation fees can be used to disincentive very inefficient transactions by discouraging users to occupy the space if they have a near-full state of charge.
- Dynamic pricing is typically needed only for Level 2 EV chargers, most drivers depart Level 3 (DC Fast Charger) stations as soon as their session ends.

[30] Electric Vehicle Charging at Work, https://innovation.luskin.ucla.edu/wp-content/uploads/2019/03/EV_Charging_at_Work.pdf

Our recommendation is to employ dynamic pricing at all Level 2 EV charging stations across the Study Area (both existing and proposed stations). To maximize effectiveness, the Partners should couple this solution with one, or all, of the other solutions outlined. CEA completed a scan of charging rates currently in place at both Level 2 and Level 3 (DC Fast Charger) EV stations across Ontario, the results are summarized in Appendix 6. A small sample of Level 2 EV chargers situated in Quebec were noted as well. Level 2 EV Charger pricing ranged from $1/hr to $2.50/hr.

5. Etiquette Signage and Education

Accessible and informative signage when paired with other dwell time solutions such as permitting and dynamic pricing can help to incent desired EV charging behaviours. Installing signage at the charging station can remind or inform EV drivers of charging etiquette. Messages such as the following:

- **Only Park in an EV charging space when you're actually charging**
- **Remember to always move your vehicle as soon as charging is complete**
- **Use the charging station app (Flo, ChargePoint) to monitor your charge should you decide to leave your vehicle**
- **If you don't need 100% state of charge, consider leaving the station available for a fellow EV driver**
- **Consider finishing your charge at 80% because the last 20% of your battery chargers slower. If you have time, consider moving to a Level 2 charger.**
- **Use the PlugShare App to check in and leave notes for other drivers**

A bonus opportunity is to add EV charging etiquette messaging to interpretive signage about local amenities, services and attractions.

6. Permitting

Like the methodology already used by parking lot owners, parking at EV charging stations could be managed via enforcement (e.g., tickets and fines). This approach could employ parking control systems (e.g., visual inspection by an individual, or camera) already in use by the parking lot owner. The parking lot owner could set limits on the length of stay in a charging station stall. They would reflect the speed of charge associated with the type of charging station (Level 2 vs. Level 3). This solution would be best for high-volume parking lots with limited EV charging stations installed. This solution could be coupled with dynamic pricing to further incent desired EV driver behaviour.

7. Valet Service

Implementing a valet service at sites with sufficient demand can maximize turnover of vehicles. This solution is best for popular tourist attractions, shopping centres, public beaches etc. This practice promotes equity and accessibility by allowing the greatest number of drivers to use the charging resource in the most efficient manner. The attendant moves the charging vehicle once it has completed its session and replaces it with another vehicle that requires charging.[31] In this way, dwell time matches the need of various drivers.

8. Apps

App-based solutions unique to the Study Area can be costly, as they require annual licensing and maintenance of existing software. While using a modern app may be ideal for residents, visitors are unlikely to research an additional app for a new area; visitors are more likely to react to the pricing or policy at public stations when they arrive. Further, most of the charging networks currently operating across the Study Area (Greenlots, Flo, ChargePoint, SWTCH, IVY etc.) have apps for their stations which already notify EV drivers when their charging session is completed.

ChargePoint even has a waitlist function. Waitlist (available on some stations) lets drivers get in a virtual line to charge when all stations are busy, helping more drivers get a charge. For Waitlist to work, drivers need to move their cars when done charging.

Utilities in other jurisdictions have developed custom apps for their network (see BC Hydro EV app in British Columbia). This additional app communicates with the charging station networks in operation in the Province (Flo, ChargePoint etc.) and enables users to search across all network providers. If it is of further interest, our recommendation is for the Partners to collaborate with local utility providers to bring one app that will service the entire Study Area. Too many apps can have the exact opposite effect where none will be used.

9. New Construction Requirements

As noted previously, one of the sources of extended dwell time at EV charging stations across the Study Area are the “garage orphans”. Garage orphans are residents who live in either residential condominiums or apartment buildings (collectively known as “multi-unit residential buildings” or MURBs) or in dwellings that lack access to a driveway or a garage. There are a few reasons why home charging may not be possible in these scenarios: the strata simply refuse to allow installation or there is not electrical capacity to support multiple Level 2 chargers, for example.

[31] EV Charging at Work, https://innovation.luskin.ucla.edu/wp-content/uploads/2019/03/EV_Charging_at_Work.pdf

While it is difficult to address the lack of charging in existing homes and buildings, the main solution here is for municipalities across the Study Area to adopt "EV-ready" requirements for new single- and multi-family residential and non-residential developments. For example, the cities of Toronto[32], Surrey and Port Moody in B.C., and multiple cities in California, have adopted requirements that 20% or more of parking spaces in new developments must feature either an EV charging station or an adjacent electrical outlet (i.e., be "EV-ready"). These innovative policies will make it easier to charge EVs in these buildings in the future. [33]

Given over 70% of EV charging happens at home, the primary solution is more home charging and workplace charging to alleviate stress on public infrastructure. [30]

[32] https://www.toronto.ca/news/city-of-toronto-raises-green-performance-standards-for-new-development-and-mandates-net-zero-ghg-emissions-for-new-city-owned-buildings/#:~:text=Electric%20vehicles%3A%20Tier%201%20will,electric%20vehicle%20(EV)%20ready.

[33]Commercial buildings: an EV-ready approach for new builds and retrofits, https://electricautonomy.ca/2021/04/14/commercial-buildings-ev-ready/

[34] B.C. looks to Ontario example in growing right-to-charge debate, https://electricautonomy.ca/2019/10/30/b-c-looks-to-ontario-example-in-growing-right-to-charge-debate/

Appendix 1. Resident and EV Driver Survey Questions and Results

EV Driver Survey

Introduction

The County of Wellington and their Partners (Cities of Guelph, Stratford, and St. Mary's and the Counties of Wellington, Dufferin, Perth, Huron, Grey and Bruce) are developing a preliminary strategy to design a regional electric vehicle charging network. The map below identifies the 'Study Area.'

To inform the strategy, the Partners are gathering public feedback from local, regional and international individuals and groups.

The purpose of this "EV Driver" survey is to understand EV charging behaviour better and uncover the needs of local and visiting EV drivers. It is intended to be completed by individuals who currently own and drive an electric vehicle. If you do not currently drive an EV, but would like to contribute, please complete this survey.

This survey will look at the following questions:

- **What motivates drivers to buy an EV?**
- **What are the habits and behaviours of current EV drivers?**
- **What challenges do EV drivers experience while travelling to and within the Study Area?**
- **What would help address these challenges and improve the EV driving experience?**

The survey will close on Tuesday, February 15, 2022. Please enter your contact info for a chance to win one of three $50 gift cards for a local business.

Community Energy Association is conducting the survey on behalf of the Cities of Guelph, Stratford, and St. Mary's and the Counties of Wellington, Dufferin, Perth, Huron, Grey and Bruce to help develop a preliminary regional electric vehicle charging network strategy. All personal information created, held or collected in this survey is protected in accordance with the Municipal Freedom of Information and Protection of Privacy Act, 1990 (MFIPPA). For questions related to this collection of personal information, contact info@communityenergy.bc.ca.This survey is hosted by Survey Monkey. Review Survey Monkey's Privacy Policy.

EV Driver Survey

Background Info

This survey asks questions related to why you purchased an EV, and the barriers you currently face. If you do not own an EV, please contribute by completing this survey.

1. What is your age range?

- ( ) Under 18
- ( ) 18-24
- ( ) 25-34
- ( ) 35-44
- ( ) 45-54
- ( ) 55-64
- ( ) 65-74
- ( ) 75 or older
- ( ) Prefer not to say

2. Do you:

- ( ) Own your home
- ( ) Rent your home
- ( ) Rent subsidized housing
- ( ) Other (please specify)

3. What municipality do you live in?

4. What province or state do you live in?

5. Which of the following statements best describe you?

- ( ) I live in the Study Area
- ( ) I commute to the Study Area for work
- ( ) I visit the Study Area (e.g., weekly, monthly, or annually) for tourism and recreation

6. Which of the following best describes your residence?

- ( ) Single detached or semi-detached house
- ( ) Townhouse house
- ( ) Apartment/condo
- ( ) Suite in a single detached or semi-detached house
- ( ) Other (please specify)

7. How many dependents (e.g., children or parents) reside alongside you in your home?

- ( ) 0
- ( ) 1
- ( ) 2
- ( ) 3
- ( ) 4
- ( ) More than 4

EV Driver Survey

Perceptions of EV Charging Infrastructure

8. What kind of EV do you have (Make and model)?

9. Do you have a second car in your household?

- Yes
- No

10. If you answered yes to the previous question, what type of vehicle is it? If you answered no, please leave this question blank.

- Electric
- Hybrid
- Internal combustion engine

11. I have owned an EV for:

- Less than 1 year
- 1-2 years
- 2-3 years
- 3-4 years
- More than 4 years

12. How important were the following motivators for you to purchase an EV?

	Extremely important	Very important	Moderately important	Slightly important	Not important at all	I don't know
Save money by not purchasing gas	○	○	○	○	○	○
Reduce my impact on the environment	○	○	○	○	○	○
Take advantage of government grants	○	○	○	○	○	○
A smoother, quieter ride than other vehicles	○	○	○	○	○	○
Recommendation from someone I know	○	○	○	○	○	○
Status/positive public image	○	○	○	○	○	○

13. When you were considering buying an EV, what information sources were most valuable to you during your research? Please check all that apply.

- ☐ Internet search
- ☐ Consumer reports
- ☐ Friends, family, neighbours, colleagues
- ☐ Car companies
- ☐ News articles
- ☐ Online owner forums/groups
- ☐ Automotive magazines
- ☐ Federal government
- ☐ Provincial, Territorial, or State government
- ☐ Municipal government
- ☐ Utilities
- ☐ Not-for-profit research and advocacy organizations
- ☐ Other (please specify)

* 14. Do you have a subscription/account with more than one charging network (e.g., flo, chargepoint, etc.)?

- ○ Yes
- ○ No

EV Driver Survey

Network Subscription - Perceptions of EV Charging Infrastructure

* 15. How many networks are you subscribed to?

- 1
- 2
- 3
- 4
- More than 4

EV Driver Survey

Network Accounts - Perceptions of EV Charging Infrastructure

16. Please let us know why you have an account with only one (or none) charging networks. Please select all that apply.

- [ ] I don’t do road trips in my EV
- [ ] I only charge at home/at work
- [ ] I don’t want to pay for it
- [ ] Other (please specify)

EV Driver Survey

Perceptions of EV Charging Infrastructure

17. Which networks are you subscribed to? (Please check all that apply)

- [ ] Flo
- [ ] Chargepoint
- [ ] Electrify Canada
- [ ] Other (please specify)

18. To what degree do you believe range anxiety is a significant barrier to owning an EV?

- ○ Strongly agree
- ○ Somewhat agree
- ○ Neither agree nor disagree
- ○ Somewhat disagree
- ○ Strongly disagree

19. Do you think a fee should be applied to charge at Level 2 stations?

- ○ Yes
- ○ No
- ○ Not sure/I don’t have enough information to answer

20. Do you think a stepped fee should be applied to charge at Level 2 stations in an effort to limit dwell time? (e.g., First 4 hours are .50cents/hour, and following hours are $4/hour).

- ○ Yes
- ○ No
- ○ Not sure/I don’t have enough information to answer

21. How important is it that the electricity used in an EV comes from renewable energy?

- 1 = not all important
- 2
- 3
- 4
- 5 = very important

EV Driver Survey

Charging and Driving Habits

22. When taking longer trips (e.g. outside of your community), do you drive your EV?

- ○ Yes
- ○ No

23. If you answered yes to the previous question, has owning an EV changed how you plan your trips? Specifically, in what ways do your behaviours change, if any?

- ☐ Route plan intentionally
- ☐ Look for accommodations with level 2 chargers
- ☐ Plan stops around availability of fast charging
- ☐ Other (please specify)

24. How often do you charge your EV at each of the following locations?

	Never	Monthly	Weekly	Multiple times a week	Daily
At home	○	○	○	○	○
At work, using a wall charger	○	○	○	○	○
At work, using a level 2 charger provided by my work	○	○	○	○	○
At work, using a public level 2 charger	○	○	○	○	○
Public level 2 charger (on-street, public parkade)	○	○	○	○	○
Public DCFC (fast charging)	○	○	○	○	○

25. How do you primarily use fast chargers? Select one that best represents your habits?

- ○ I don’t. I only charge at home
- ○ I don’t. I primarily use Level 2 chargers
- ○ They are my main sources of charging
- ○ I only use them on road trips (regional or national travel)
- ○ I don’t know/No preference

26. How important are the following features of a public charging station?

	Extremely important	Very important	Moderately important	Slightly important	Not important at all	I don't know/no preference
Charging speed	○	○	○	○	○	○
Amenities (cafes, restaurants, parks) within walking distance	○	○	○	○	○	○
Proximity to the route you are on	○	○	○	○	○	○
Reliability (e.g., station status is accurate)	○	○	○	○	○	○
Can pay with a credit card	○	○	○	○	○	○
Can activate with multiple network cards (interoperability)	○	○	○	○	○	○
Located immediately at a facility/business	○	○	○	○	○	○
High level of perceived safety (e.g., lighting)	○	○	○	○	○	○
Multiple stations co-located	○	○	○	○	○	○

27. While using a public charger, how would you prefer to use your time while the car charges? Please check all that apply.

- ☐ Shopping
- ☐ Eating and drinking
- ☐ Outdoor activities and walking
- ☐ Work/use laptop/phone
- ☐ Other (please specify)

_____

28. How much of a challenge are the following to being an EV owner? [Drop down menus with Not a challenge, Minor challenge, Significant challenge]

	Not a challenge	Minor challenge	Significant challenge
High cost to purchase an EV	○	○	○
Chargers are usually unavailable or in use	○	○	○
Charges take too long	○	○	○
Lack of charging at residence	○	○	○
Lack of charging at work provided by my employer	○	○	○
Lack of charging for longer trips	○	○	○
Limited options for heavy-duty use (e.g., towing, off-road, etc.)	○	○	○
Loss of driving range in cold weather	○	○	○

29. What comments do you have about the challenges of being an EV driver, and how could the charging options could be improved

EV Driver Survey

Contact Info (Optional)

30. Please enter your contact information if you would like to be entered into the draw for prizes:

Name	
Email Address	
Phone Number	

Resident Survey

Introduction

The County of Wellington and their Partners (Cities of Guelph, Stratford, and St. Mary's and the Counties of Wellington, Dufferin, Perth, Huron, Grey and Bruce) are developing a preliminary strategy to design a regional electric vehicle charging network. The map below identifies the 'Study Area.'

The purpose of this "Resident" survey is to better understand issues residents face when considering purchasing an EV. Your answers will also help us determine how a regional EV charging network might help residents overcome barriers to EV adoption. This survey is intended to be completed by individuals who do not currently own or drive an EV. If you already own/drive an EV, please complete our EV Driver Survey here. The survey will close on Tuesday, February 15, 2022. Please enter your contact info for a chance to win one of three $50 gift cards for a local business.

Community Energy Association is conducting the survey on behalf of the Cities of Guelph, Stratford, and St. Mary's and the Counties of Wellington, Dufferin, Perth, Huron, Grey and Bruce to help develop a preliminary regional electric vehicle charging network strategy. All personal information created, held or collected in this survey is protected in accordance with the Municipal Freedom of Information and Protection of Privacy Act, 1990 (MFIPPA). For questions related to this collection of personal information, contact info@communityenergy.bc.ca.This survey is hosted by Survey Monkey. Review Survey Monkey's Privacy Policy.

Resident Survey

Background Info

1. What is your age range?

- ( ) Under 18
- ( ) 18-24
- ( ) 25-34
- ( ) 35-44
- ( ) 45-54
- ( ) 55-64
- ( ) 65-74
- ( ) 75 or older
- ( ) Prefer not to say

2. Do you:

- ( ) Own your home
- ( ) Rent your home
- ( ) Rent subsidized housing
- ( ) Other (please specify)

3. What municipality do you live in?

4. What province or state do you live in?

5. Which of the following statements best describe you?

- ( ) I live in the Study Area
- ( ) I commute to the Study Area for work
- ( ) I visit the Study Area (e.g., weekly, monthly, or annually) for tourism and recreation

6. Which of the following best describes your residence?

- ( ) Single detached or semi-detached house
- ( ) Townhouse house
- ( ) Apartment/condo
- ( ) Suite in a single detached or semi-detached house
- ( ) Other (please specify)

7. How many dependents (e.g., children or parents) reside alongside you in your home?

- ( ) 0
- ( ) 1
- ( ) 2
- ( ) 3
- ( ) 4
- ( ) More than 4

Resident Survey

Resident Survey Questions

8. What type of vehicle(s) do you currently drive? Enter the number of vehicles you own in each category. If you don't own a vehicle or use a car share, put a "1" in the last row.

