Appendix A
to
Report FL2023-001

Feasibility Plan for the Transition of The City's Non-Emergency Fleet to Electric Vehicles

City of Kawartha Lakes
November 2021

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Abbreviations and Acronyms

AC – alternating current
BEV – battery electric vehicle
CASE – connected, autonomous, shared and electric
CAV – connected autonomous vehicle
CCS – combined charging system
DC – direct current
DCFC – direct current fast charger (synonymous with Level 3 charger/charging station)
DER – distributed energy resource
DVP – Don Valley Parkway
EHVAP – Electric and Hydrogen Vehicle Advancement Partnership (Ontario)
EV – electric vehicle (includes both battery and plug-in hybrid electric vehicles)
EVIP – Electric Vehicle Incentive Program (Ontario)
EVSE – Electric vehicle supply equipment
EVWG – Electric Vehicle Working Group (Toronto)
FCEV – hydrogen fuel cell electric vehicle
FSA – forward sortation area (determined by first three postal code characters)
GHG – greenhouse gas
GPS – global positioning system
GTA – Greater Toronto Area
GTHA – Greater Toronto and Hamilton Area
HEV – hybrid electric vehicle
HOV – high occupancy vehicle
ICE – internal combustion engine
IEA – International Energy Agency
ITS – intelligent transportation system
kW – kilowatt
kWh – kilowatt hour
LEV – low-emission vehicle (includes electric and hydrogen fuel cell electric vehicles; synonymous with ZEV)
MURB – multi-unit residential building
OECD – Organisation for Economic Co-operation and Development
PHEV – plug-in hybrid electric vehicle
SAE – Society of Automotive Engineers
TGS – Toronto Green Standard
TRAP – traffic-related air pollution
TTC – Toronto Transit Commission
V - volt
VKT – vehicle kilometres travelled
ZEV – zero-emission vehicle (includes electric and hydrogen fuel cell electric vehicles; synonymous with LEV)

Introduction

The City of Kawartha Lakes is a unitary municipality in Central Ontario, Canada. It is a municipality legally structured as a single-tier city; however, Kawartha Lakes is the size of a typical Ontario county and is mostly rural. It is the second largest single-tier municipality in Ontario by land area. The City of Kawartha Lakes has a land area of 3,059 km^2 with a population of 75,423 (2016).[1]

Moving the City's fleet towards zero emission options and supporting the transition from fossil fuel internal combustion engines (ICE) to Electric Vehicles (EV) is directly in line with the City of Kawartha Lakes 2020-2023 Strategic plan. There is great cohesion with the City's vision and mission statements while aligning with our guiding principles and strategic priorities.

By supporting the growth of EVs and charging infrastructure the City has an opportunity to align with its strategic priority for a healthy environment. The increased uptake of electric vehicles is expected to make a significant contribution towards meeting emission reduction targets set out by both provincial and federal governments.

Our goal should be to promote, assist and support our resident's transition to electrified passenger vehicles, with an additional focus on supporting the move to more efficient modes of transport such as walking, cycling and public transit. This in turn will lead to a wide range of benefits in addition to GHG reductions.

One of the main challenges the City will face when transitioning its fleet from ICE vehicles to EV is the large geographical area the municipality encompasses. Also, a significant portion of the area being rural will provide charging and electrical capability challenges.

The City of Kawartha Lakes Healthy Environment Plan published in 2019 identifies transportation as the largest contributor (45%) to the City's 647,470 tonnes of CO^2e production taking place within the City boundaries. [2]

Given Ontario's mix of emissions-free electricity generation, each battery electric vehicle adopted in the City of Kawartha Lakes will lead to GHG emissions reductions of 3 to 5 tonnes per year, relative to gas-powered vehicles. Each plug-in hybrid electric vehicle will lead to reductions of 2 to 3.5 tonnes per year. Creating landscape that is conducive to the increased adoption of electric vehicles is therefore a central goal of City of Kawartha Lakes. To deliver on this and related goals, the City of Kawartha Lakes needs to follow other municipalities like the City of Toronto and embark on a multi faceted approach involving multiple City divisions and community partners. EV adoption and implementation has potential to be a tourism and economic driver for our City while improving our environmental stewardship.

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[1] https://www.google.com/search?client=firefox-b-e&q=city+of+kawartha+lakes

[2] https://www.kawarthalakes.ca/en/resourcesGeneral/Documents/Healthy-Environment-Plan-Long.pdf

The goal of this report is to highlight key considerations for EV and EV charging implementation plans. Other goals of this report are to develop and implement an EV strategy, and identify barriers, opportunities and best practices related to the deployment of electric mobility solutions in the City of Kawartha Lakes.

This report is a great first step towards the required investigation and an introduction to EV technology. It also identifies the needs of the City and the required next steps.

Section 2 includes a high-level look at the types of commercial electric vehicles available, and the types of charging infrastructure available for these vehicles.

Section 3 overviews the state of electric vehicle adoption from global, national, provincial and municipal perspectives.

Section 4 delves into best practices in municipality-led efforts to advance electric mobility, breaking down types of actions into different categories that are in some cases best facilitated by contributions from specific stakeholder groups.

Section 5 explores potential impacts that EVs pose to local electrical grids, and how utilities are planning for such impacts. It highlights the need to make charging infrastructure accessible to potential electric mobility users regardless of their type of housing, income level, or travel patterns. This section then explores emerging transportation technologies and trends that could significantly influence the direction and scope of the City's EV implementation in the near future.

Section 6 overviews the key areas for action that the City of Kawartha Lakes should address. It outlines which stakeholder groups are candidates to make valuable contributions to different types of actions.

Section 7 provides a high-level summary of the report and outlines next steps in the development of City of Kawartha Lakes EV implementation plan.[3]

[3] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

2.1 Electric Mobility Options: A Brief Overview

There are currently four broad classes of vehicles that can be used to deliver electric mobility. The common feature of these vehicles is that they are able to provide propulsion via an electric motor for at least a portion of total distance travelled. The four types are briefly described below, along with a conventional internal combustion engine (ICE) vehicle.

Internal Combustion Engine (ICE) Vehicle: A conventional vehicle that burns gasoline or diesel to generate motive power. The average ICE vehicle is only about 21% efficient, meaning that almost 80% of the energy produced from burning gasoline or diesel is wasted, predominantly as heat energy. ICE vehicles are currently used across all vehicle modes (passenger cars and trucks, medium- and heavy-duty vehicles), and continue to dominate the global vehicle market.

Hybrid Electric Vehicle (HEV): Combines an ICE with a battery-electric propulsion system. Uses regenerative braking and/or the ICE to charge the battery; no external source of power is used. These 'conventional' hybrids tend to have much smaller batteries and shorter all-electric ranges than PHEVs. Vehicle hybridization has emerged as an option for most modes of vehicles, and has helped to achieve modest GHG reductions.

Plug-in Hybrid Electric Vehicle (PHEV): A HEV with the option to charge the battery with an external source of electricity. These vehicles typically have larger batteries and longer all-electric ranges than HEVs. Modern PHEVs tend to have electric ranges anywhere from 25 to 85 km. This means that their users can conduct a significant amount of day-to-day driving exclusively using electric propulsion, while having the option to make longer trips using petroleum if charging is unavailable or too time-consuming.

Battery Electric Vehicle (BEV): BEVs only contain a battery-electric propulsion system. The battery is charged by plugging in to an external source of electricity. In contrast to low-efficiency ICE vehicles, BEVs tend to have efficiencies around 80%. Commercially available BEVs tend to have ranges between 150 and 540 km on a single charge.

Although BEVs have zero tailpipe emissions (they don't even have tailpipes), the quantity and location of greenhouse gas (GHG) emissions and air pollutants released to power BEVs depends on the regional grid's mix of energy sources. In Ontario in 2017,[4] electricity generation was 96% emissions-free, meaning that the net contribution of BEVs to emissions of air pollutants and GHGs in the province is minimal. Because a large majority of BEV charging occurs overnight, when Ontario's natural gas peaker

[4] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

[5]plants are typically not supplying any power to the grid, emissions associated with BEV use in the province are almost negligible.

In addition to low emissions, BEVs are noted for requiring significantly less maintenance than ICE vehicles. This is due in part to the fact that ICE vehicle powertrains tend to contain about 2,000 moving parts, whereas BEV powertrains contain about 20.

In recent years, BEV architectures have emerged as viable options for almost every type of vehicle, from drones, to scooters and bicycles, motorcycles, passenger cars, delivery vehicles, buses, construction and mining vehicles, and even heavy-duty on-road freight trucks.

Fuel Cell Electric Vehicle (FCEV): Uses a fuel cell and hydrogen gas to power an electric motor which drives the propulsion system. Hydrogen (H2) can be produced from methane (CH4) via a process called steam reforming, or from water (H2O) via electrolysis. Once the hydrogen is produced it must be pressurized, distributed and stored. Inside the vehicle, a fuel cell stack converts the hydrogen into electricity which is used to charge a small battery which in turn powers an electric motor. The FCEV refueling process is similar to that of conventional ICE vehicles, and only takes several minutes to complete. The efficiency of FCEVs depends on the technologies and processes used in producing, compressing, transporting, and converting the hydrogen, but conservative estimates indicate a net efficiency of approximately 30%.

As FCEVs use electric motors for propulsion they are most often categorized as a form of electric mobility. However, due to their unique fueling requirements, the potential for integrating FCEVs into the City's electric mobility landscape is beyond the scope of this report. While access to electricity is ubiquitous, access to hydrogen gas requires extensive production and distribution infrastructure that currently does not exist.

The above-mentioned vehicles are often collectively referred to as zero emission vehicles, or ZEVs. Although the term is not strictly accurate, as all of the vehicles produce emissions at some point during their use, manufacture, or through the production of their fuels, it is nonetheless used in literature and in government policy documents. [6]Sometimes the term low emission vehicles, or LEVs, is used to refer to the same group of vehicles.

[5] https://web.archive.org/web/20190614220543/https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf
[6] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

For the purpose of this report, the term electric vehicle (EV) is used to refer to all BEVs and PHEVs.

2.2 EV Charging: A Brief Overview

There are several options for EV recharging, each of which has unique benefits and limitations.

Level 1 Charging: This type of charging takes place when an EV user plugs their vehicle into a standard electrical outlet. These outlets typically supply power at a rate of 1.8 kW (120 V x 15 A), so charging a depleted 30 kWh EV battery would take over 16 hours using this method. These outlets are ubiquitous, however, and are sometimes installed in parking facilities or on the outer walls of buildings to power equipment such as engine block heaters, appliances and tools. Level 1 charging is an option when time is not of the essence; for example, when a vehicle is parked for a long period (e.g., overnight, at work, or at a transit hub) and isn't needed right away. All production EVs are compatible with this type of charging.

Level 2 Charging: This type of charging typically provides power at a rate of up to 7.2 kW (240 V x 30 A), though amperage can vary depending on the charging hardware and circuit. This is the same level of power used by clothes dryers and electric ovens, and any device that plugs into a 3- or 4-pronged 240 V outlet. A standard Level 2 outlet will charge a fully depleted 30 kWh EV battery in a little more than 4 hours. This faster speed makes Level 2 charging stations much more practical for EV users who only plan to stop for an hour or two, perhaps at sites such as restaurants, parks, retail outlets, gyms, theatres, or visitor parking lots for residential buildings. Most home-based charging stations are Level 2, and can be programmed to begin the charging process during off-peak electricity usage hours, regardless of when a user actually plugs in their vehicle. SAE J1772 ports and connectors are the North American standard for Level 1 and Level 2 charging, and all EVs are compatible with this type of charging.

Level 3 Charging (DC fast/quick charging): This type of charging provides direct current (DC) power – the same type of power distributed by high-voltage electricity transmission infrastructure in North America, and the same type of power stored by EV batteries. DC fast charging uses at least 480 V, and net power delivered can range from 50 kW to 350 kW or greater in modern 'ultra-fast' DC chargers.[7] Most currently available EVs can charge at a rate of up to 50 kW, so a 30 kWh battery could be fully charged in 30 to 40 minutes. Eventually, ultra-fast DC chargers could allow EVs with longer than typical ranges (and therefore larger batteries) to fully charge in under 10 minutes. Level 3 chargers are much more expensive to purchase and install than Level 2, and as a result are not typically used in residences. They are suitable at sites where EV users do

[7] https://evsafecharge.com/dc-fast-charging-explained/

not want to remain for any longer than necessary, such as highway rest stops between major destinations.

Table 1: Summary of Charging Station Types

Descriptor	Level 1	Level 2	Level 3
EVs Supported	All PHEVs and EVs	All PHEVs and EVs	BEVs (not all)
Typical Voltage	120	240	480
Current Type	AC	AC	DC
Requirements	Requires standard electrical outlet	Requires 240 volt electrical outlet (for portable chargers) or circuit (stationary charger)	Charging facility in a fixed location
Charging Time Range	8 - 30 hours	4 - 10 hours	25 - 30 min (to 80% of full charge)
Range Added per Hour (approx.)	8 km	40 km	320+ km
Hardware and Installation Cost	$1,000 – $1,500	$5,000 – $15,000	$50,000 - $100,000
Applications	Long term parking (home, work, etc.)	Long and short-term parking (home, office, retail storefronts, etc.)	Long-distance travel (highways)

(Figure 1)

Source: Adapted from *Accelerating the Deployment of Zero Emission Vehicles: Atlantic Canada and the Prairies*[8]