SUV	
Van	
Car	
Pick-up Truck	
Motorcycle	
I don’t own a vehicle	

9. When do you anticipate purchasing or leasing a new vehicle for your household?

- ○ No plan
- ○ 5+ years
- ○ 2-5 years
- ○ Next 2 years

10. Will your next vehicle be an additional vehicle for your household or a replacement vehicle?

- ○ Replacement vehicle
- ○ Additional vehicle

11. Have you considered purchasing or leasing an electric vehicle for your household?

- ○ Yes
- ○ No

12. What is the average distance you drive on a typical day?

- ○ Less than 20 km (less than 12 miles)
- ○ 20-40 km (12-24 miles)
- ○ 60-80 km (37-50 miles)
- ○ 80-100 km (50-62 miles)
- ○ Over 100 km (over 62 miles)

Resident Survey

Resident Survey Questions

13. How familiar are you with electric vehicles?

- ( ) Very familiar (Have looked at different EV models or gone for a test drive)
- ( ) Somewhat familiar (Heard about them, but haven't researched very much)
- ( ) Not at all familiar (I know very little about them)
- ( ) Other (please specify)

14. Have you noticed EV chargers in your neighbourhood or within the Study Area when travelling regionally?

- ( ) Yes
- ( ) No

15. Do any of your friends or neighbours own an EV?

- ( ) Yes
- ( ) No

16. If you were considering buying an EV, which factors would motivate you? Please check all that apply.

- [ ] EV tax rebates and incentives
- [ ] Access to home charging
- [ ] Save money by not purchasing gas
- [ ] Access to high-occupancy vehicle (HOV) lanes and EV parking
- [ ] Utility rebate for a charging station
- [ ] Discounted utility rates for EV charging
- [ ] Reduced registration fee
- [ ] A smoother, quieter ride than gas-powered vehicles
- [ ] Public charging stations are more common
- [ ] Strong recommendation from someone I know
- [ ] Status/public image
- [ ] Reduced environmental impact
- [ ] Other (please specify)

17. If you were interested in finding out more about EVs, where would you go to get this information? Please check all that apply.

- [ ] Internet search
- [ ] Consumer reports
- [ ] Friends, family, neighbours, colleagues
- [ ] Car companies
- [ ] News articles
- [ ] Online owner forums/groups
- [ ] Automotive magazines
- [ ] Federal government
- [ ] Provincial, Territorial, or State government
- [ ] Municipal government
- [ ] Utilities
- [ ] Not-for-profit research and advocacy organizations
- [ ] Other (please specify)

18. Listed below are some of the most common real and perceived barriers to EV adoption. How concerned would you be about the following when purchasing an EV? [Extremely concerned, Very concerned, Slightly concerned, Not concerned at all, I don't know]

	Not concerned at all	Slightly concerned	Moderately concerned	Very concerned	Extremely concerned	I don't know
Lack of familiarity with technology	○	○	○	○	○	○
Lack of vehicle choice (make, model)	○	○	○	○	○	○
Limited options for heavy-duty use (e.g., towing, off-road, etc.)	○	○	○	○	○	○
Lack of charging at residence	○	○	○	○	○	○
Lack of charging at work provided by my employer	○	○	○	○	○	○
Lack of charging for longer trips	○	○	○	○	○	○
The range of the EV (e.g., the distance that can be driven in a single charge)	○	○	○	○	○	○
The range of the EV in winter specifically	○	○	○	○	○	○
How an EV handles winter driving conditions	○	○	○	○	○	○
High cost to purchase an EV	○	○	○	○	○	○
Limited used EV market	○	○	○	○	○	○

Resident Survey

Resident Questions

19. If you owned an EV, where might you charge it most often?

- ○ At work
- ○ On the go/public charging
- ○ At home
- ○ I don't know

20. Do you have the ability to charge an EV at home?

- ○ Yes, I have access to an outlet on my property
- ○ No, but I could easily retrofit my home to have charging
- ○ No, I only have on-street parking
- ○ No, I'm in a multi-unit building (condo) or apartment without charging facilities
- ○ I don’t know
- ○ Other (please specify)

[ ]

Resident Survey

Resident Survey Questions

21. How important is it that the electricity used in an EV comes from renewable energy?

- ○ 1 = not all important
- ○ 2
- ○ 3
- ○ 4
- ○ 5 = very important

22. What benefits do you think could result from having a more robust EV charger network? Please select all that apply.

- ☐ More EV adoption
- ☐ Reduced costs for vehicle maintenance
- ☐ Positive environmental impact: Improved air quality/ reduced vehicle emissions
- ☐ No benefits
- ☐ Other (please specify)

23. Do you have any other comments or questions?

Resident Survey

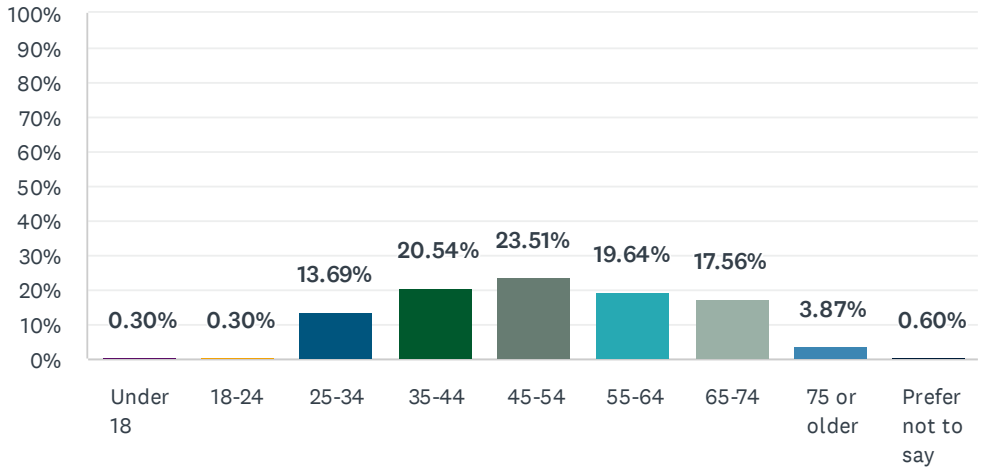
Contact Info (Optional)

24. Please enter your contact information if you would like to be entered into the draw for prizes:

Name	
Email Address	
Phone Number	

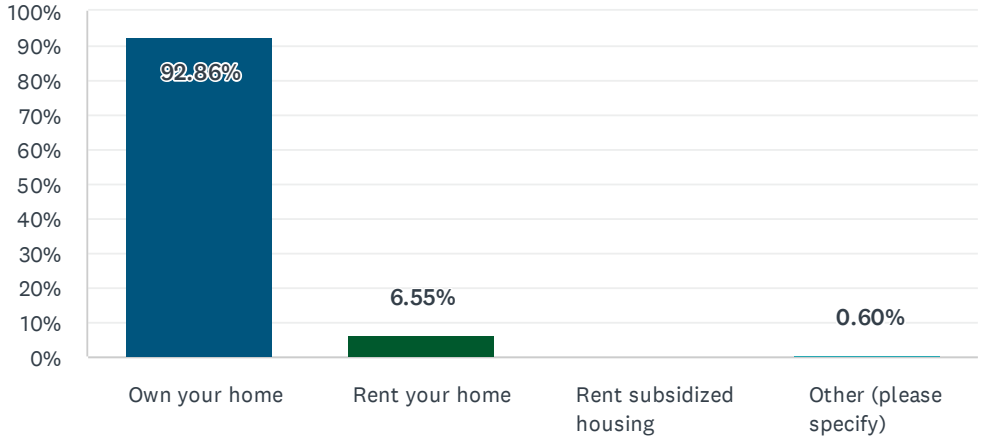
Q1 What is your age range?

Answered: 336 Skipped: 2



Q2 Do you:

Answered: 336 Skipped: 2



Q3 What municipality do you live in?

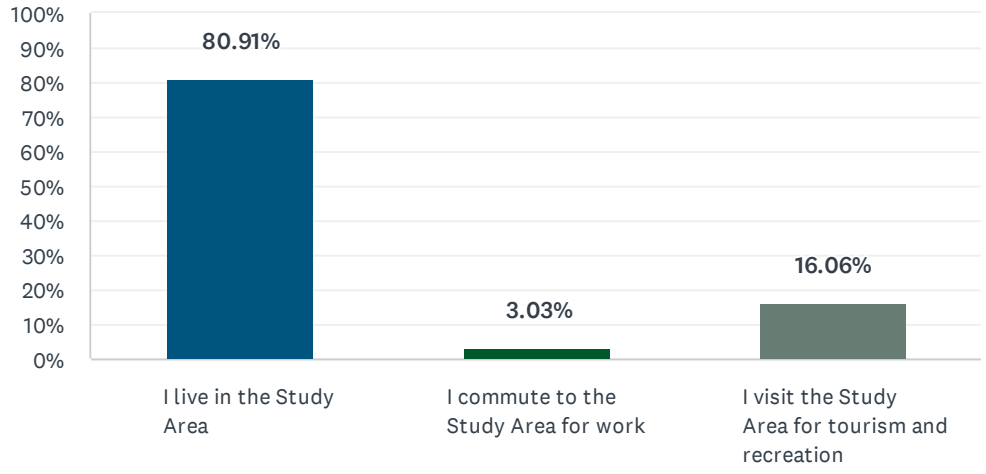
Answered: 337 Skipped: 1

Q4 What province or state do you live in?

Answered: 336 Skipped: 2

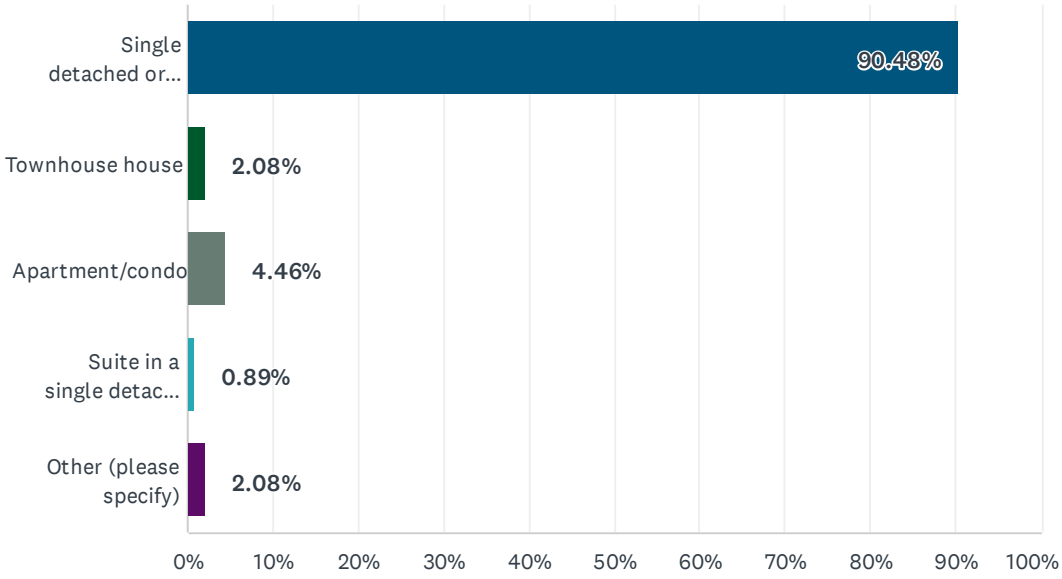
Q5 Which of the following statements best describe you?

Answered: 330 Skipped: 8



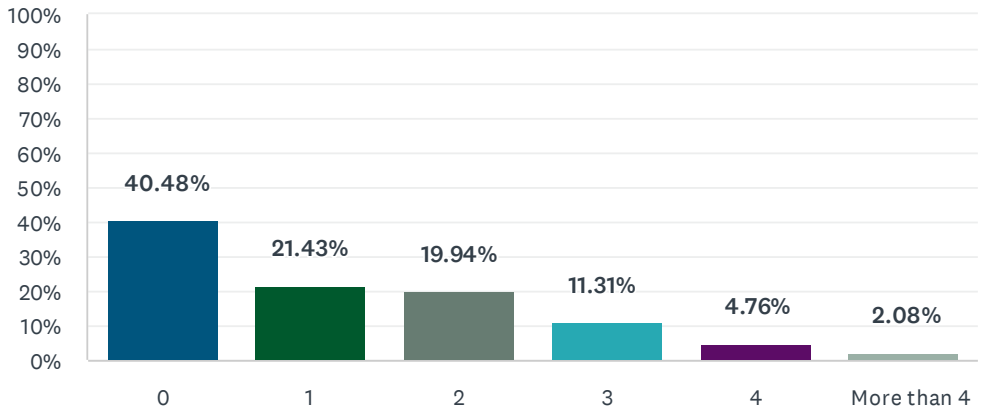
Q6 Which of the following best describes your residence?

Answered: 336 Skipped: 2



Q7 How many dependents (e.g., children or parents) reside alongside you in your home?

Answered: 336 Skipped: 2

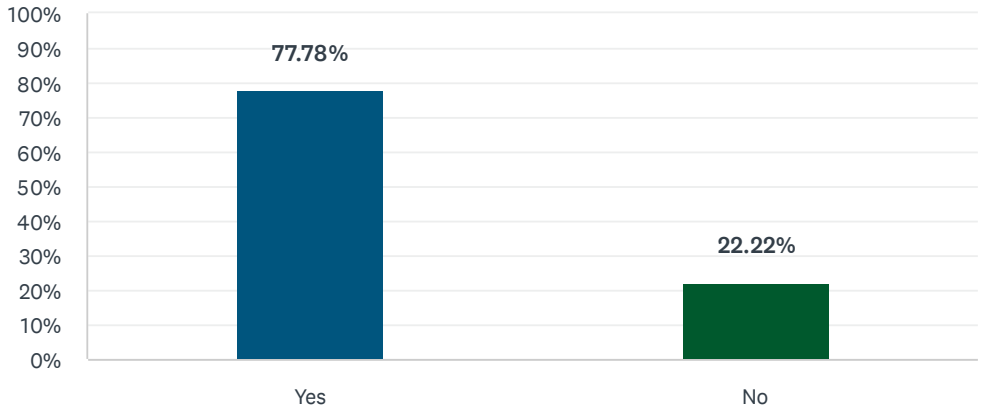


Q8 What kind of EV do you have (Make and model)?

Answered: 267 Skipped: 71

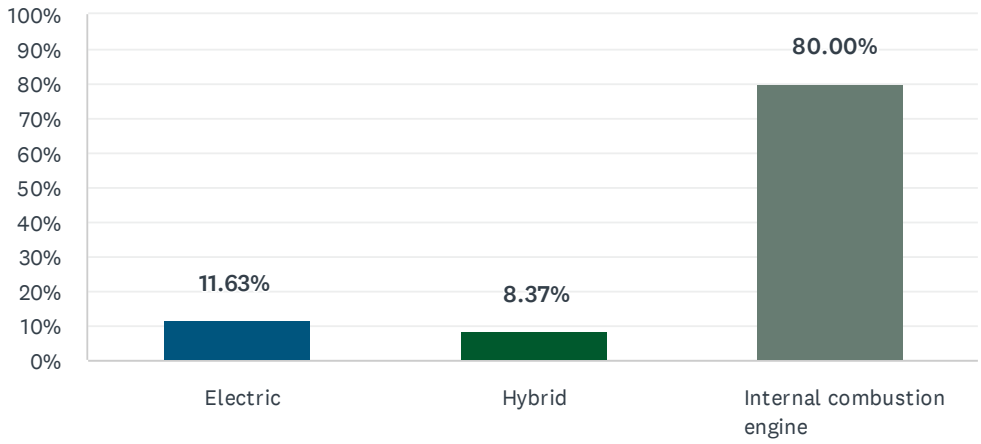
Q9 Do you have a second car in your household?

Answered: 270 Skipped: 68



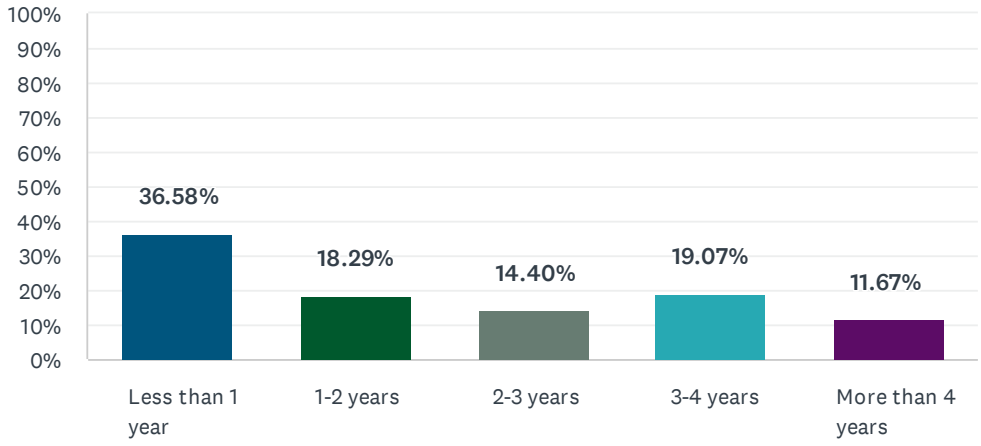
Q10 If you answered yes to the previous question, what type of vehicle is it? If you answered no, please leave this question blank.