State of Zero Emission Vehicles – International Perspective

The global EV market is growing at a very rapid rate. In its Global EV Outlook 2018, the International Energy Agency (IEA) estimates that over 1 million EVs were sold worldwide in 2017, an increase of 54% over the previous year. Figure 2 shows leading countries in EV adoption by total volume and market share. China and the United States had the highest sales volume of EVs in 2017, at approximately 579,000 and 198,000 vehicles, respectively. In terms of sales share, Norway is the world's leader, with over 39% of new sales being electric in 2017, followed by Iceland at 11.7% and Sweden at

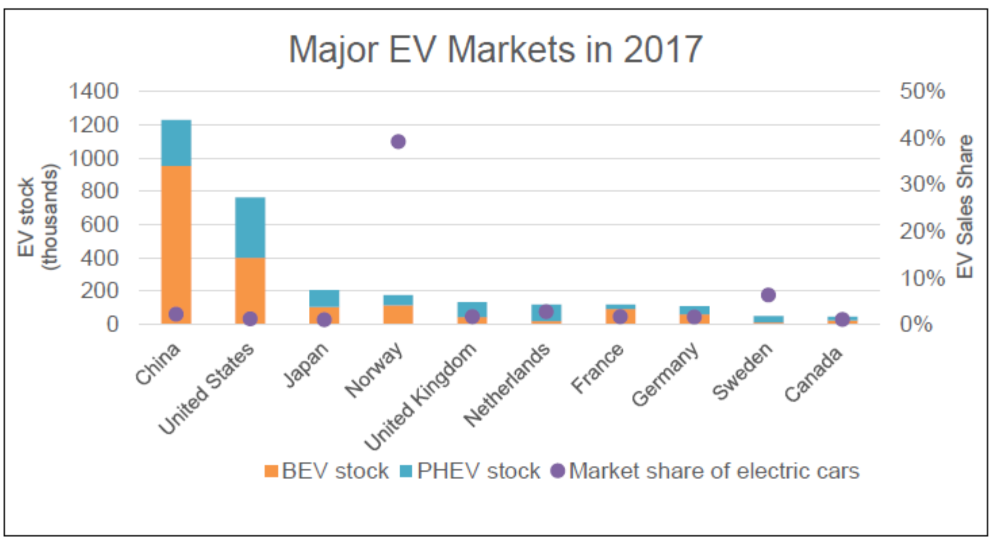
[8] https://www.pollutionprobe.org/publications/accelerating-deployment-zevs-atlantic-canada-prairies/

6.3%. In most other countries, including Canada, EV sales share represented less than 2% of total passenger vehicle sales in 2017.

Supportive policies have been a key driver of EV uptake in leading jurisdictions, which have employed a combination of measures including EV purchase price subsidies, investments in refuelling/charging infrastructure, public procurement plans, regulatory measures, etc.

The total number of EVs on the road reached 3.1 million worldwide in 2017, up 57% from the previous year. China has the world's largest EV market, with over 1 million vehicles in active service, which accounts for about 40% of the global EV fleet. The United States and Japan follow with 762,000 and 205,000 vehicles, or 24% and 7% of the global total, respectively.

However, the EV market remains relatively small in absolute size, considering that there are approximately 1.14 billion light-duty vehicles in use today.[9] The IEA estimates that only three of its Electric Vehicles Initiative (EVI) member countries have a rolling stock share of 1% or higher: Norway (6.4%), Netherlands (1.6%) and Sweden (1.0%). [10]



(Figure 2): Major EV markets by stock volume and sales share in 2017[11]

Charging infrastructure trends mirror the rise in EV uptake, with private chargers at residences and workplaces estimated to number approximately 3 million worldwide in

[9] https://www.greencarcongress.com/2015/07/20150706-navigant.html
[10] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf
[11] https://webstore.iea.org/download/direct/1045?filename=global_ev_outlook_2018.pdf

2017, complemented by almost 320,000 publicly accessible Level 2 stations and over 110,000 DC fast chargers.[12]

Supportive government policies are expected to continue to drive significant growth in EV uptake.[13] Several jurisdictions, including California and China, have set ZEV mandates, requiring automakers to sell a minimum percentage of ZEVs every year (those that don't meet the fleet average threshold pay a tax or buy compliance credits). A number of countries, including Norway, France, the United Kingdom and India, as well as major cities, have set EV targets or bans on conventional ICE vehicles. Falling costs of lithium-ion batteries and commitments from automakers to expand EV model availability in their fleets are other key factors driving EV market growth, enabling adoption among a wider range of consumers. Bloomberg New Energy Finance's (BNEF) survey of more than 50 companies, found that the average cost of an EV battery pack was $209 per kilowatt-hour in 2017, an 80% drop since 2010. BNEF expects the cost will fall below $100 per kilowatt-hour by 2025, a rate that is seen as "a tipping point in the adoption of EVs."[14] The number of commercially-available EV models is expected to increase from 155 in 2017 to 289 by 2022. A number of automakers are pledging to sell only electric models beginning in the next 7 to 10 years.[15]

Forecasts for EV adoption vary widely, with global EV sales projected to comprise 11 to 25% of car sales by 2025,[16] [17] [18] and up to 55% by 2040. IEA estimates that electric light-duty vehicles (LDVs) will number between 125 and 228 million, or 6 to 12% of the global LDV stock by 2030, depending on the scenario.[19] Bloomberg New Energy Finance forecasts 559 million EVs on the road by 2040, representing 33% of the global passenger vehicle fleet.

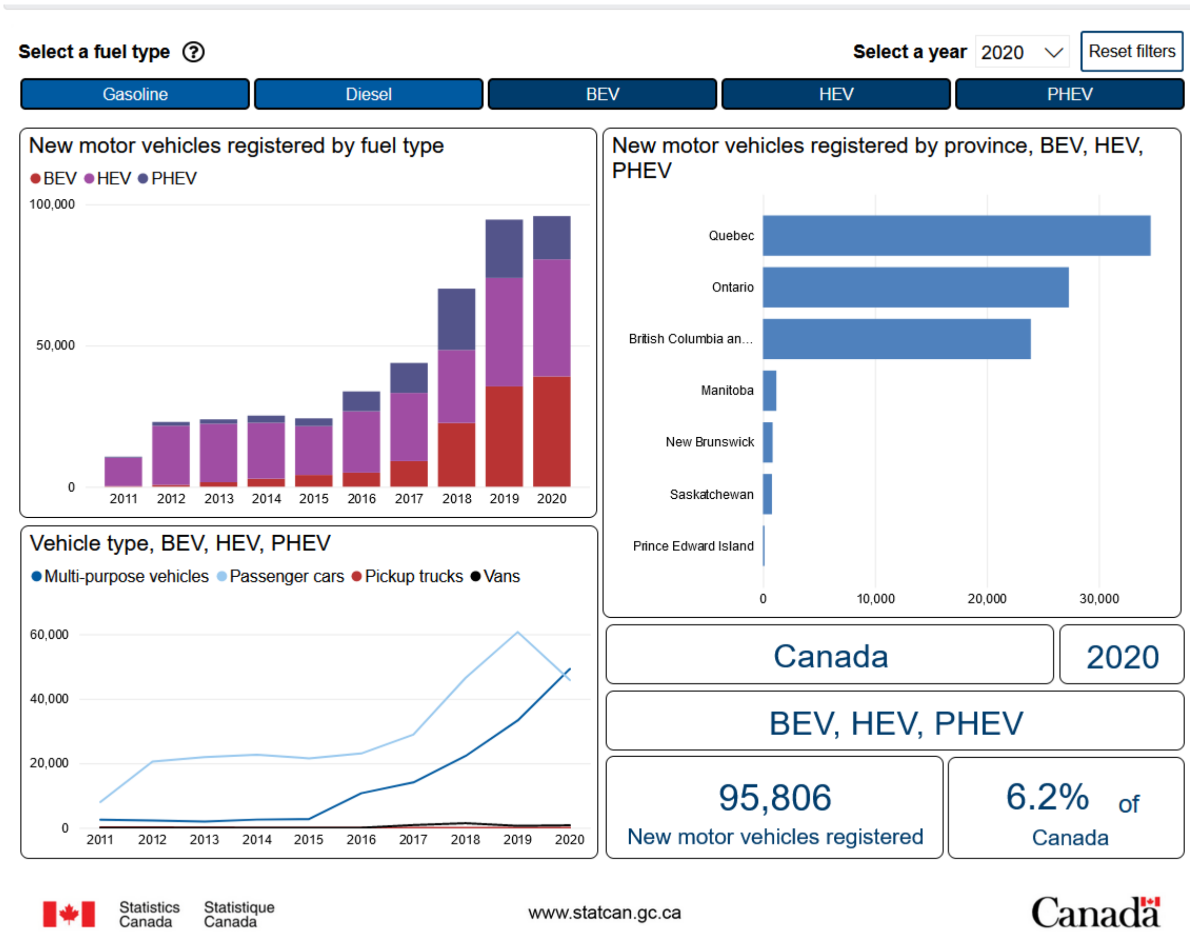
3.1 EV Landscape in Canada

Canada has seen a massive expansion in the EV market over the past several years (Figure 3). In 2020, new EV sales reached approximately 95,806 vehicles. EV sales have steadily increased. The national EV market share is 6.2%. For comparison, the 2015 EV market share was 1.3% or 24,197. Canadian EV sales have increased steadily year over year with the largest increases in 2018 and 2019.[20]

[12] https://webstore.iea.org/download/direct/1045?filename=global_ev_outlook_2018.pdf
[13] https://webstore.iea.org/download/direct/1045?filename=global_ev_outlook_2018.pdf
[14] https://www.bloomberg.com/news/articles/2017-12-05/latest-bull-case-for-electric-cars-the-cheapest-batteries-ever
[15] https://bnef.turtl.co/story/evo2018?teaser=true
[16] https://www.goldmansachs.com/insights/technology-driving-innovation/cars-2025/
[17] https://rmi.org/wp-content/uploads/2017/04/RMI_Electric_Vehicles_as_DERs_Final_V2.pdf
[18] https://bnef.turtl.co/story/evo2018?teaser=true
[19] https://webstore.iea.org/download/direct/1045?filename=global_ev_outlook_2018.pdf
[20] https://www150.statcan.gc.ca/n1/pub/71-607-x/71-607-x2019028-eng.htm

In June of 2021, the Federal Government announced it would adopt requirements for 100% of passenger vehicle sales to be zero emissions or EVs by 2035. Accelerating Canada's previous goal of 100 percent sales by 2040.[21]

In addition to supportive government policies, key factors that have contributed to strong growth in EV sales in Canada in recent years have included increased consumer familiarity and interest in the technology, expanded model availability, and increased demand in the Province of Ontario driven by the provincial purchase rebate program.[22] The federal government has invested and additional $1.5 billion dollars in Canada's popular incentive program iZEV which offers ZEV buyers a $5,000.00 incentive while hybrid EV are eligible for a $2,500.00 incentive. [23]



(Figure 3)

[21] 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

[22] https://www.fleetcarma.com/electric-vehicles-sales-update-q2-2018-canada/

[23] https://www.canadadrives.ca/blog/news/government-fuels-electric-vehicle-demand-with-electric-car-rebates-in-canada-and-top-affordable-electric-vehicles

Figure 4 shows a variety of 2021/22 year models that have the longest driving range in the industry. The travel distance ranges from 145km up to 370km. All the vehicles shown are within the City's threshold for capital procurement cost for a passenger vehicle.

New EV's 2021/22 With Longest Driving Range						
Year	Brand	Model	HP	Estimated KM Range	Tested KM Range	Base Price
2022	Mini Cooper	Electric	181	184	-	$ 30,750.00
2021	BMW	i3	170	246	145	$ 45,445.00
2021	Hyundai	Ioniq Electric SE	134	274	242	$ 34,250.00
2022	Volvo	XC Recharge Twin	402	359	242	$ 56,395.00
2022	Nissan	Leaf S Plus	214	364	290	$ 33,375.00
2022	Kia	Niro EV FWD	201	385	290	$ 41,165.00
2022	Audi	Q4 e-tron	295	388	-	$ 50,995.00
2022	Hyundai	Kona Electric SEL FWD	201	415	258	$ 35,225.00
2022	Chevrolet	Bolt EV 1LT	200	417	-	$ 31,995.00
2021	Volkswagen	ID.4 Pro	201	419	338	$ 41,190.00
2022	Ford	Mustang Mach-E California Route 1 FWD	290	491	403	$ 51,875.00
2021	Tesla	Model Y Long Range AWD	384	525	354	$ 53,190.00
2021	Tesla	Model 3 Long Range AWD	221	568	370	$ 47,690.00

(Figure 4)

Over 44 EV models (either fully electric or plug-in hybrids) are available for sale in Canada today. The top 6 most popular EV vehicles in 2020 in order are Toyota Prius Family (6,417), Tesla Model 3 (6,151), Hyundai Ioniq (5,117), Chevrolet Bolt (4,026), Nissan Leaf (1,535) and Tesla Model S (961). [24] While the price differential between conventional ICE vehicles and EVs is declining, affordability remains an issue. Based on data collected from the Canada Energy Research Institute (CERI), EV models annual ownership costs between 6% and 19% more (excluding government rebates) than their ICE comparator (see Figure 5).[25] In order Golf 14%, Hyundai 11%, Tesla 7%, Jaguar 19%, Tesla x 100D 6% cost more than their ICE comparator. There is high potential for the annual ownership cost for ICE vehicles to increase as fuel costs rise making EV more attractive to vehicle owners.