Answered: 215 Skipped: 123



Q11 I have owned an EV for:

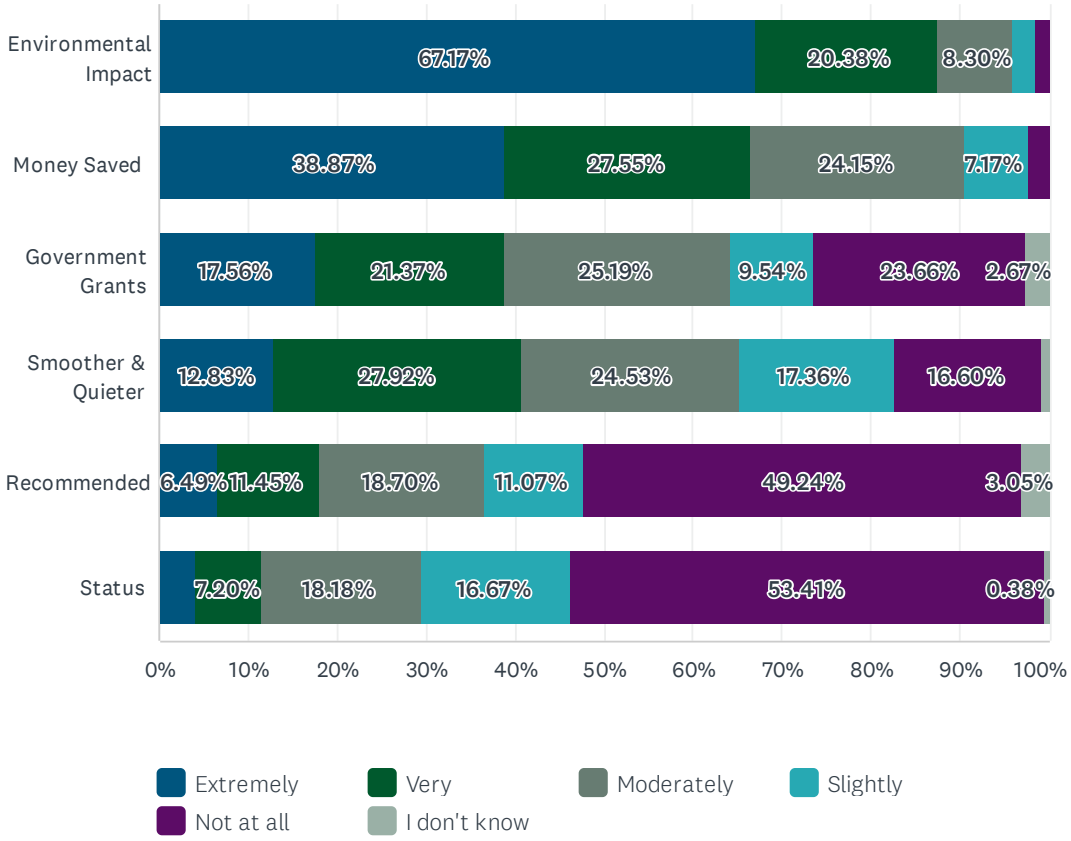
Answered: 257 Skipped: 81



Q12 How important were the following motivators for you to purchase an EV?

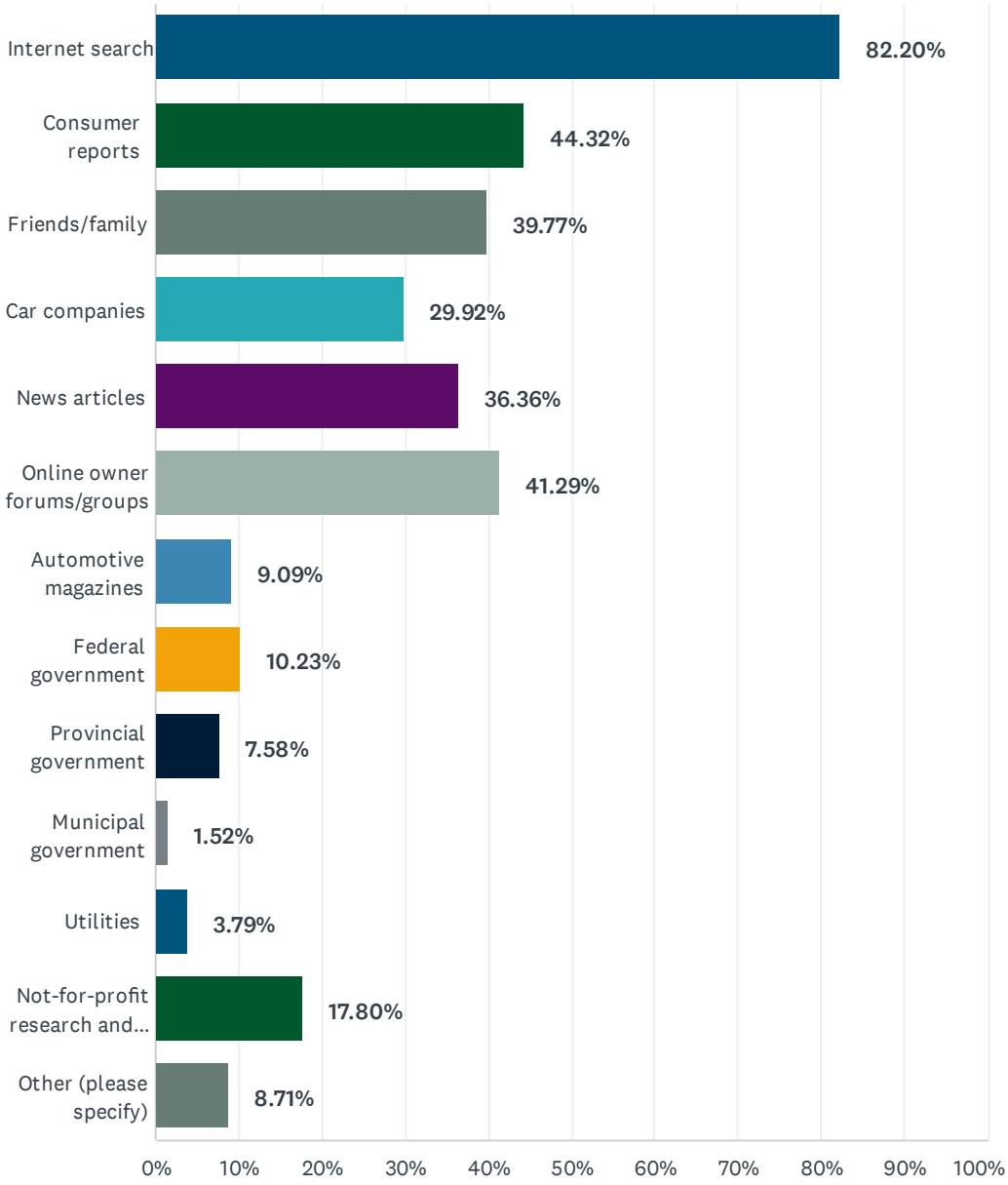
Answered: 266 Skipped: 72

EV Driver Survey



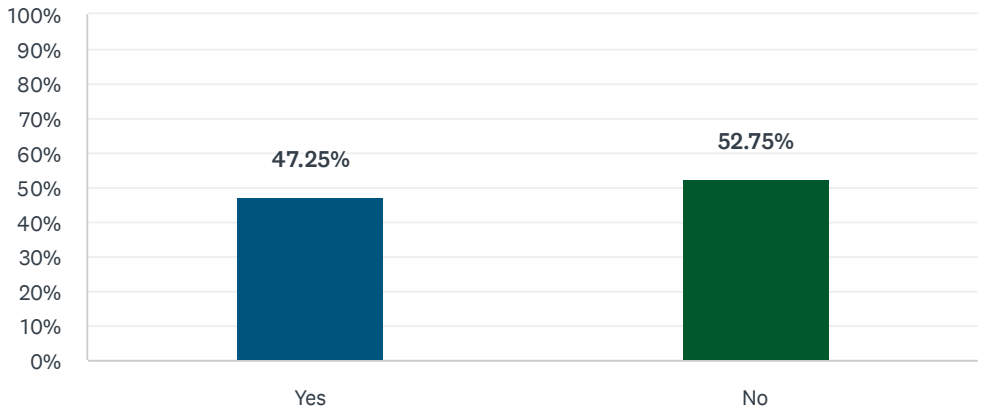
Q13 When you were considering buying an EV, what information sources were most valuable to you during your research? Please check all that apply.

Answered: 264 Skipped: 74



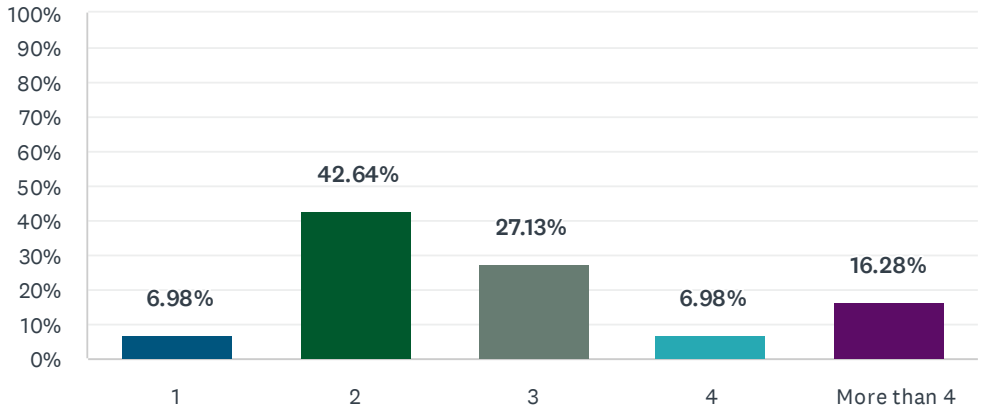
Q14 Do you have a subscription/account with more than one charging network (e.g., flo, chargepoint, etc.)?

Answered: 273 Skipped: 65



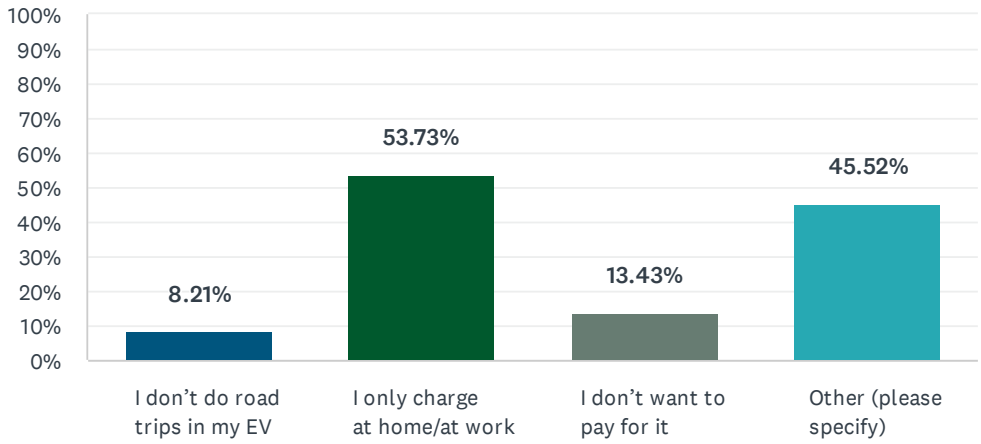
Q15 How many networks are you subscribed to?

Answered: 129 Skipped: 209



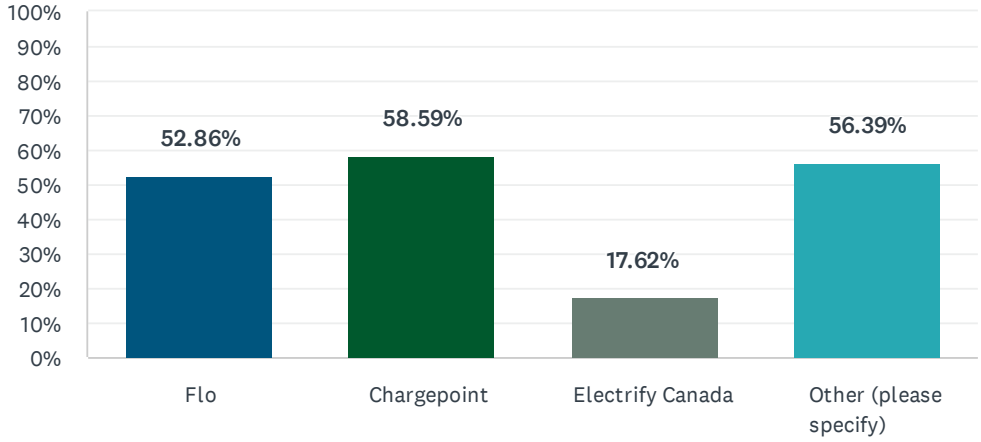
Q16 Please let us know why you have an account with only one (or none) charging networks. Please select all that apply.

Answered: 134 Skipped: 204



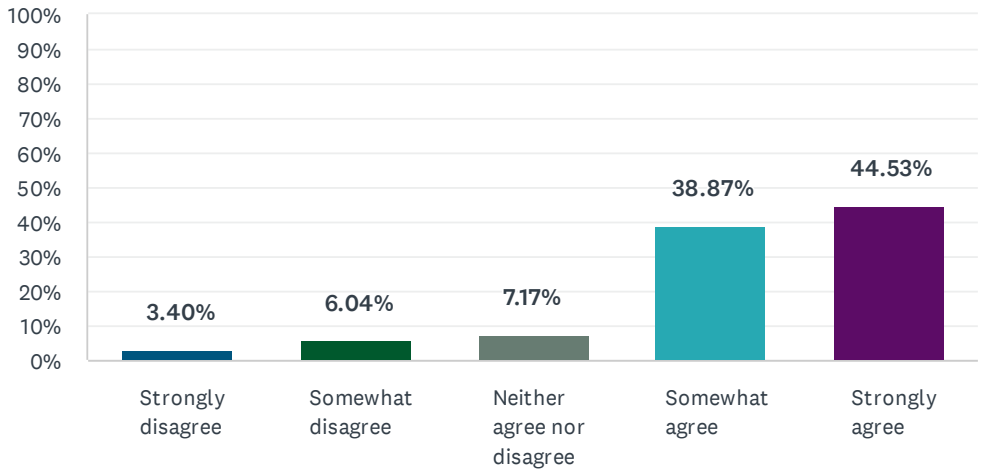
Q17 Which networks are you subscribed to? (Please check all that apply)

Answered: 227 Skipped: 111



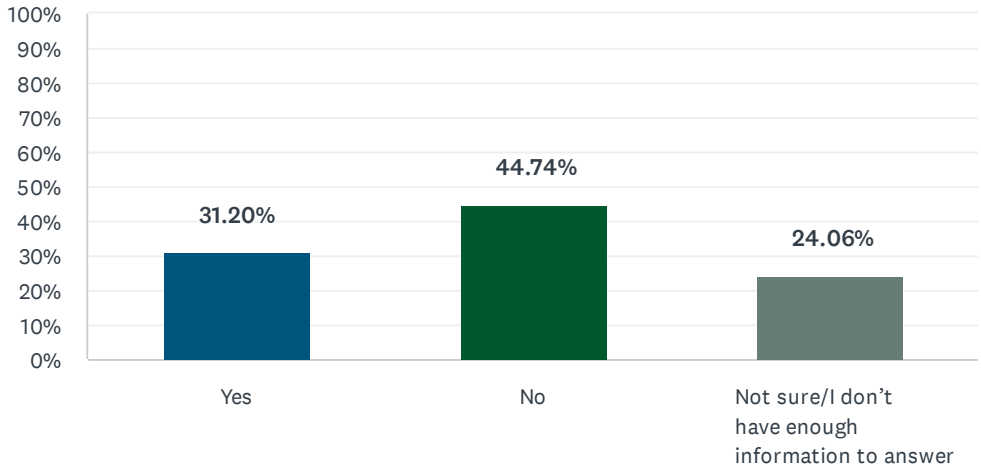
Q18 To what degree do you believe range anxiety is a significant barrier to owning an EV?

Answered: 265 Skipped: 73



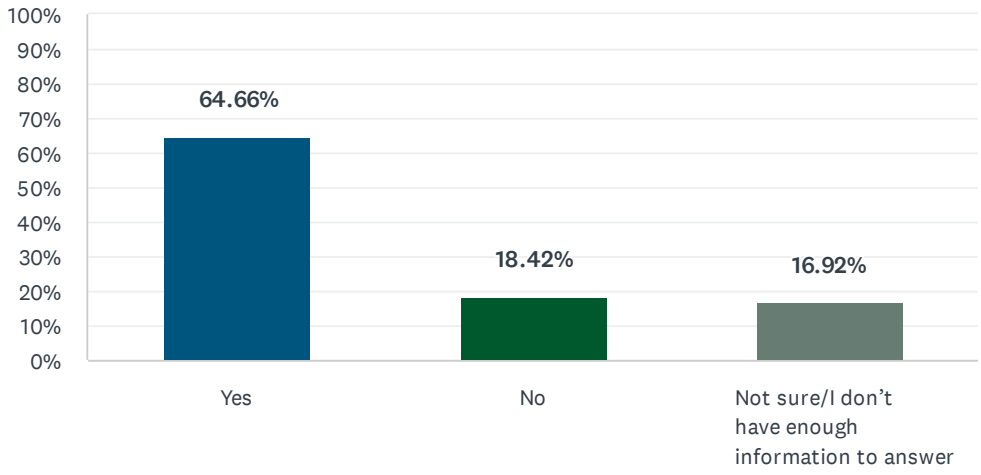
Q19 Do you think a fee should be applied to charge at Level 2 stations?

Answered: 266 Skipped: 72



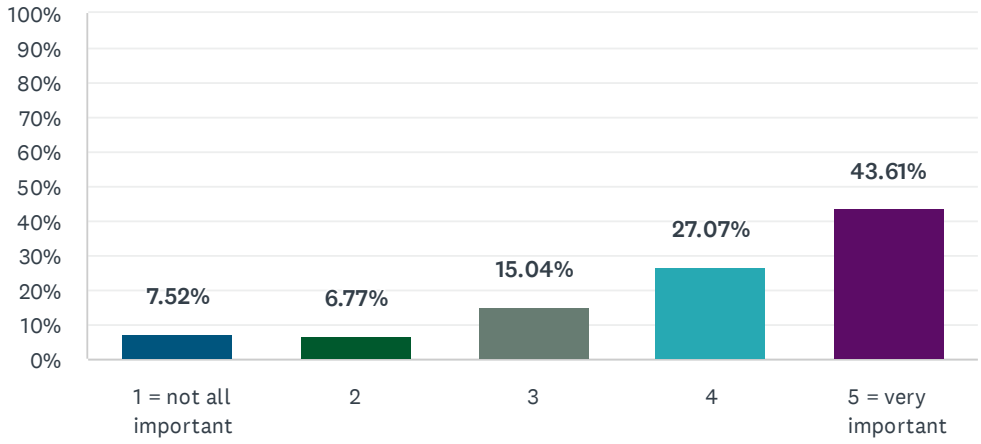
Q20 Do you think a stepped fee should be applied to charge at Level 2 stations in an effort to limit dwell time? (e.g., First 4 hours are .50cents/hour, and following hours are $4/hour).