[24] https://logels.com/auto-parts-waterloo/electric-vehicles-canada/

[25] https://ceri.ca/assets/files/Electricity%20Commodity%20Update_June%202020_Final.pdf

Table 2. Annual Car Ownership Costs

Vehicle	Year	Class	Type	MSRP	Annual Fuel Cost (Canadian Average)	Other Annual Ownership Costs (without Rebates)	Other Annual Ownership Costs (With Federal Rebates) - Excluding BC and QC	Other Annual Ownership Costs (Federal + Provincial Rebates) - British Columbia	Other Annual Ownership Costs (Federal + Provincial Rebates) - Quebec
VW e-Golf	2020	Compact	EV	$37,895	$354	$14,776	$13,037	$12,675	$9,482
VW Golf GTI	2020		ICE	$32,245	$1,461	$12,657	n/a	n/a	n/a
Kia Niro Sx Touring	2020	Station Wagon:	EV	$54,495	$354	$19,405	$17,760	$17,367	$14,267
Kia Niro Sx Touring	2020		HEV	$35,695	$907	$14,271	n/a	n/a	n/a
Hyundai Ioniq - Preferred	2020	Mid Size	EV	$41,499	$301	$16,723	$14,918	$14,619	$10,698
VW Passat Execline	2020		ICE	$36,495	$1,461	$14,893	n/a	n/a	n/a
Tesla Model S 100D	2018	Full Size	EV	$122,000	$392	$39,697	n/a	n/a	n/a
AUDI A8 L	2018		ICE	$112,200	$2,331	$42,874	n/a	n/a	n/a
Jaguar I-Pace S	2020	SUV: Small	EV	$89,800	$523	$33,615	n/a	n/a	n/a
Jaguar F-Pace S	2020		ICE	$70,900	$2,219	$27,309	n/a	n/a	n/a
Tesla Model X 100D	2018	SUV: Standard	EV	$123,800	$457	$41,766	n/a	n/a	n/a
Porsche Cayenne GTS	2018		ICE	$111,300	$2,369	$39,318	n/a	n/a	n/a

Data source: *Canadian Automotive Association (2020), Natural Resources Canada (2020), autoTRADER.ca (2020). Table by CERI.*

(Figure 5)

3.2 EV Landscape in Ontario

BC, Ontario and Quebec have been leading the charge in EV adoption in Canada. The sales of EV vehicles in 2020 in Canada equaled 95,806. Quebec, Ontario and British Columbia were responsible for 89.6% of the country's EV sales totaling 85,876 (Figure 6). Each province has shown year-over-year growth in EV sales. Their progression is supported by the implementation of comprehensive EV strategies in the three provinces.[26]

[26] https://www150.statcan.gc.ca/t1/tbl1/en/cv.action?pid=2010002101

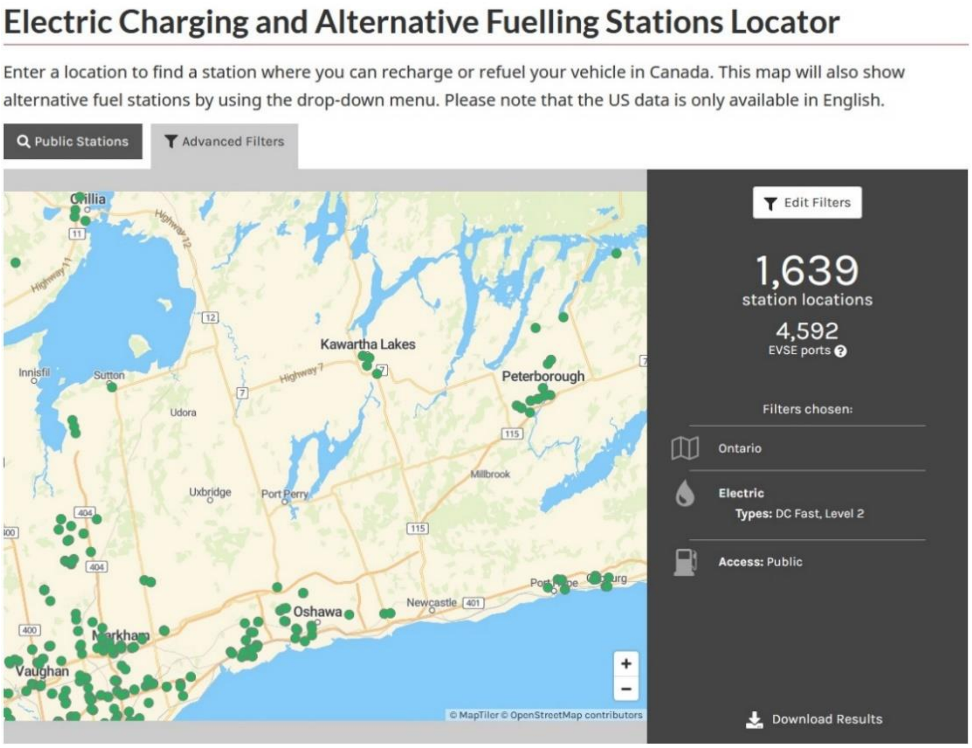
New motor vehicle registrations				
Frequency: Annual				
Table: 20-10-0021-01				
Release date: 2021-07-27				
Geography: Canada, Province or territory				
	Canada	Quebec	Ontario	British Columbia and the Territories
Fuel type	2020	2020	2020	2020
	Units			
All fuel types	1,545,561	383,261	600,626	181,183
Battery electric	39,036	17,067	8,158	12,087
Hybrid electric	41,453	8,526	16,807	8,715
Plug-in hybrid electric	15,317	9,035	2,357	3,124
Total EV's	95,806	34,628	27,322	23,926
% to Total Vehicle Sales Vs. All Unit Sales	6.2%	9.0%	4.5%	13.2%
Provincial Combined Total	85,876			
% of National EV Sales	89.6%	36.1%	28.5%	25.0%
Footnotes:				
How to cite: Statistics Canada. Table 20-10-0021-01 New motor vehicle registrations				
https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2010002101				

(Figure 6)

3.3 EV Landscape in The City of Kawartha Lakes

The uptake of EVs in the City of Kawartha Lakes is minimal and limited to date. A handful of EV units can be seen within the City. In conversations with local electrical contractors, many local businesses have been investigating the possibility of installing charging units. The Ross Memorial Hospital has demand based on medical professionals owning EV units which creates the need for at work charging capabilities. The process is a bit like the chicken and the egg-which comes first.

The City currently has 4 active charging stations. These stations are isolated to Lindsay. One is located at a public facility, the Lindsay Recreation Complex. (see figure 7 & 8)



(Figure 7)

[27]Above Map: Publicly accessible charging infrastructure in the City of Kawartha Lakes. As shown in the Map (Figure 7), charging stations in City are limited to 4 and only in Lindsay.

City of Kawartha Lakes EV Charging Locations							
Private or Public	Location		Hrs of Operation	Type	EVSE Port	Connection	
	Name	Address					
Public	Nissan Economy Wheels	129 Angeline St. N Lindsay, ON K9V 4M9	24 Hrs	2	1	J1772	
Public	Scotiabank	165 Kent St W Lindsay, ON K9V 3B6	24 Hrs	DC Fast	1	CHAdeMO CCS	
Public	Lindsay Recreation Complex	133 Adelaide St Lindsay, ON K9V 3H7	24 Hrs	DC Fast	1	CHAdeMO CCS	
Public- Call Ahead	Boyer Chevrolet	15 Willowdale Ct Lindsay, ON K9V 4S5	M-W, 7:30am- 5:30pm Th, 7:30am- 5:00pm F, 8:00am- 1:00pm	2	1	J1772	

(Figure 8)

[27] https://www.nrcan.gc.ca/energy-efficiency/transportation-alternative-fuels/electric-charging-alternative-fuelling-stationslocator-map/20487#/find/nearest?country=CA

As the City embarks on its EV implementation plan, a detailed local survey should be completed to collect data to better help guide and inform the City. The survey should collect the following data as a minimum:

- Travel corridor preferences
- EV owner demographics
- Age
- Gender
- Education
- Annual income
- Region of residence
- Average daily KM traveled
- Rationale ownership for EV
- Satisfaction level with EV
- Satisfaction with changing infrastructure availability and location
- Future EV procurement potential

3.4 Implementation of Charging Infrastructure

The City of Kawartha Lakes has an exciting opportunity to advance EV uptake in our region. The current charging infrastructure limitations are inhibiting the growth and travel of EVs into and around our region. Vehicle manufacturers have committed and are transitioning their manufacturing to EVs or hybrid units and this is apparent by the various models offered by all the major vehicle manufacturers.

The time is now to focus on this movement and planning needs to commence immediately. The transportation industry is changing and the City will need to adapt and progress with it.

There are two approaches to moving forward regarding charging implementation in the City, which is Push and Pull.

Push- EV owners have procured an EV unit, they charge at home and now want (push) the ability to charge at their place of work, at their grocery store (shopping), at the gym (recreation facility). This has started in our community and as EV popularity rises, the push for EVs charging will continue.

Pull- The City of Kawartha Lakes installs various charging stations in strategic locations and in travel corridors to promote travel into our tourist area and promote spending within our community. The idea is to place charging infrastructure in convenient locations near shopping and restaurants as charge times range from 10min up to

40mins or longer. The introduction of EVs will truly change culture as things will be different.

Below are a few options for charging stations; single and dual port changers.

3.5 Smart Charging Stations

Dual Port Single Port

(Level 2 Charger)

Dual Port Single Port

(Level 3 Charger)

(Figure 8)

[28]

While completing research for this report we had the opportunity to meet with representatives from ChargePoint, one of the industry leaders in EV charging stations. They offer all types and configurations possible. Information learned and options we discovered are as follows:

- Companies like ChargePoint are capable of providing a turn key charging solution
  - Type 1, 2 & 3 chargers are available
  - Type 2 units are stocked locally
- **ChargePoint Cloud Plans Power Up Your Charging Stations**
  - Set the price that drivers pay to use charging stations based on energy cost, duration, time of use, session length or driver group. Funds collected from drivers are electronically transferred to a designated bank account.
  - Advanced access controls manage which drivers can access stations and when.
  - Power Management software reduces station installation costs, lowers ongoing electricity costs and lets you charge more vehicles.
  - More than 35 charts and analytics, available with a click, summarize important trends for planning and management reporting.

[28] https://www.chargepoint.com/en-ca/products/commercial/express-plus/

    - Waitlist makes charging more convenient by notifying drivers when a charging spot becomes available for them and holding it until they can plug in their vehicle.
    - Integration with fleet fuel cards, telematics and asset management systems simplifies EV charging for fleets.
    - A valet feature automatically notifies parking staff when cars are done charging so they can be moved.
    - A graphical dashboard shows real-time status and a detailed map, making it easy to manage stations from your desk or mobile phone.
- ChargePoint App
    - Find a Place to charge checks for open spots in real time. Search by price and charging speed. Many spots are free to use.
    - Start a Charge from your phone start a charging session with the ChargePoint app. Or use your free ChargePoint card.
    - Track It all in one place. See how much money you're saving. Compare your home and public charging.

As data is collected from charging stations it can be reviewed and analyzed to help guide future charging location placement.

3.6 Grant Applications

The federal government has multiple grant applications/programs available. There is a grant provided through the National Resources Canada (NRCan). The contribution through this Program will be limited to fifty percent (50%) of Total Project Costs up to a maximum of five million dollars ($5,000,000) per project and up to a maximum of two million dollars ($2,000,000) per project for Delivery Organizations. Applications from Ultimate Recipient to Delivery Organizations will be limited to less than $100,000.

The maximum funding per type of infrastructure is as follows:

Type of Infrastructure	Output	Maximum Funding
Level 2 (208 / 240 V) connectors	3.3kW to 19.2kW	Up to 50% of total project costs, to a maximum of $5,000 per connector
Fast charger	20kW to 49kW	Up to 50% of total project costs, to a maximum of $15,000 per charger
Fast charger	50kW to 99Kw	Up to 50% of total project costs, to a maximum of $50,000 per charger
Fast charger	100 kW and above	Up to 50% of total project costs, to a maximum of $75,000 per charger
Hydrogen refuelling station	Dispensing at 700 bar or 350 bar minimum	Up to 50% of total project costs, to a maximum of $1,000,000 per site

Grant applications can be submitted and approved through NRCan. With a $ 150,000 municipal investment the City could proceed with a 20 port charging station pilot project which would give the municipality the start it needs to transition some of the City's fleet to EV and also promote travel and tourism for EV drivers. Based on the uptake and success of the program additional charging locations could be budgeted for and installed.

Ideal locations for charging units would be within the downtown cores of our villages.

3.7 Barriers to EV Adoption in The City of Kawartha Lakes

As highlighted by the surveys from Plug'n Drive and Environics Research, a number of barriers exist that can prevent consumers from buying an EV. The upfront cost of EVs relative to ICE vehicles is a key factor affecting the purchasing decisions of consumers. While EVs can have lower Total Costs of Ownership (TCO) than comparable ICE vehicles, most consumers do not conduct this level of assessment when making a vehicle purchasing decision, and merely consider the sticker prices of different options. Providing informational support to prospective car buyers such as vehicle ownership cost calculators was identified by several project stakeholders as an area in which municipal governments can play a key role.

Lack of access to sufficient and convenient charging infrastructure is another barrier to EV adoption. Most EV charging occurs at home, so consumers living in multi-unit residences or houses without a dedicated parking spot are faced with a formidable challenge with regard to EV ownership. EV owners in this scenario, who are often referred to as 'garage orphans,' often rely on charging infrastructure in workplaces, retail locations and other public locations, but these options may not be conveniently located. Limited charging infrastructure along intercity and inter-provincial highways can present a barrier to long-distance travel. The lack of charging opportunities contributes [29]to consumer 'range anxiety,' a concern that the vehicle will run out battery power before reaching its destination or an appropriate charging point. Limited consumer awareness of existing charging stations and charging requirements for EVs is another contributing factor to range anxiety.