Answered: 266 Skipped: 72



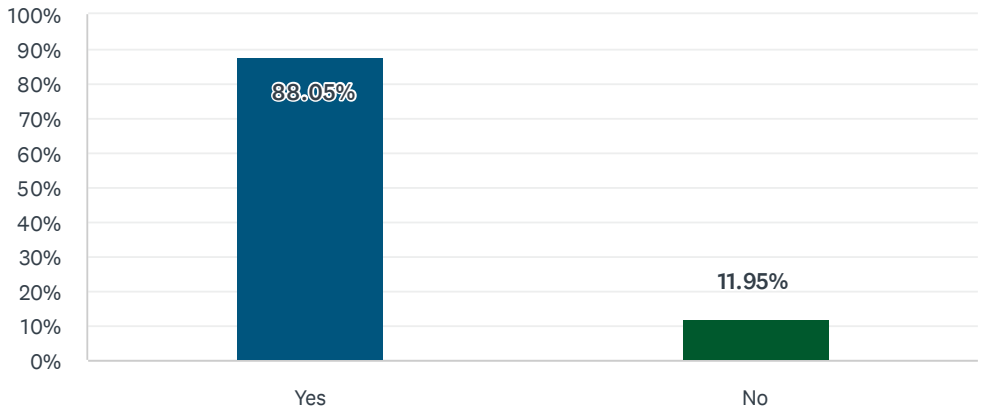
Q21 How important is it that the electricity used in an EV comes from renewable energy?

Answered: 266 Skipped: 72



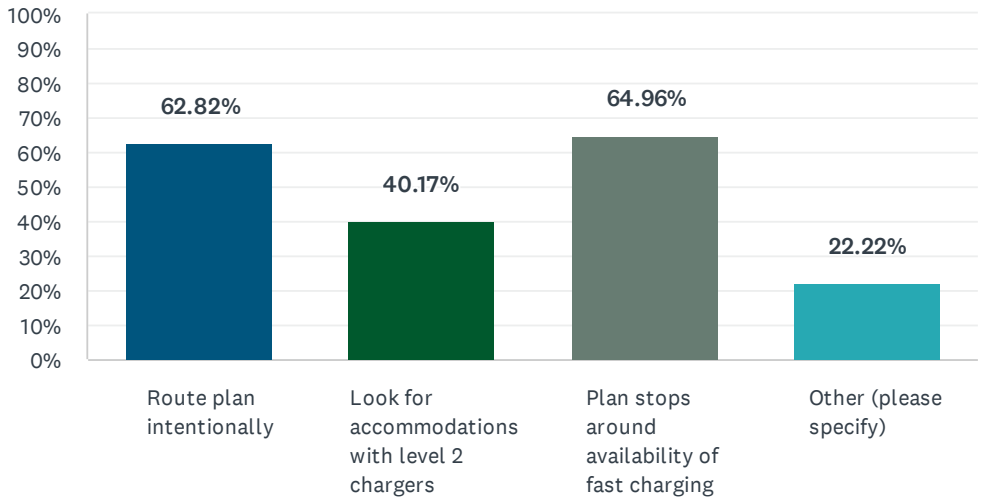
Q22 When taking longer trips (e.g. outside of your community), do you drive your EV?

Answered: 251 Skipped: 87



Q23 If you answered yes to the previous question, has owning an EV changed how you plan your trips? Specifically, in what ways do your behaviours change, if any?

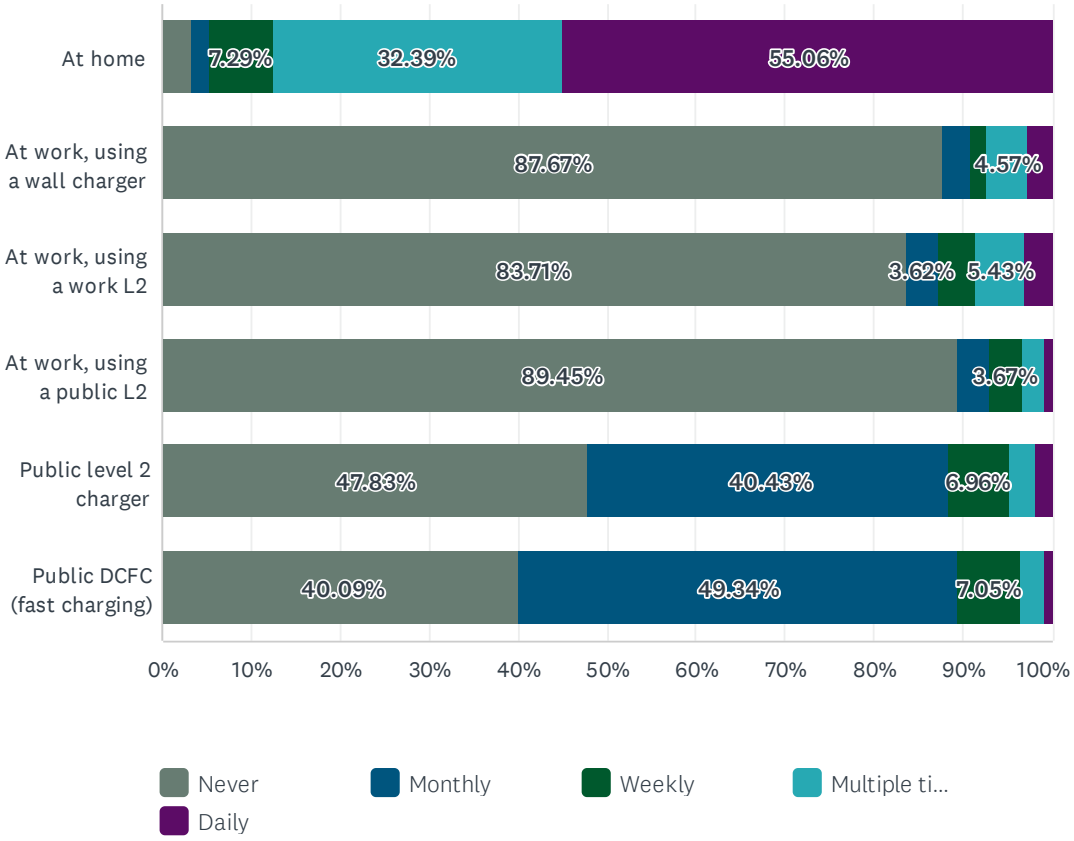
Answered: 234 Skipped: 104



Q24 How often do you charge your EV at each of the following locations?

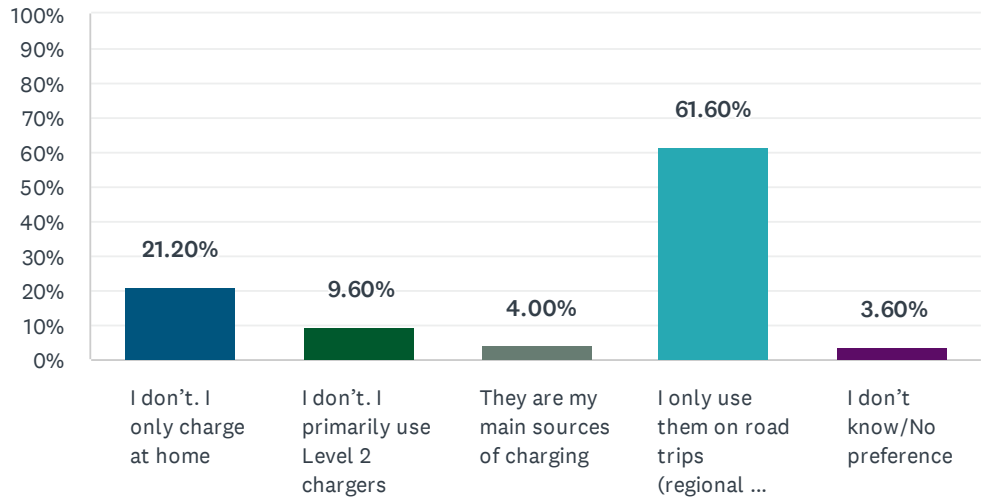
Answered: 250 Skipped: 88

EV Driver Survey



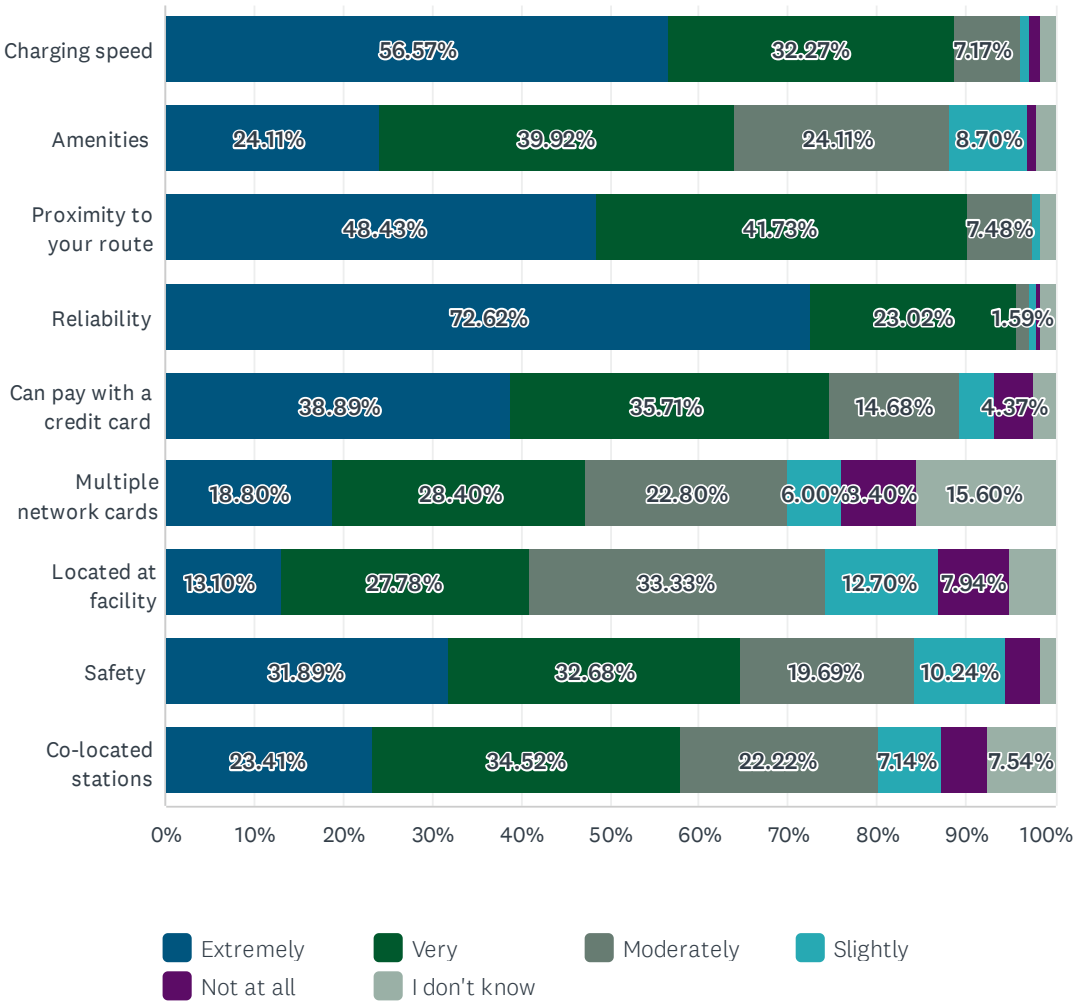
Q25 How do you primarily use fast chargers? Select one that best represents your habits?

Answered: 250 Skipped: 88



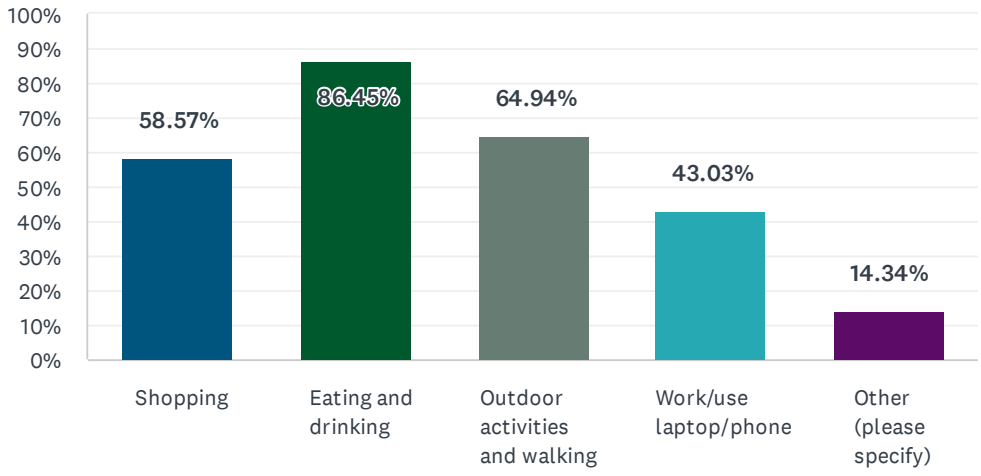
Q26 How important are the following features of a public charging station?

Answered: 254 Skipped: 84



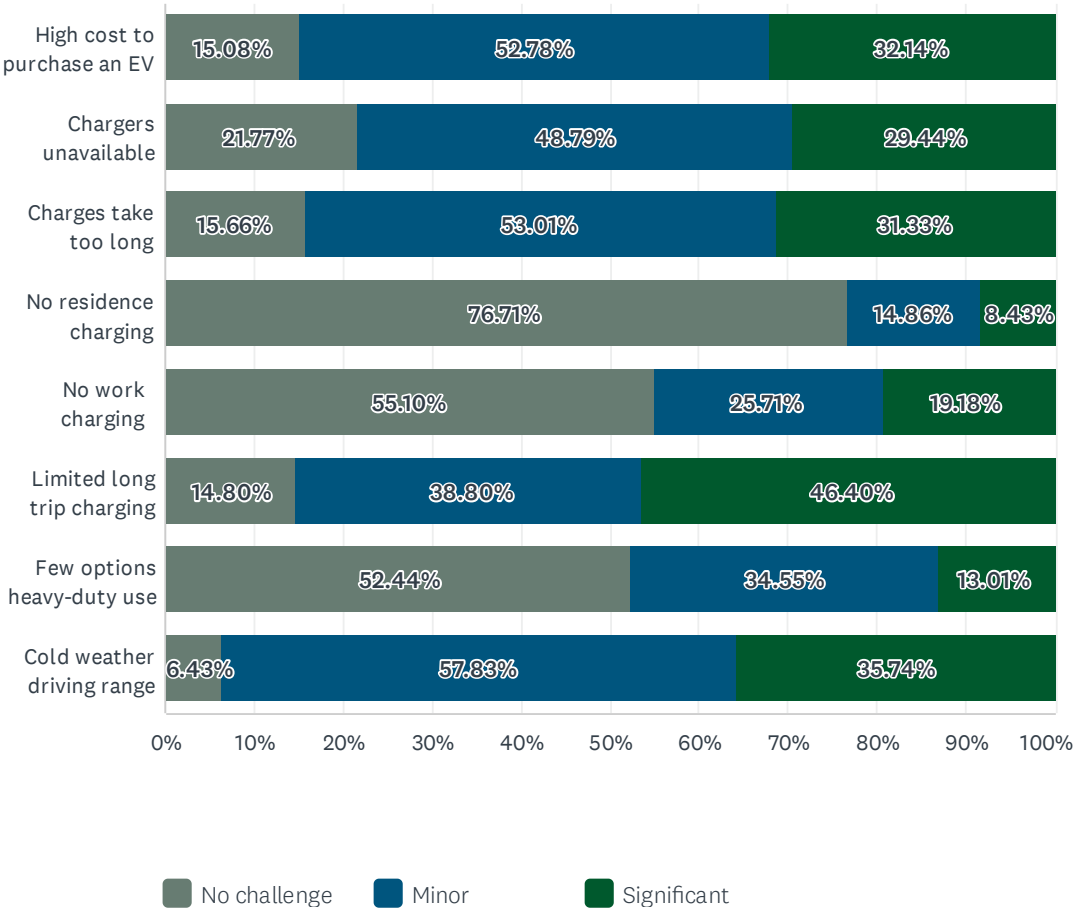
Q27 While using a public charger, how would you prefer to use your time while the car charges? Please check all that apply.

Answered: 251 Skipped: 87



Q28 How much of a challenge are the following to being an EV owner?