Consumers lack knowledge and understanding of EVs, such as model availability, charging requirements and availability, TCO, environmental benefits, and available incentives. While a number of resources exist, there is no centralized one-stop-shop resource that provides brand neutral, up-to-date and user-targeted information and tools that could help consumers understand how an EV could meet their specific needs.

Limited supply and long wait times at dealerships are other challenges that potential EV buyers face. A recent survey by Clean Energy Canada has found that only 40% of dealerships across BC, one of Canada's leading EV markets, had at least one EV on

[29] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

the lot. Most BC dealerships estimated that the wait times for newly ordered EVs to arrive would typically be between three months to a year, and up to 18 months in some cases. The study also found that some dealers lacked knowledge about EVs, and/or a willingness to sell them, which contributes to the customer experience barrier.

The barriers discussed above represent important opportunities for action on the part of the City, working in collaboration with stakeholders who are likewise trying to overcome these barriers.

3.8 Codes, Standards and By-Laws

Provincial Codes and Standards

Provisions related to EV Supply Equipment (EVSE) are under O.reg.48/01 of the Ontario Condominium Act. Condo boards in Ontario are required to approve an application to install EVSE unless certain exemptions exist. The Ontario Condominium Act is currently under review by the Ministry of Government and Consumer Services. A group of EV stakeholders in City have been working to ensure that changes made to the legislation will make it easier for condominium owners and corporations to install EV charging infrastructure.

Ontario Building Code

The Ontario Building Code amendment (O. Reg. 332/12) relating to EV charging in commercial buildings came into effect on January 1, 2018. The amendment requires that at least 20% of parking spaces in new large non-residential buildings be equipped with EVSE. The remaining 80% of parking spaces should be designed to permit future installation of EVSE. In addition, The Ontario Ministry of Municipal Affairs held consultations in 2017 on changes to the Building Code that would require EV charging in 20% of indoor parking spaces and ‘rough-ins’ in the remaining spaces in apartment buildings. The feedback from those consultations is currently under review.

Leadership in Energy and Environmental Design (LEED)

Under LEED BD+C, credits are available related to EVs and EVSE as Location and Transportation (LT) credit Green Vehicles. A possible 1 point is available by meeting the following requirements:

- Designate 5% of all parking spaces as preferred parking for green vehicles or provide a discounted parking rate of at least 20% for green vehicles.
- Install level 2 or greater EVSE in 2% of all parking spaces (separate from and in addition to preferred parking spaces in the first requirement). The chargers must be networked or internet addressable to participate in demand response programs or time of use pricing. Alternatively, install liquid or gas alternative

fueling facilities or a battery switching station capable of refueling a number of vehicles per day (equal to at least 2% of all spaces).

4 Municipal Electric Mobility Strategies

4.1 Municipal Best Practice

A growing number of municipalities around the world are preparing and actively planning for a transition to electric mobility. Electric mobility offers municipalities a means to reduce transportation-related greenhouse gas (GHG) emissions as well as other emissions that contribute to reduced air quality. A strategic and thoughtful plan can expedite a municipality in implementing a cleaner, low-carbon transportation network. This section of the report documents examples of how leading municipalities around the world are preparing for this transition.

Other municipalities have carried out research to identify key characteristics that contribute to successful electric mobility uptake at the municipal and regional scale. The research drew on work of the International Council on Clean Transportation (ICCT), which assessed 14 major cities in North America, Europe and China who are leaders in promoting electric mobility. The research showed that the following key themes could be attributed to successful electric mobility uptake:

- Incentives (financial and non-financial)
- Research and community engagement through awareness campaigns
- Charging infrastructure[30]

The current work identifies best practices at the municipal level for cities that have developed strategies to accelerate the deployment of electric mobility and/or have higher than average electric mobility uptake. While global cities were considered, the research focused on cities in Canada and the U.S., given similarities to the City in terms of vehicle use and the regulatory landscape. A growing number of North American cities have developed or are in the process of developing some form of local or regional electric mobility strategy.

Electric mobility strategies vary in complexity for each individual city as they are tailored to address specific barriers, political landscapes, and/or existing partnerships. The following common themes can be drawn from leading cities' electric mobility strategies:

- Charging Infrastructure
- Education and Outreach
- Collaboration and Partnerships

[30] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

- Regulations and Policies
- Fleets, Transit and Car Sharing
- Incentives
- Economic Development

These correlate well with the five areas of opportunity previously identified which included:

- Policy and regulation
- Research, community awareness and behaviour change
- Financial and non-financial incentives
- Availability of charging infrastructure
- Understanding and developing the EV industry, workforce, and training

The remainder of this section provides examples of initiatives/actions in each of these areas from leading jurisdictions with city-level electric mobility strategies and/or exceptionally high uptake of electric mobility options such as EVs.

4.2 Charging Infrastructure

Ensuring that EV charging infrastructure is located in strategic areas of a city is crucial to the success of any electric mobility strategy. The City of Vancouver's EV Ecosystem Strategy recognizes EV infrastructure as an increasingly important community amenity and focuses on integrating EV infrastructure in such a way that EVs can assimilate into the urban environment and daily life.

Charging EVs is a different experience than going to a gas station – even DC fast charging (Level 3) can take 10-40 minutes depending on battery size. There is therefore a correlation between where vehicles are parked for longer periods of time, and where charging solutions are most important. Most charging occurs at home (80-90%), followed by work, then public charging. This section considers each of these charging locations separately.

For home and workplace charging, municipalities typically focus on codes and standards with incentives provided by other entities (e.g., other levels of government). Municipalities take a more direct role in the installation of public charging infrastructure.

For EV owners, the most convenient place to charge is at home. The second most convenient place is at work, with other locations typically becoming less and less convenient.

4.3 Home Charging

As mentioned above, home charging is the most important type of charging to enable EV ownership. Home charging is relatively straightforward for single-family homes with driveways as the decision to install charging equipment rests solely with the homeowner and the main barrier is typically cost. It is less straightforward for residents of multi-unit residential buildings MURB and garage orphans (homes with no driveways or garages requiring residents to park on the street). In these cases, charging equipment must be installed in communal parking areas, or curbside, and requires the involvement of property owners/managers or municipal governments. In addition to cost, other barriers facing MURB and garage orphan charging include electrical capacity, space, regulations for on-street charging and the requirement to allocate charging costs to equipment users.

Single Family Homes
The City of Vancouver has amended the building code for new construction to require one energized outlet per parking area (garage, carport) for single family dwellings. North Vancouver is incorporating into its zoning bylaws that all new residential developments (one and two unit) be Level 2 EV ready.

To address costs, several jurisdictions provide incentives toward the purchase and/or installation of Level 2 chargers at home. For example, the Charging Solutions and Incentives Program in BC provided $750 for single family homes. [31]

Garage Orphans
Charging for garage orphans is addressed through the installation of public curbside charging.