Answered: 252 Skipped: 86



Q29 What comments do you have about the challenges of being an EV driver, and how could the charging options could be improved

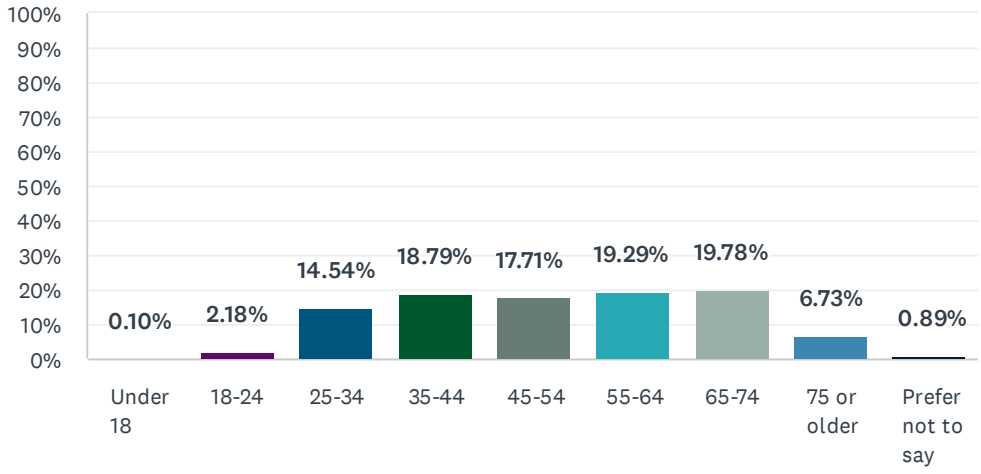
Answered: 195 Skipped: 143

Q30 Please enter your contact information if you would like to be entered into the draw for prizes:

Answered: 202 Skipped: 136

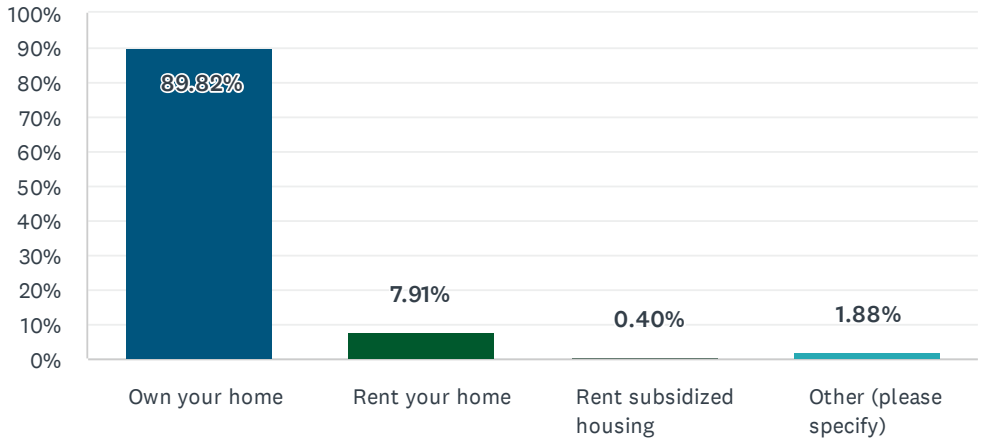
Q1 What is your age range?

Answered: 1,011 Skipped: 4



Q2 Do you:

Answered: 1,012 Skipped: 3



Q3 What municipality do you live in?

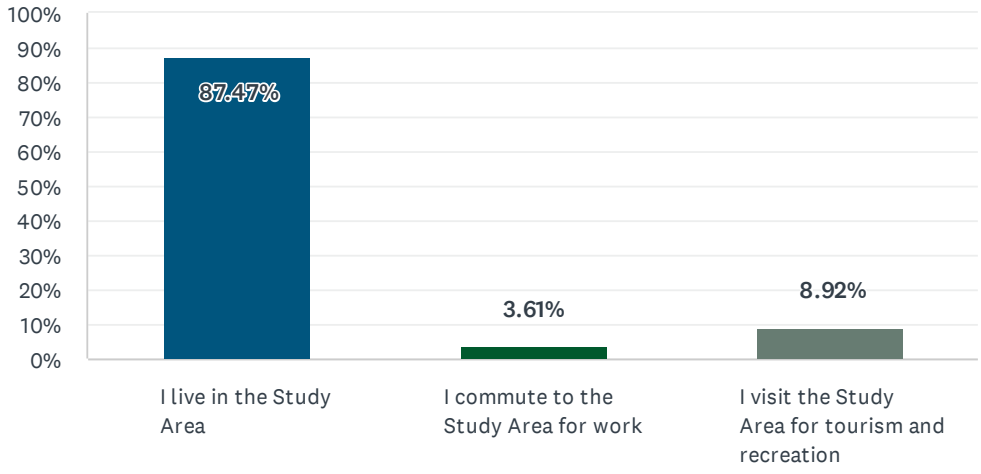
Answered: 1,004 Skipped: 11

Q4 What province or state do you live in?

Answered: 1,005 Skipped: 10

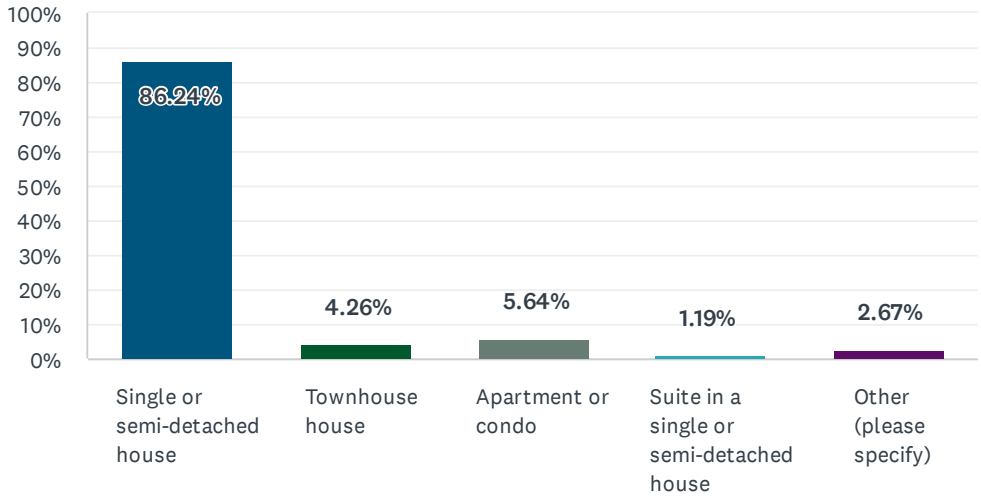
Q5 Which of the following statements best describe you?

Answered: 998 Skipped: 17



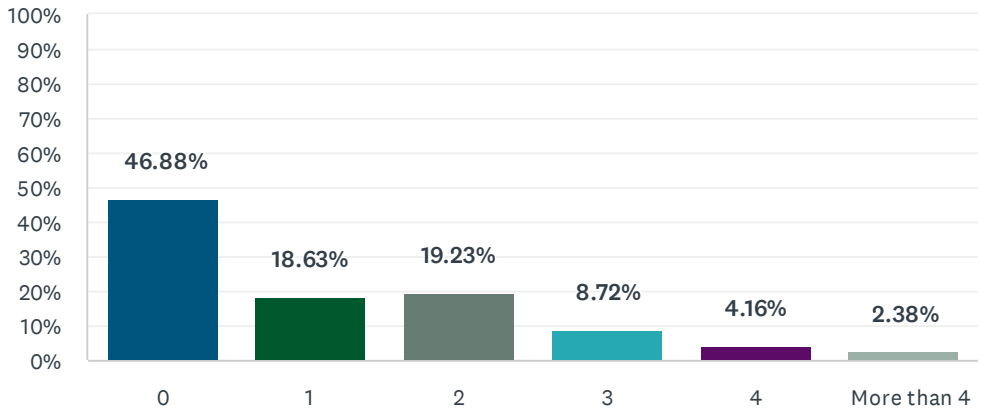
Q6 Which of the following best describes your residence?

Answered: 1,010 Skipped: 5



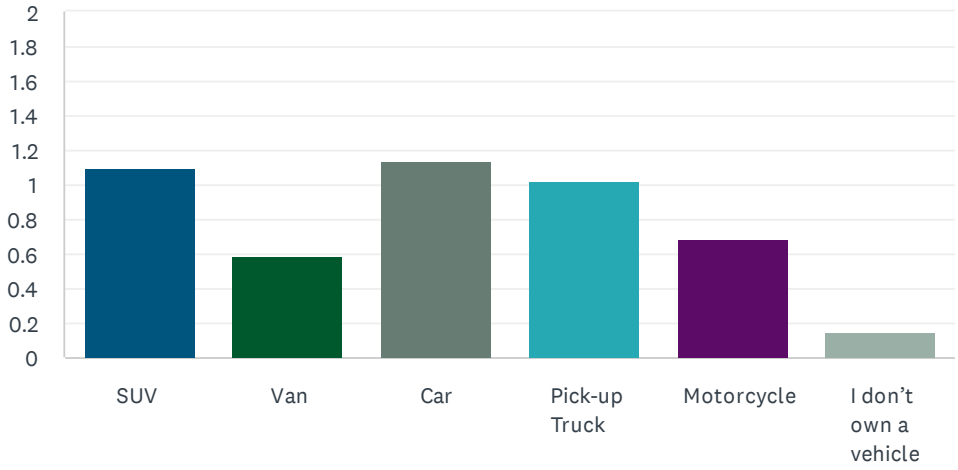
Q7 How many dependents (e.g., children or parents) reside alongside you in your home?

Answered: 1,009 Skipped: 6



Q8 What type of vehicle(s) do you currently drive? Enter the number of vehicles you own in each category. If you don't own a vehicle or use a car share, put a "1" in the last row.

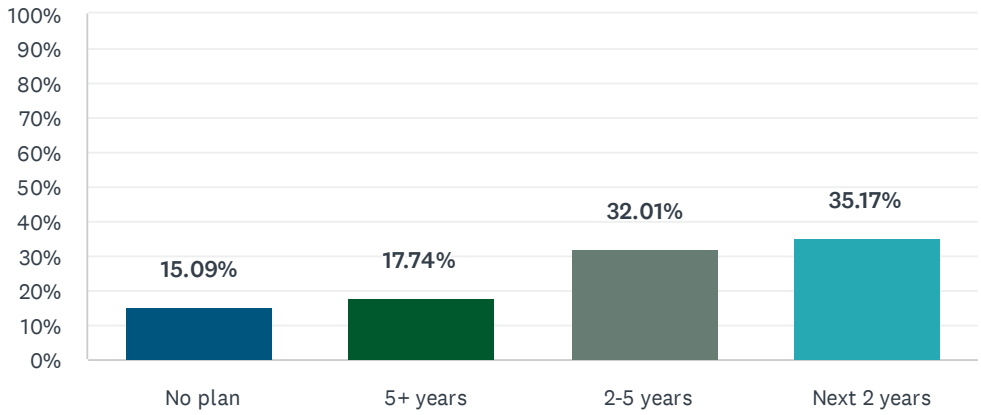
Answered: 977 Skipped: 38



ANSWER CHOICES	AVERAGE NUMBER	TOTAL NUMBER	RESPONSES
SUV	1	643	588
Van	1	92	155
Car	1	676	592
Pick-up Truck	1	422	414
Motorcycle	1	95	138
I don't own a vehicle	0	7	46
Total Respondents: 977			

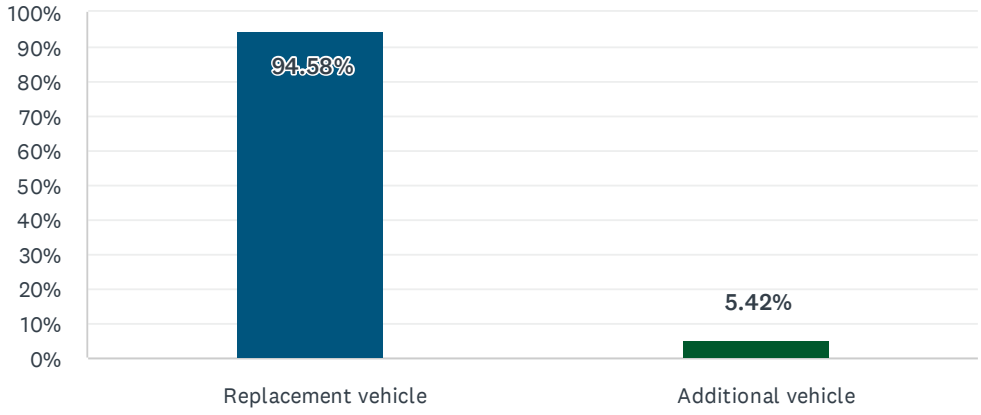
Q9 When do you anticipate purchasing or leasing a new vehicle for your household?

Answered: 981 Skipped: 34



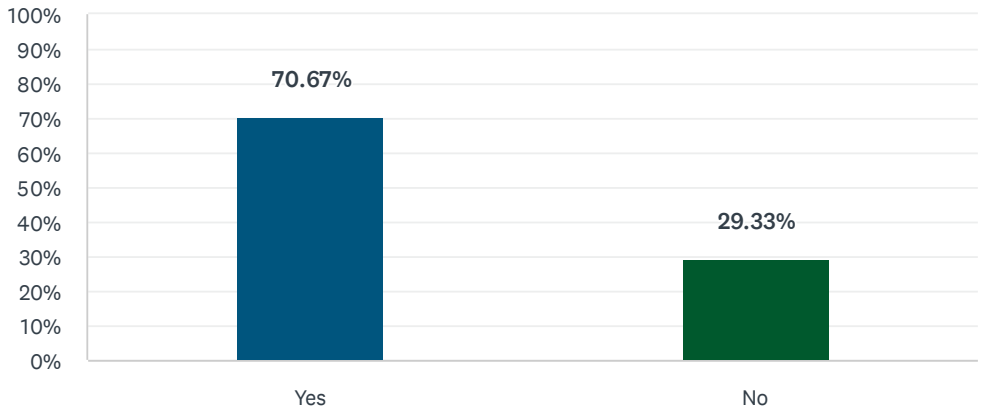
Q10 Will your next vehicle be an additional vehicle for your household or a replacement vehicle?

Answered: 978 Skipped: 37



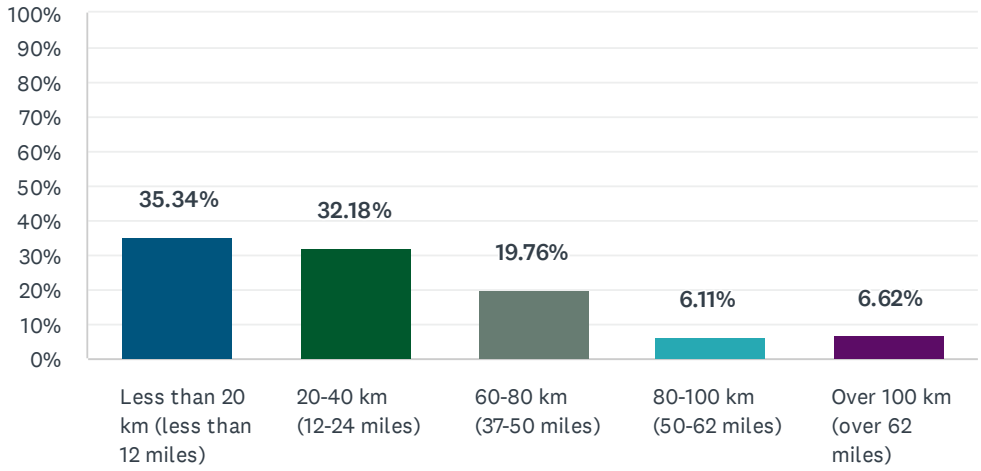
Q11 Have you considered purchasing or leasing an electric vehicle for your household?

Answered: 982 Skipped: 33



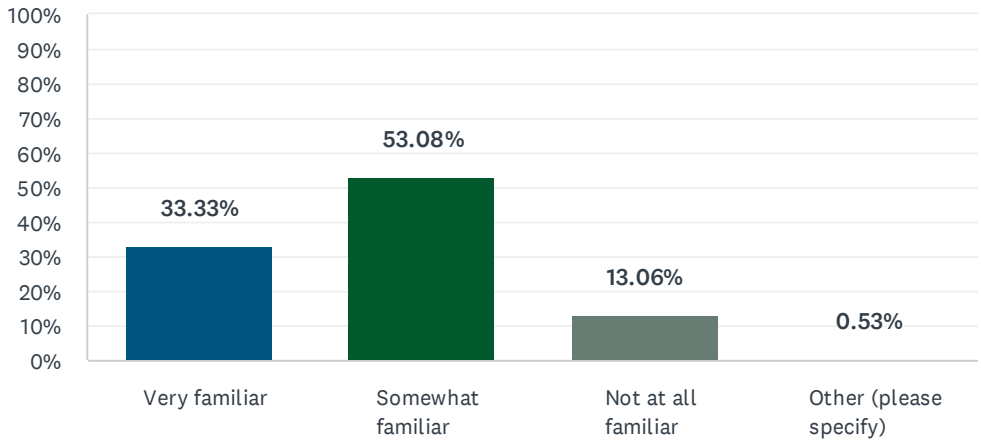
Q12 What is the average distance you drive on a typical day?

Answered: 982 Skipped: 33



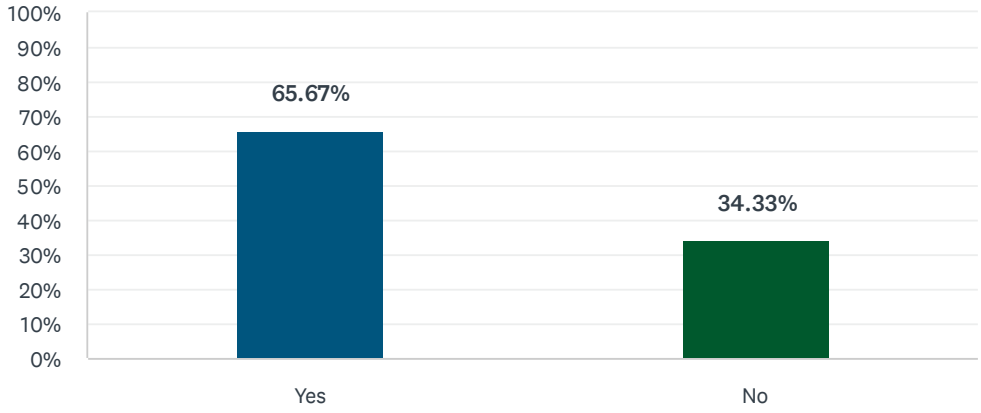
Q13 How familiar are you with electric vehicles?

Answered: 942 Skipped: 73



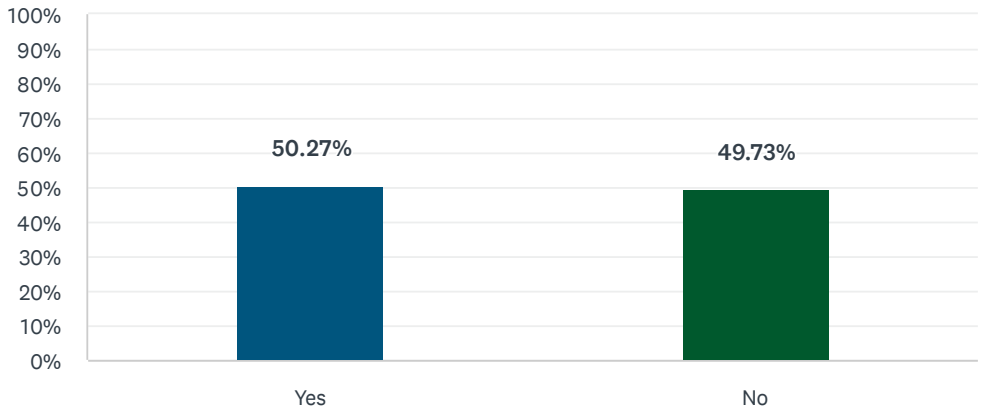
Q14 Have you noticed EV chargers in your neighbourhood or within the Study Area when travelling regionally?

Answered: 941 Skipped: 74



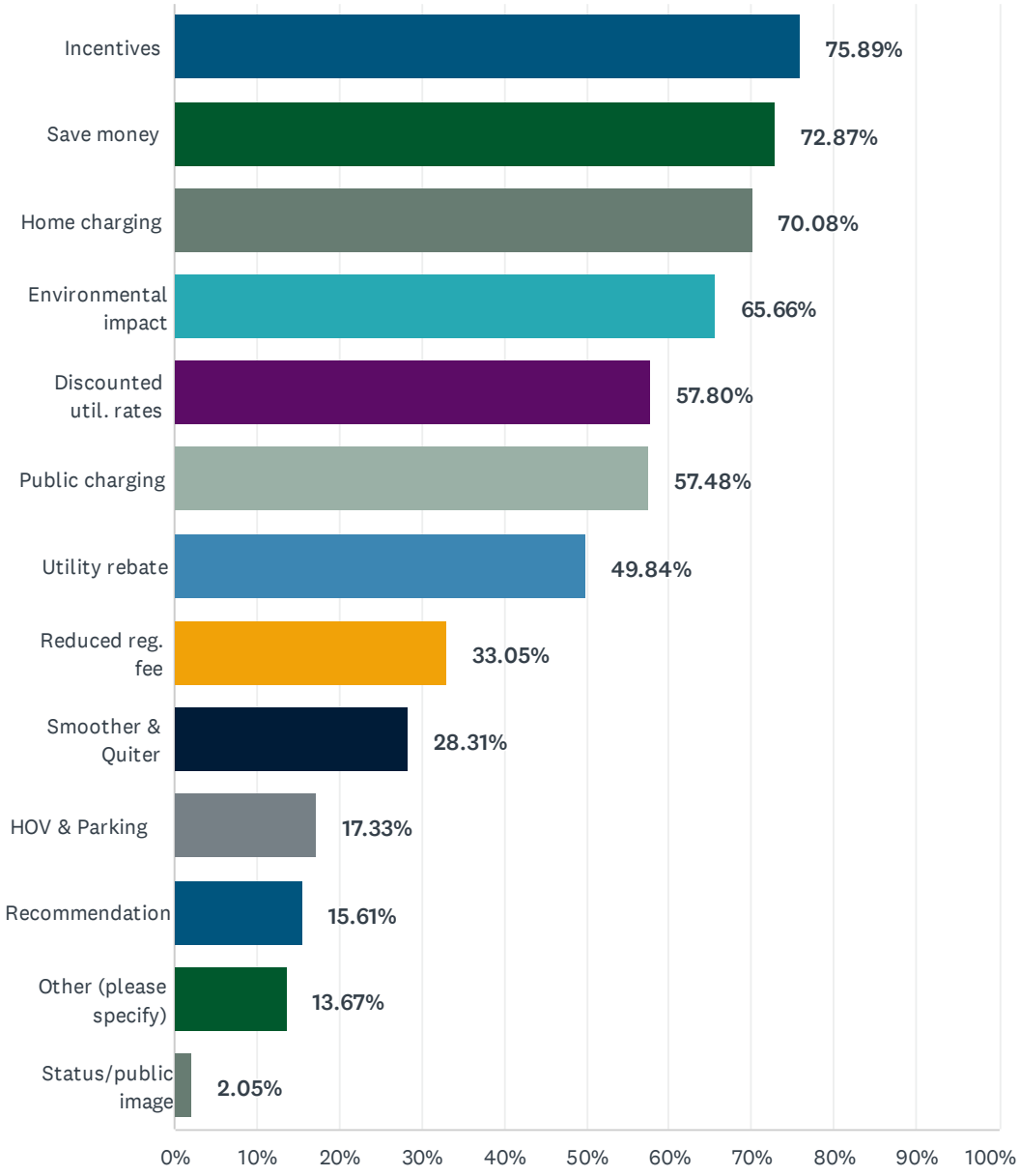
Q15 Do any of your friends or neighbours own an EV?

Answered: 941 Skipped: 74



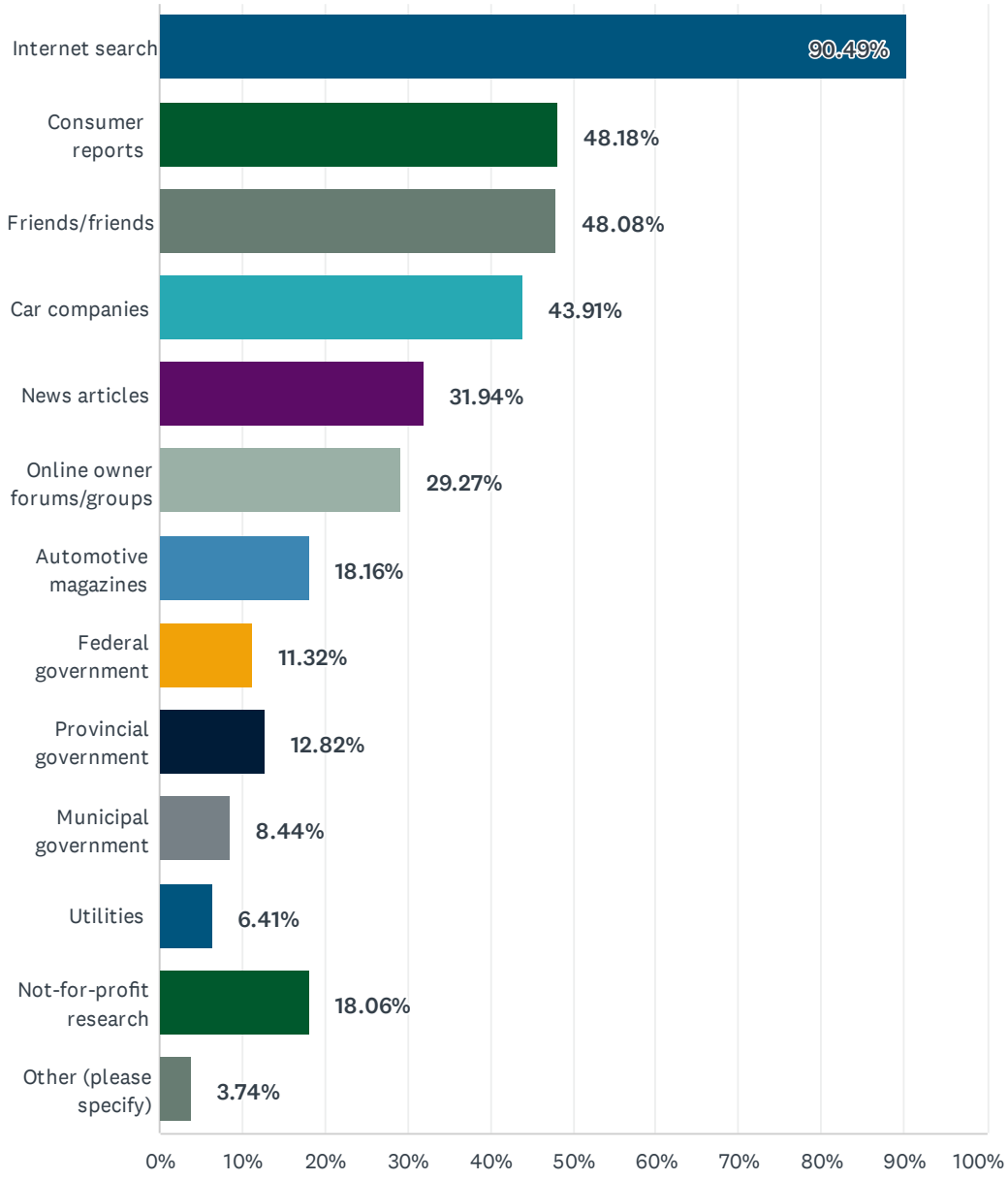
Q16 If you were considering buying an EV, which factors would motivate you? Please check all that apply.

Answered: 929 Skipped: 86



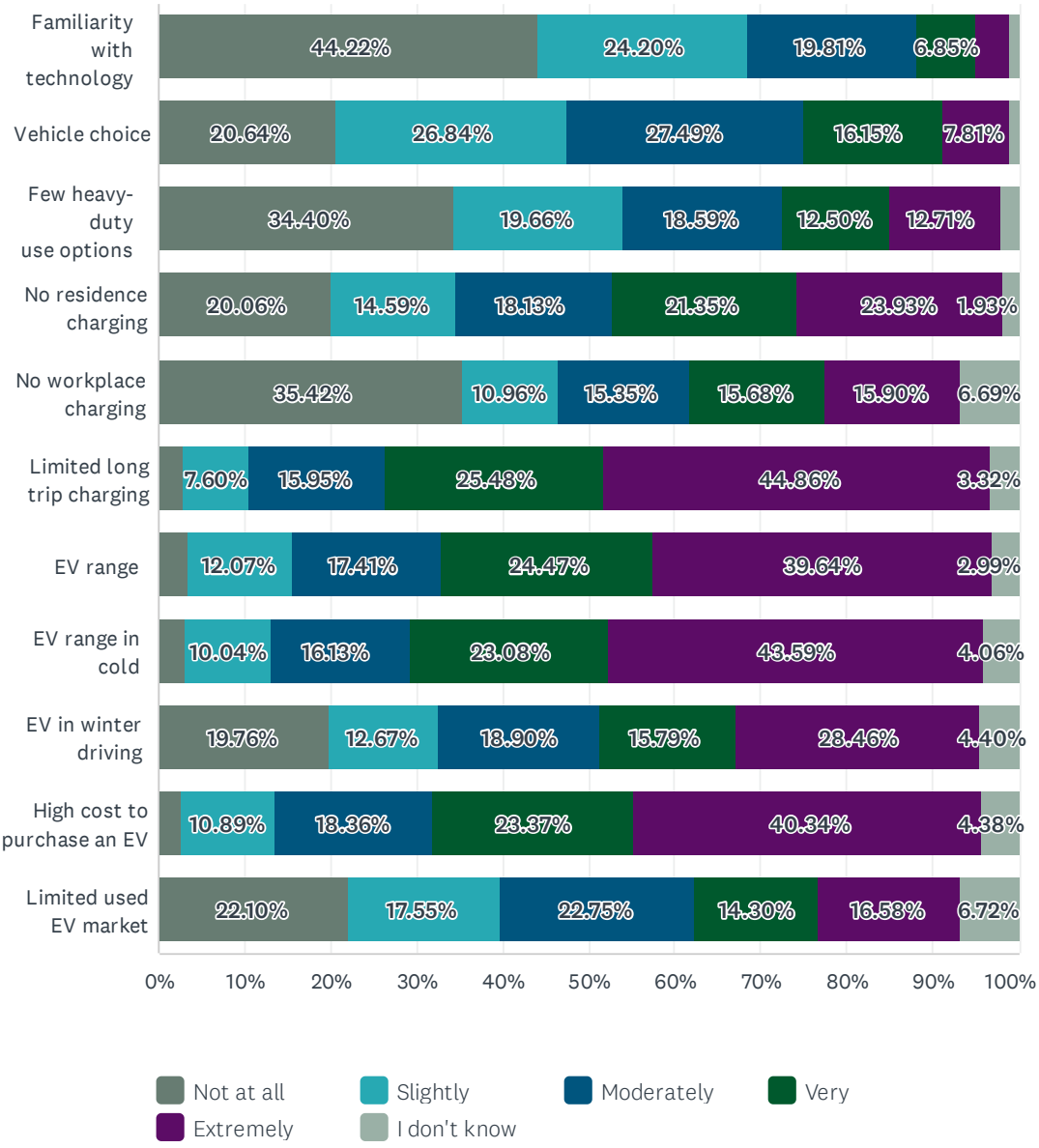
Q17 If you were interested in finding out more about EVs, where would you go to get this information? Please check all that apply.

Answered: 936 Skipped: 79



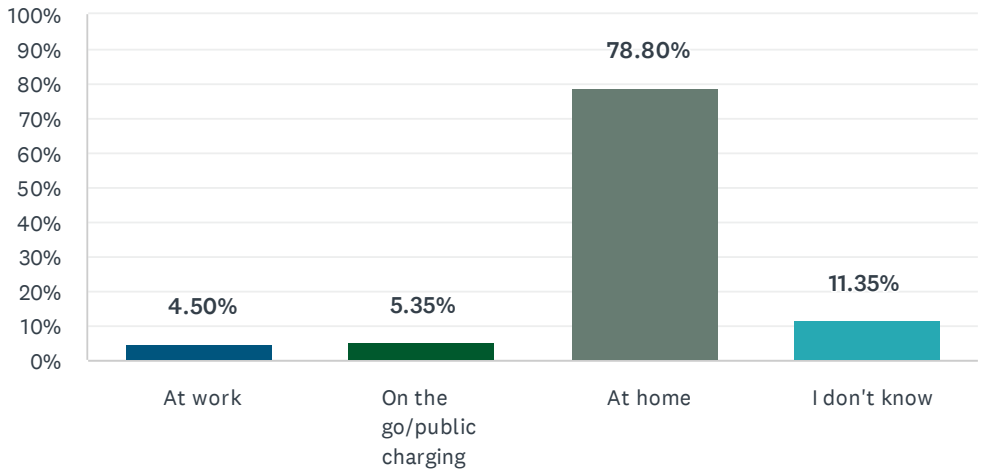
Q18 Listed below are some of the most common real and perceived barriers to EV adoption. How concerned would you be about the following when purchasing an EV?

Answered: 938 Skipped: 77



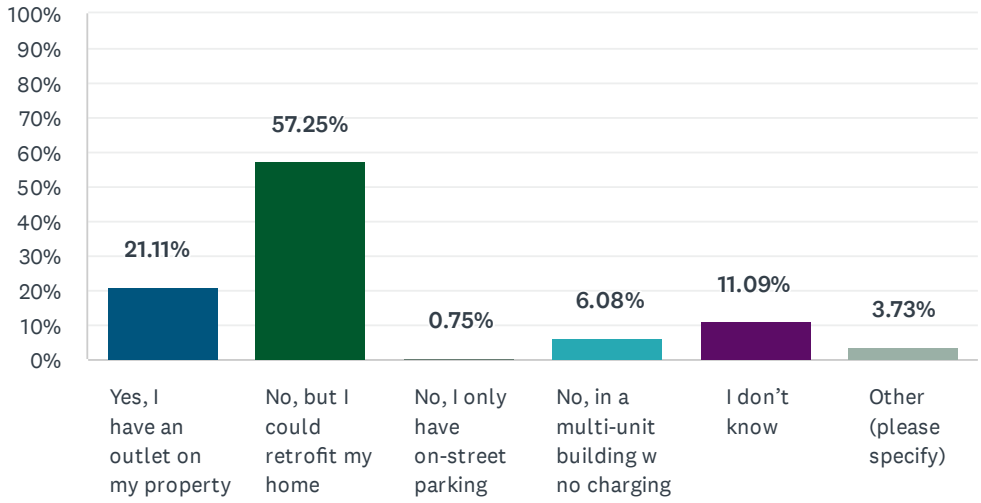
Q19 If you owned an EV, where might you charge it most often?

Answered: 934 Skipped: 81



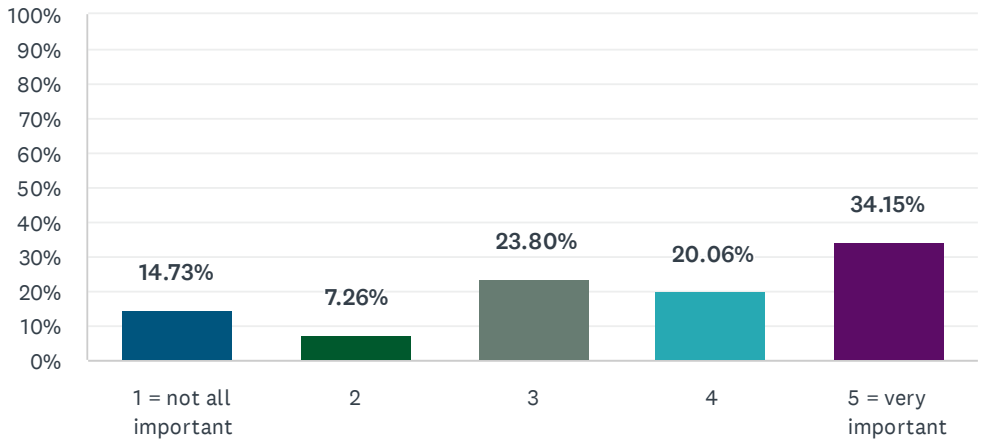
Q20 Do you have the ability to charge an EV at home?

Answered: 938 Skipped: 77



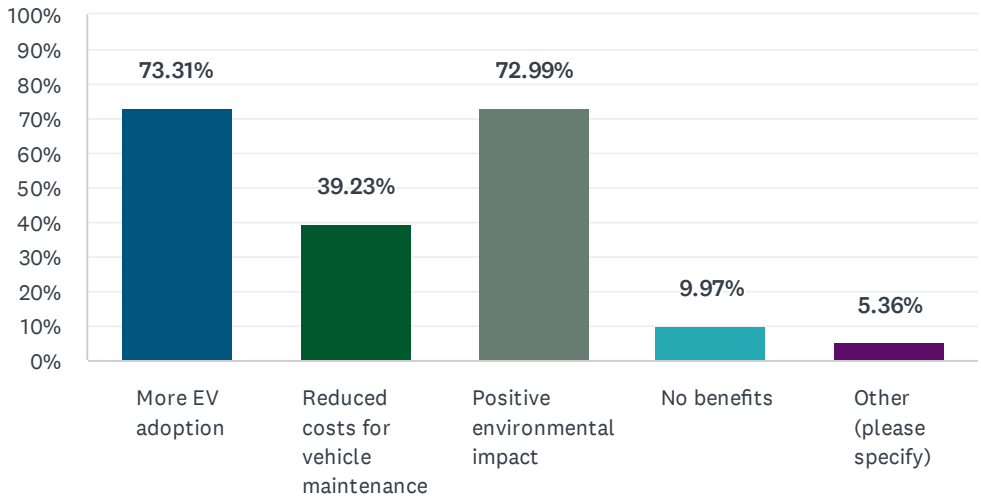
Q21 How important is it that the electricity used in an EV comes from renewable energy?

Answered: 937 Skipped: 78



Q22 What benefits do you think could result from having a more robust EV charger network? Please select all that apply.

Answered: 933 Skipped: 82



Q23 Do you have any other comments or questions?

Answered: 375 Skipped: 640

Q24 Please enter your contact information if you would like to be entered into the draw for prizes:

Answered: 594 Skipped: 421

Appendix 2. Level 3 (DC Fast Charger) EV Stations

The following table summarizes the proposed locations for Level 3 EV stations (both Phase 1 and Phase 2), and potential sites within each locale. The ownership of the site is denoted as county-, municipal- or privately-owned. Additionally, where possible the feedback from the Local Distribution Company as to the technical feasibility (desktop evaluation only) of a proposed site to host both (1) 100 kW charger with the infrastructure and capacity to support the addition of another (1) 100kw or (1) 150kW charger in the future. Proposed sites without 3-Phase power have been highlighted red, they are documented for reference, but they should not be considered for implementation as the cost to bring 3-Phase power to a site is significant and can double or triple the cost to install a station.

A recommended next step is to review the remaining proposed sites against the siting criteria again.

Location	Local Distribution Company	Site	Result of desktop evaluation of technical feasibility	Site Notes (with respect to Siting Criteria)
Tobermory (Phase 1)	**Hydro One**	7 Nicholas Street (County)	3-Phase power NOT available near the site. System expansion work would need to be performed to bring 3-Phase power to site.	
		22 Bay St. South (County)	Three phase power is available at the back of the parking lot from Head Street but would require a new transformer connection. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Near natural asset (harbour), public restrooms available, amenities nearby. Off the Highway, less visible.
		39 Legion Street (Municipality)	3-Phase power available near the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	One block further from the harbour, public restrooms and amenities than 22 Bay St. South location. Off the Highway, less visible.
		On street angle parking on Bay Street NE and SW of Brock Street (Municipal)	3-Phase power NOT available near the site. System expansion work would need to be performed to bring 3-Phase power to site.	

		4 Bay Street (Municipal)	3-Phase power available near the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Near natural asset (harbour), public restrooms available, amenities nearby. Off the highway.
		7468 Highway 6 – Blue Anchor Motel (Private)	3-Phase power available near the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Near natural asset (harbour), public restrooms available, amenities nearby. On the highway, may be less ideal for walking to nearby amenities? Highway location is more visible.
		7456 Highway 6 – Blue Heron Cruises (Private)	3-Phase power available near the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Near natural asset (harbour), public restrooms available, amenities nearby. On the highway, may be less ideal for walking to nearby amenities? Highway location is more visible
Wiarton (Phase 1)	**Hydro One**	268 Berford Street (County)	Existing three phase, 3 x 50kVA pole mount transformers supply this site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Outside of town core. Not as many amenities nearby.
		671 Frank Street – Long Term Care Centre (County)	Existing three phase, 500kVA pad-mount transformer supply this site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Residential neighborhood. No amenities in the region for public use.
		William Street at Berford Street (Municipal)	There is already underground conduit in place from the main transformer for the recommended location, being the William St angle parking located on the northwest side of the intersection of Berford St and William	Close to main street, lots of nearby amenities.

			St. The conduit was installed with two charging stations (each servicing two spaces). This space satisfies the criteria as it is close to downtown shops, banks, hotel/accommodation, and high-density housing and is located immediately adjacent to a high traffic volume corridor (Provincial Highway 6).	
		Louisa Street at William Street (Municipal)	3-Phase power available near the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Close to main street, lots of nearby amenities.
		315 George Street – Town Hall (Municipal)	3-Phase power available at the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Close to main street, lots of nearby amenities.
		578 Brown Street - Library (Municipal)	3-Phase service to existing facility. System and service assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Not as close to main street as other proposed sites. Closer to the waterfront and natural assets.
		402 William Street - Bluewater Park (Municipal)	3-Phase power available near the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Not as close to main street as other proposed sites. Closer to the waterfront and natural assets.
Durham (Phase 1)	**Hydro One**	Riverside Park, Durham N0G 1R0 (Municipal)	3-Phase power NOT available near the site. System expansion work would need to be performed to bring 3-Phase power to site.	
		185 George Street West N0G 1R0 (Municipal)	No reply provided.	Town hall site with lots of parking but no amenities nearby.

Kincardine (Phase 1)	**Westario & ?**	529 Gary Street (County)	Not Westario	Close to natural spaces, no amenities nearby.
		601 Durham Street – Davidson Centre (County)	There is 3-phase running down Durham St. across from this address.	In the park, lots of natural spaces. No amenities besides the community centre meaning nothing would be accessible outside of operating hours.
		20 McLaren St. Tiverton - Tiverton Sports Centre (County)	Not Westario	600m walk from town centre and services.
		310 Durham Market St. North – Victoria Park (Municipal)	3-Phase line runs up this road and is underground on the south side. There is an aerial 3-phase line running up along Durham Market Street S.	Situated near main street. Near river and river trail, close to park space.
		1475 Concession 5, Kincardine – Municipal Administration Centre (Municipal)	Not Westario.	Situated outside of town centre. No amenities besides the admin centre meaning nothing would be accessible outside of operating hours.
		870 Saugeen Street - Dunsmore Park (Municipal)	There is a 3-Phase line that runs down Durham that ends in front of the water treatment plant.	Close to natural area (waterfront). Uncertain as to availability of amenities and services nearby.
Shelburne (Phase 1)	**Hydro One**	151 Centre Street L9V 3R7 – Long Term Care Centre (County)	Existing three phase, 1MVA, customer owned pad-mount transformer supplies this site.	Residential street, amenities are >550m away.
		167 Centre Street L0N 1S4 - Long Term Care Centre (County)	Existing three phase supply to site. Three separate 300kVA, pad-mount transformers supply the Centre. System assessment required to determine if existing	Other side of building. Residential street, amenities are >550m away.

			infrastructure will need to be reconfigured to support any of the installations.	
		203 Main Street East L9V 3K7 – Town Office (Municipal)	3-Phase service to existing facility. 3 x 37.5kVA pole-mount transformers. Service capacity upgrade would be required including incremental load assessment	Close to town centre and amenities. Large parking lot with many stalls available.
		200 Fiddle Park Lane L0N 1S0 - Centre Dufferin Rec Complex (Municipal)	3-Phase power available at the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Situated outside of town centre. No amenities besides the rec complex meaning nothing would be accessible outside of operating hours.
		506269 ON-89 L9V 0N7 (Private)	3-Phase power available near the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	On the highway, high visibility. One restaurant and service station nearby. No sidewalks connecting to Boyne Valley Provincial Park? (~800 m away)
Wingham (Phase 1)	**Westario**	274 Josephine Street - Wingham Town Hall (Municipal)	This address is fed 3-phase from rear lot from Edward St.	Located in town centre, many amenities nearby. Ample size parking lot with several stalls available.
		281 Edward Street - Huron County Library (Municipal)	The 3-phase line dead ends just before this address. It's behind 274 Josephine St.	Further from town centre, not as many amenities in the near vicinity.
		99 Kerr Drive – North Huron Westcast Community Centre (Municipal)	Kerr Drive has 3-phase running along it down to Hwy 86.	Situated outside of town centre. No amenities besides the community centre meaning nothing would be accessible outside of operating hours.
		Parking lot at 55 Josephine Street N0G 2W0 (Private)	The pole line running in the rear lot behind the grocery store is 3-Phase. There is also a	Further out from town centre (850 m) but near natural space

			3-phase Kabar switch across the road if an underground feed is of interest.	and several amenities in the vicinity.
		100 David Street N0G 2W0 (Private)	There is a 3-phase line running through the west side of 100 David Street between David St and Victoria St. East.	Further out from town centre. Not near natural space. A few amenities in the vicinity.
		43 Alfred Street West N0G 2W0 (Private)	There is a 3-phase line running down Alfred across the road from this address.	Further out from town centre. Large parking lot with several parking stalls available. Still walkable to main street and amenities. No amenities at site besides mini-mart.
Listowel (Phase 1)	**Hydro One**	260 Main Street West – North Perth Public Library (Municipal)	3-Phase service to existing facility. Service capacity upgrade would be required including incremental load assessment	Next to town centre. No amenities at the site but within walking distance.
		330 Wallace Ave N. – North Perth Municipal Office (Municipal)	3-Phase service to existing facility. System and service assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Next to town centre. 450m from natural space and skateboard park. No amenities at the stie but within walking distance.
		169 Main Street E. – Ward and Uptigrove Municipal Lot (Municipal)	3-Phase power available near the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Next to town centre. Several businesses in the vicinity. No public restrooms available.
Bluewater (Phase 1)	**Hydro One**	9 Jane Street, Bayfield (County)	Existing three phase, 3 x 50kVA pole mount transformers supply this site/ system assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Residential area, no amenities nearby.
		4 Jane Street, Bayfield - Bayfield Community	3-Phase power available at the site. System assessment required to determine if existing	Situated outside of town centre. No amenities besides the

		Centre & Arena (Municipal)	infrastructure will need to be reconfigured to support any of the installations.	community centre meaning nothing would be accessible outside of operating hours.
		18 Bayfield Main Street N., Bayfield – Huron County Library (Municipal)	3-Phase service to existing facility. Service capacity upgrade would be required including incremental load assessment	Located in town centre, several amenities, and services in the vicinity.
		14 Mill Ave, Zurich - Bluewater Municipal Office (Municipal)	FESTIVAL	In town centre, mixed use area of residential and businesses. No notable amenities for visitors in direct vicinity of site.
		34023 Mill Road, Bayfield (Private)	3-Phase power available near the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Further out from town centre (>1km). Besides gas station no amenities nearby.
		Parking lot at 71 Main St. S, Bayfield (Private)	3-Phase power available near the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Further out from town centre. Large parking lot with several parking stalls available. Grocery store at site.
		Parking lot at 2 Main Street S. Bayfield (Private)	3-Phase power available near the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Further out from town centre. Minimal sidewalk infrastructure. Limited amenities at site.
Flesherton (Phase 1)	Hydro One	101 Highland Drive – Grey Highlands Municipal Library (Municipal)	3-Phase power available at the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Outside of town centre (600m). Connected by sidewalk infrastructure. No amenities at site beyond Arena and Library meaning nothing would be

				accessible outside of operating hours.
		40 Sydenham Street, Flesherton – South Grey Museum (Municipal)	3-Phase service to existing facility. Service capacity upgrade would be required including incremental load assessment	Outside of town centre but connected by sidewalk infrastructure. Some amenities at site including washrooms and natural spaces.
		1 Toronto Road (Private)	3-Phase power available near the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Located in town centre, several amenities nearby.
Thornbury	**EPCOR**	32 Mill Street, Thornburty, The Blue Mountains – Town of Blue Mountains Municipal Office (Municipal)		Located outside of town centre. Minimal amenities at site.
		41 Bruce Street North, Thornbury – Thornbury Municipal Harbour (Municipal)		Residential area near shoreline. Minimal amenities at site, no food services.
		105 Arthur Street West, Thornbury		Several businesses and services in the vicinity including a grocery store. Sidewalk infrastructure in place connecting different services.
Lucknow (Phase 1)	**Westario**	550 Willoughby Street (County)	There is a 3-phase primary line running along the length of Willoughby St. This address is serviced with 3-phase power as is the LCBO. There is also a 3-phase line running along Inglis just across from the baseball diamond.	150m from main street. No amenities or services at site.

		662 Campbell Street - Lucknow Arena/Caledonia Park (Municipal)	There is 3-phase power servicing the community centre. It also runs through the property and ties back into the main st.	200m from main street connected via sidewalk infrastructure. No amenities available at site when Arena is not operating.
		560 Willoughby Street (Private)	There is a 3-phase primary line running along the length of Willoughby St. This address is serviced with 3-phase power as is the LCBO. There is also a 3-phase line running along Inglis just across from the baseball diamond.	150m from main street. No amenities or services at site.
		737 Campbell Street (Private)	The run in front of the On the Go station is 3-phase. Mary's (adjacent property) is the limit of Westario's boundary in Lucknow.	Located further out from town centre connected via sidewalk infrastructure.
Paisley **(Phase 1)**	**Hydro One**	391 Queen St. North, Paisley – Paisley Arena (Municipal)	3-Phase power available at the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Limited services nearby. Town centre is over the bridge (260 m).
		293 James Street (Municipal)	3-Phase power NOT available near the site. System expansion work would need to be performed to bring 3-Phase power to site.	
		Parking lot at Bruce County Road 3 and Goldie Street (Municipal)	3-Phase power available near the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	
		436 Queen Street North (Private)	3-Phase power available near the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Residential area. Grocery store at site. Large parking lot with several parking stalls available.

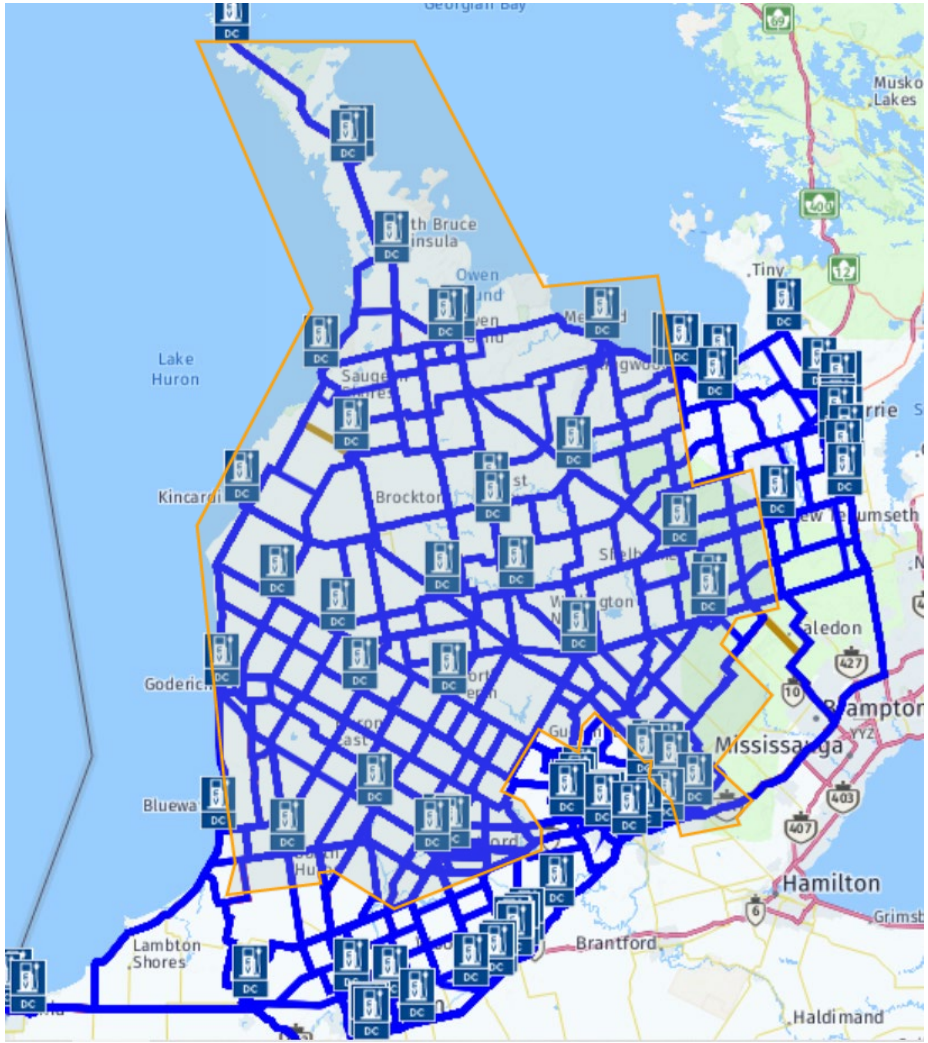
		277 Queen Street North (Municipality)	Existing three phase supply to site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	Located close to town centre. Several amenities nearby.
Mitchell (Phase 2)	**ERTH Power Corp?**	Parking lot directly east of 55 Montreal Street, Mitchell (Municipal)		220m from town centre. No amenities at stie.
		160 Wellington Street, Mitchell – West Perth Municipal Office (Municipal)	Conduit is in place.	Outside town centre. Large parking lot with several stalls available. Activities in the nearby vicinity but no food services.
		80 Ontario Road, Mitchell (Municipal)		Situated in town centre. Several amenities in the vicinity including natural spaces.
		Private parking lot at 145 Ontario Road, Mitchell (Private)		Located just outside town centre. Grocery store at site. No food services. Beginning of residential area.
Seaforth (Phase 2)	**Festival?**	72 Main Street South (parking lot behind building) – Huron East Town Hall (Municipal)		Located in town centre. Several amenities located in the nearby vicinity.
		108 Main Street S. – Huron East Library (Municipal)		Near town centre. Accessible via sidewalk infrastructure. Grocery store at site.
		122 Duke Street – Seaforth Community Centre (Municipal)		Located outside of town centre in residential neighbourhood. No amenities when the community centre is not operating.
Southampton (Phase 2)	**Westario**	33 Victoria Street N. (County)	Building has 208V and 600V 3 Phase power.	400m from town centre. Near park and natural spaces. Limited

				services at site. No amenities when the Museum is not operating.
		28 Victoria Street (Municipal)	There is a 3-phase line running down Victoria St. in front of both 28 Victoria Street S. and 28 Victoria Street N.	400m from town centre. Near park and natural spaces. Limited services at site.
		1 Beach Road (Municipal)		On the shoreline. Residential street. Limited parking at site. Outside of town centre. May not be ideal during the winter.
		Street Parking at 58 Morpeth Street (Municipal)		On the shoreline. Residential street. Limited parking at site. Outside of town centre. May not be ideal during the winter.
		328 McNabb Street (Municipal)	There is a 3-phase line running down McNabb Street.	Outside of town centre. Park located at site but no other amenities. May not be ideal during the winter.
		1 Chantry View Drive (Municipal)		On the shoreline. A few amenities at site including natural spaces but no food services. May not be ideal during the winter.
		70 Front Street (Municipal)		On the shoreline. A few amenities at site including natural spaces but no food services. May not be ideal during the winter.
Lion's Head (Phase 2)	**Hydro One**	4 Tackabury Crescent - Arena (Municipal)	3-Phase power available at the site. System assessment required to determine if existing	Outside of town centre. No amenities at site beyond community centre meaning

			infrastructure will need to be reconfigured to support any of the installations.	nothing would be accessible outside of operating hours.
		1 Forbes Street (Municipal)	3-Phase power available near the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	On the shoreline. A few amenities at site including natural spaces but no food services.
		1 Bruin Street (Municipal)	3-Phase power available at the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	On the shoreline. A few amenities at site including natural spaces but no food services.
Ferndale (Phase 2)	**Hydro One**	2928 Highway #6, Ferndale – Ferndale Tourism Office (Municipal)	3-Phase power available at the site. System assessment required to determine if existing infrastructure will need to be reconfigured to support any of the installations.	On the highway, highly visible. A few amenities at site but no food services.

Appendix 3. Level 3 (DC Fast Charger) Map After Project Completion

The following image provides a summary of the connectivity between Level 3 (DC Fast Chargers) EV stations across the Study Area and as they connect to stations already existing outside the Study Area (boundary denoted by orange polygon). The blue lines indicate the routes between stations that can be travelled successfully by the modeled EV.



Appendix 4. Environmental Benefits Summary Table

The following table summarizes the modelled environmental co-benefits of the forecasted local adoption of EVs because of this project a well as use of the network by visitors.

	2025	2030	2040
Business As Usual			
Vehicles	420,291	439,548	480,749
Annual new car sales	26,029	27,221	29,773
BAU Gas GJ	7,042,735	6,478,917	2,900,656
BAU GHG	479,605	443,715	213,929
BAU $	$407,671,658	$499,319,764	$633,797,967
Annual PEV Sales	3,841	16,918	29,773
Cumulative PEV Sales	13,753	65,555	301,676
Project			
PEV Growth rate	65.0%	29.9%	7.4%
Annual PEV Sales	8,174	27,221	29,773
Annual PEV full retirement (15 yr. lifespan)	-	-	8,174
Cumulative PEV Sales	20,965	138,147	408,245
Net new Electricity (kWh)	11,801,060	118,769,516	122,987,970
Electricity cost ($)	$1,938,068	$23,731,197	$36,375,643
PEV as % new car sales	31.40%	100.00%	100.00%
PEV % of fleet	4.99%	31.43%	84.92%
Savings			
Energy savings gasoline (GJ)	82,469	824,240	853,719
GHG savings from reduced gasoline consumption (tCO_2e)	5,801	57,975	60,048
Energy usage electricity (GJ)	20,617	206,060	213,430
GHG's from electricity (tCO_2)	178	1,680	1,930
Net GHG savings (or increase)	5,623	56,295	58,119
Annual Fuel Cost Savings	$4,617,524	$54,048,851	$64,969,338
Cumulative Fuel Cost Savings	$6,850,215	$170,651,510	$813,956,399
Net Savings			
Net Annual GHG savings (tCO_2e/yr)	5,623	56,295	58,119

Net Cumulative GHG savings (tCO_2e)	8,433	186,274	802,048
Air Contaminant Reductions			
Particulate Matter - <2.5 microns - $PM_{2.5}$ (ug/m^3)	0.06	0.36	1.02
Nitrous oxide - NO_2 (ppb)	0.026	0.156	0.442
Carbon monoxide – CO (ppb)	15	90	255
Ozone – O_3 (ppb)	0.115	0.69	1.955

Appendix 5. Level 2 EV Charging Stations

The following table summarizes the prioritization of proposed locations for banks of level 2 chargers in the Study Area.

	Locale	Physical Street Address	County	Priority 1	Priority 2	Priority 3
				13	10	51
1	Bruce County Museum	33 Victoria St N, Southampton, ON N0H 2L0	Bruce County			
2	Little Cove Adventures (Tobermory);	7111 ON-6, Tobermory, ON N0H 2R0	Bruce County			
3	Bluewater Park Splashpad (Wiarton),	400 William St, Wiarton, ON N0H 2T0	Bruce County			
4	National Park Visitor Centre (Bruce Peninsula National Park and Fathom Five National Marine Park),	120 Chi sin tib dek Rd, Tobermory, ON N0H 2R0	Bruce County			
5	Solways Farm Market and Bakery (Wiarton);	267 ON-6, Wiarton, ON N0H 2T0	Bruce County			
6	Ascent Aerial Park (Sauble Beach)	11 Lakeshore Blvd N, Sauble Beach, ON N0H 2G0	Bruce County			
7	Public parking (Sauble Beach)	5 Lakeshore Blvd N, Sauble Beach, ON N0H 2G0	Bruce County			
8	Blue Mountain Resort	190 Gord Canning Dr, The Blue Mountains, ON L9Y 1C2	Grey County			
9	Plunge Aquatic Centre;	220 Gord Canning Dr Unit AY1, The Blue Mountains, ON L9Y 0V9	Grey County			

10	Scandinave Spa Blue Mountain;	152 Grey County Rd 21, The Blue Mountains, ON L9Y 0K8	Grey County			
11	Scenic Caves Nature Adventures;	260 Scenic Caves Rd, The Blue Mountains, ON L9Y 0P2	Grey County			
12	Craigleith Heritage Dep Museum	113 Lakeshore Rd E, The Blue Mountains, ON L9Y 0N1	Grey County			
13	Owen Sound Parking Lot	1st Avenue East between 8th Street East and 7th Street East, Owen Sound	Grey County			
14	Owen Sound Bayshore Community Centre	2040 3rd Avenue East, Owen Sound	Grey County			
15	Grey Bruce Health Services	1800 8th Street East, Owen Sound	Grey County			
16	YMCA / Regional Recreation Centre	1400 8th Avenue East, Owen Sound	Grey County			
17	Grey Roots Museum and Archives	102599 Grey Road 18, Georgian Bluffs	Grey County			
18	Meaford Hall Arts & Cultural Centre	12 Nelson St E, Meaford, ON N4L 1N6	Grey County			
19	Meaford Arena	151 Collingwood Street, Meaford	Grey County			
20	Markdale Arena	75 Walker Street, Markdale	Grey County			
21	Markdale Parking (potential redevelopment area)	4 Main Street, Markdale	Grey County			
22	Future Markdale Hospital	220 Toronto Street South, Markdale	Grey County			
23	Town Hall and/or Adjacent Parking Lot	At Bridge Street East and Mill Street, Thornbury	Grey County			
24	Thornbury - Hester Street Parking Lot	Corner of Hester Street and Bridge Street East, Thornbury	Grey County			

25	Beaver Valley Community Centre	58 Alfred St W, Thornbury, ON N0H 2P0	Grey County			
26	Durham George Street West Parking Lot	At corner of Garafraxa Street North and George Street West, Durham	Grey County			
27	Durham Arena	451 Saddler Street West, Durham	Grey County			
28	Durham Hospital	320 College Street North, Durham	Grey County			
29	Dundalk Library	80 Dundalk Street, Dundalk	Grey County			
30	Dundalk Arena and Fair Grounds	590 Main Street East, Dundalk	Grey County			
31	Flesherton Library and Arena	101 and 102 Highland Drive, Flesherton	Grey County			
32	Hanover P and H Centre / Slots-Raceway	275 5th Street, Hanover	Grey County			
33	Hanover Hospital	90 7th Avenue, Hanover	Grey County			
34	Hanover Town Hall / Library	341 10th Street, Hanover	Grey County			
35	Neustadt Recreation Centre	210 Forler Street, Neustadt	Grey County			
36	Neustadt Downtown location	456 Jacob Street, Neustadt	Grey County			
37	Cobble Beach Golf and Country Club	221 McLeese Drive, Georgian Bluffs	Grey County			
38	Chatsworth - Future Arena site	5 Toronto Sydenham Street, Chatsworth	Grey County			
39	Bayfield - Clan Gregor Square	6 The Square, Bayfield, ON N0M 1G0	Huron County			
40	Goderich - Main Beach Pavilion	270 Harbour St, Goderich, ON N7A 4J	Huron County			

41	Goderich - Goderich Square - East St.	48 East St #44, Goderich, ON N7A 1N3	Huron County			
42	Goderich - GART Trailhead	Goderich to Auburn Rail Trail, Goderich, ON N7A 3Y2	Huron County			
43	Goderich - Huron Historic Gaol	181 Victoria St N, Goderich, ON N7A 2S9	Huron County			
44	Blyth - Blyth Arena & Community Centre	377 Gypsy Ln, Blyth, ON N0G 2W0	Huron County			
45	Walton - G2G Rail Trailhead	83041 Brussels Line, Walton, ON N0K 1Z0	Huron County			
46	Town Hall Parking Lot	322 Main Street South, Exeter	Huron County			
47	Port Albert Beach	28-20 Huron St N, Goderich, ON N7A 3X9	Huron County			
48	Donnelly Brewing Site	2740 Rd 164, Mitchell, ON N0K 1N0	Huron County			
49	Welcome Centre, Downtown Mitchell	9 Huron Road, Mitchell Ontario	Huron County			
50	Wildwood Conservation Area (Perth South)	3995 Line 9, St. Marys, ON N4X 1C5	Perth County			
51	Learning Hub-Training Centre	Elma Memorial Community Centre at 251 Main Street, Atwood, ON	Perth County			
52	McCully's Hill Farm (Perth South)	4074 Perth Line 9, St. Marys, ON N4X 1C5	Perth County			
53	Community Hub in Listowel	AT the Listowel Library	Perth County			
54	TNT Berries (Perth East)	1904 Line 34, Perth East, ON N0B 2P0	Perth County			

55	G2G Rail Trail, Perth East - Powell Road Kiosk	4693 Powell Rd, Wallenstein, ON N0B 2S0	Perth County			
56	TLC Alpaca (West Perth)	4616 Road 170, Mitchell, ON N0K 1N0	Perth County			
57	Lynn River Farm Store (Perth East)	2529 37 Line, Stratford, ON N5A 6S2	Perth County			
58	Huckleberry Hives (Perth East)	4505 46 Line, Gads Hill, ON N0K 1J0	Perth County			
59	Shakespeare Brewing Company (Perth East)	2178 Line 34, Shakespeare, ON N0B 2P0	Perth County			
60	Roancroft Picture Framing Prints Street Parking	95 Queen St E, St. Marys, ON	Perth County			
61	St. Marys Station Gallery;	5 James St N, St. Marys, ON N4X 1B1	Perth County			
62	Canadian Baseball Hall of Fame and Museum;	386 Church St S, St. Marys, ON N4X 1C2	Perth County			
63	Town Hall Theatre;	175 Queen St E, St. Marys, ON N4X 1C5	Perth County			
64	The Quarry	425 Water St S, St. Marys, ON N4X 1B6	Perth County			
65	The Stratford Perth Museum;	4275 Huron St, Stratford, ON N5A 6S6	Perth South			
66	Hockley Valley Provincial Park - Park in Free BT Lot	Hockley Rd, Mono, ON L9W 2Y8	Shelburne			
67	Dufferin County Forest	937513 Airport Rd, Mansfield, ON L0N 1M0	Shelburne			

68	Mono Cliffs Provincial Park	795086 3rd Line EHS, Shelburne, ON L9W 5Y2	Shelburne			
69	Guelph Grotto	199 Victoria Rd S, Guelph, ON N1E 6T9	Guelph			
70	Puslinch Community Centre	23 Brock Road South, Puslinch	Wellington			
71	Wellington County Museum and Archive	0536 Wellington County Rd 18, Fergus	Wellington			
72	Drayton Municipal Parking lot	14 Main West, Drayton	Wellington			
73	Rockmosa Community Hall	74 Christie St, Rockwood	Wellington			
74	(future) Erin Library	Daniel St, Erin	Wellington			
75	Mount Forest Sports Complex	850 Princess St, Mount Forest	Wellington			
76	Arthur Community Centre	158 Domville St, Arthur	Wellington			

Appendix 6. Current Usage Fee Summary for Level 2 and Level 3 (DC Fast Charging) Stations

CEA completed a scan of current usage fees at Level 3 (DC Fast Charging) and Level 2 EV chargers across Ontario and parts of Quebec. The following table summarizes the findings.

Table 1. 2022 Level 3 and Level 2 EV charger usage fees.

Station	L2 or Fast Charger	Municipality	Prov	Network	Location	Cost
Ivy Dryden	Fast Charger	Dryden	ON	IVY	Commercial complex	$18/hour + 13% tax
Scotiabank	Fast Charger	Stratford	ON	EV Connect Canada	Commercial Complex	Flat fee: $3.95 While charging: $9.60/hr. While parked, not charging: $9.60/hr.
CF Fairview Park	Fast Charger	Kitchener	ON	FLO	Commercial complex	$20/hour
Denny's	Fast Charger	Guelph	ON	SWTCH	Restaurant	$18/hour
Canadian Tire	Fast Charger	Mississauga	ON	FLO	Commercial complex	$20/hour
Agincourt Canadian Tire	Fast Charger	Scarborough	ON	Electrify Canada	Commercial complex	Pass (Free): (1-90 kW) $0.27/minute, (1-350 kW) $0.57/minute Pass+ ($4.00 Monthly): (1-90 kW) $0.21/minute, (1-350 kW) $0.44/minute

Manulife Centre	Fast Charger	Toronto	ON	GE WattStation	Commercial complex	Flat fee: $3.95 + While charging: $12.00/hr. + While parked, not charging: $10.00/hr. after 60 mins
Onroute Innisfil	Fast Charger	Innisfil	ON	IVY	Commercial complex	$18/hour
Terry Fox Park & Ride	Fast Charger	Kanata	ON	Circuit Electrique	Park & Ride	$1.75/hour
IVY Temiskaming Shores	Fast Charger	Temiskaming Shores	ON	IVY	Hotel	$18/hour
Dépanneur Voisin Lou Bell	Fast Charger	Val-d'Or	QC	Circuit Electrique	Gas Station	$1.75/hourly
Mountain Granite	Fast Charger	Thurso	QC	FLO	Commercial complex	$12/hour
Marché Maisonneuve	Fast Charger	Montréal	QC	Circuit Electrique	Commercial complex	$1.75/hour
Prémont Harley-Davidson	Fast Charger	Québec City	QC		Commercial complex	$4.80/hour
Rôtisserie Fusée	Fast Charger	Donnacona	QC		Commercial complex	$5/30 minutes
Davy Lake Campground Resort	L2	Ignace	ON		Campground	Website says $15 for car charging (includes day pass)
Superior Hyundai	L2	Thunder Bay	ON	FLO	Dealership	$1.50/hour
CF Fairview Park	L2	Kitchener	ON	FLO	Commercial complex	$1.50/hour
Conestoga Mall	L2	Waterloo	ON	FLO	Commercial complex	$1.50/hour
Canadian Tire	L2	Mississauga	ON	FLO	Commercial complex	$1.50/hour

Cole St Paring Lot	L2	Toronto	ON	ChargePoint	Commercial complex	All Days - $1.00/hr. Max - $50.00 per session Parking - Free for 90 minutes
Holly Community Centre	L2	Barrie	ON	FLO	Community Centre	$2.50/hour
Performance Court	L2	Ottawa	ON	ChargePoint	Restaurant	$2.50 session fee, plus parking cost
Terry Fox Park & Ride	L2	Kanata	ON	Circuit Electrique	Park & Ride	$1/hour
Pembroke and Area Community Access Center	L2	Pembroke	ON	FLO	Community Centre	$2.50/hour
Site Historique Opémican	L2	Temiscaming	QC		Historic Site	$2.50 per session
STO - Centre d'entretien et d'exploitation	L2	Gatineau	QC	FLO	Office	$1/hour
St Hubert Express	L2	Laval	QC	Circuit Electrique	Commercial complex	$1/hour
Cartier Stationnement / Chargement	L2	Montréal	QC	Circuit Electrique	Commercial complex	$1/hour
Benny & Co	L2	Bécancour	QC	ChargePoint	Commercial complex	$1/hour
Hôtel Le Bonne Entente	L2	Québec City	QC	ChargePoint	Hotel	$20 fee