MURBs
Vancouver's EV Ecosystem Strategy requires every parking space in MURBs, excluding visitor parking, to have an energized outlet capable of supporting Level 2 EVSE installation. Many other cities in BC have similar requirements for new builds, requiring that 20% to 100% of parking spaces be EV ready.
Apartment buildings pose additional challenges as well that can be addressed through regulation. For example, in California, Assembly Bill 2565 provides for renters to be able to install chargers in their parking spots. Senate Bill 880 makes it illegal to prohibit or restrict charger installation in a designated parking spot in a MURB and provides for certain conditions if the charger is installed in a common area. A common interest development may not prohibit or restrict the installation or use of EVSE in a designated parking spot.

The Charging Solutions and Incentives Program in BC provides a rebate for MURBs of 75% up to $4,000 for Level 2 charging equipment.

[31] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

The majority of current EV owners live in single family homes in areas of cities where homes have driveways and/or garages, which allow for the installation of private charging stations for at-home charging. The majority of City of Kawartha Lakes residents (85%) reside in single family dwellings.

In addition to incentives, policies can also enable and mandate EV readiness. For example, San Francisco has the 100 percent EV Ready ordinance, which requires all new residential and commercial buildings to have 10% of spots be 'turn key ready' (ready for EV charger installation), 10% of spots be 'EV flexible' (ready for potential charging and upgrades), and 80% of spots be 'EV capable' (have conduit run to avoid future cost barriers). The Ontario Building Code was amended for buildings (including commercial buildings) to include the provision that not less than 20% of parking spaces be provided with EVSE installed (excluding apartment buildings). The remaining parking spaces in the building are to be designed to permit future installation of EVSE. In the District of North Vancouver, approximately 10% of parking stalls in commercial and industrial buildings must be EV ready (i.e., wired for level 2 charging).[32]

4.4 Workplace Charging

Where close to home charging solutions are seen as reasonable but less convenient (e.g., on-street charging), having access to workplace charging as a secondary solution can significantly improve the value proposition for EV ownership. A nation-wide U.S. study by the International Council on Clean Transportation (ICCT) found that people are 20 times more likely to buy an EV if their employer provides workplace charging stations.

Barriers to workplace charging are similar to challenges with MURB and garage-orphan charging – except for new lots, workplace parking was not originally designed to accommodate charging.

Workplace charging is typically addressed through non-municipal incentives. The Charging Solutions and Incentives Program in BC rebate for workplaces is 50% up to $4,000 for Level 2 charging equipment or $2,000 for Level 1. Charge to Work NY provides $8,000 per EV workplace charging station in New York City. The Branché au travail program in Quebec offers a 75% rebate for the purchase and installation of a workplace charging station to a maximum of $5,000.

The availability of workplace charging makes EV purchasing more attractive.

[32] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

4.5 Public Charging

Most municipal-level electric mobility strategies include specific actions to increase the number of public charging stations. While public charging is the least-used type of charging, it does provide key benefits:

- Increases visibility of charging solutions and hence addresses range anxiety concerns for potential EV owners
- Enables travel where EV owners no longer have access to home and/or workplace charging

Barriers to public charging include:

- Supply equipment owners/operators are not allowed to mark up electricity rates (resulting in a poor business case for public EVSE deployment). Charging solutions typically have to price usage based on the time spent at the charging space, and not based on the amount of electricity used.
- Interoperability between charging systems (apps, payment, cards, etc.)
- Lack of deployment – e.g., on-street opportunities limited/unavailable in downtown locations.

One of the strategic goals of Montreal's Transportation Electrification Strategy is to "roll out a network of charging stations to support the desired gradual conversion of Montreal's automobile stock." The City is installing a charging network for privately[33] owned EVs with a goal of 1,000 charging stations by the end of 2025 to serve the entire municipal territory.

The Drive Clean Seattle Electrification Initiative has numerous implementation actions to promote increased adoption of electric mobility by increasing access to charging, such as developing a network of off-street charging station clusters and exploring pathways to allow EV charging in the right-of-way. Other actions include pilot projects in collaboration with City Light (a local electrical utility), including installing 20 DC fast chargers and at least 200 charging stations in customer homes.

The City of Portland's Electric Vehicle Strategy prioritizes charging infrastructure in areas that have fewer existing public charging stations, higher proportions of multi-family housing and garage-free homes, residents with higher average vehicle kilometres travelled, and higher proportions of low-income residents, as well as at destinations where

[33] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

people tend to travel longer distances to access. One of the goals of Portland's Strategy is to double the number of Level 2 and DC Fast Chargers available to the public.

One of the goals of Vancouver's EV Ecosystem Strategy is to maximize access to EV charging. The Strategy outlines a suite of actions to achieve this goal. Examples of actions include a curbside pilot project (program for commercial business and single-family home owners that do not have access to off-street parking), the development of charging hubs that support residents, commercial fleets, EV taxis and EV car sharing, and improving public Level 2 charging access and visibility.

The municipality of Oslo, Norway owns and operates charging infrastructure on public lands. The municipality also partners with private real estate entities to support publicly accessible charging infrastructure that is privately owned and operated.

In Amsterdam, Netherlands there are over 2,000 total charge points and over 30 fast charge points, with an ambitious goal to become a zero-emission city by 2025. All public charging stations are powered by locally-generated wind power.

Options for Publicly Accessible Charging Infrastructure Deployment

Publicly available charging infrastructure should be deployed in areas of the city where space permits and does not contribute to increased congestion or parking pressure. Potential areas in the City include municipally owned parking lots, privately owned parking lots, large retailer's/shopping centres and roadsides. There are some public parking lots located across the City which could be leveraged in combination with [34]roadsides to expand EVSE accessibility. Similarly, there are many large retail locations (i.e., supermarkets) and shopping centres located throughout the city where private land owners could become involved in expanding charging infrastructure. Two considerations for these types of charging will include grid readiness (especially for Level 3 hubs) and enforcement. An enforcement strategy is a key component of shared charging infrastructure to ensure that charger usage and accessibility are optimized.

4.6 Education and Outreach

While education and outreach intent can vary (e.g., educating landlords on EV charging versus educating consumers on electric mobility benefits), many city-level electric mobility strategies include some actions and/or goals related to education and outreach. Cities with exceptional electric mobility uptake typically have some form of education and outreach actions or events conducted at the municipal level.

For example, the City of Portland's Electric Vehicle Strategy includes developing outreach and education materials and developing programs to engage builders and

[34] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

architects, as well as increasing public awareness of EV chargers via improved signage, marketing and outreach.

The City of Seattle's Implementation Strategy outlines specific actions to increase awareness of the benefits of electrification and consumer exposure to electric mobility, such as developing a website dedicated to providing electric mobility information and participating in National Drive Electric Week as well as other electric mobility events.

The City of Vancouver's EV Ecosystem Strategy intends to 'improve community experience and knowledge in vehicle charging'. Examples of specific actions to support this goal include developing public charging points to be sources of information for ICE drivers as well as providing education to landlords and property managers to further the acceptance of MURB EV charging retrofits.

As part of its electric mobility promotion, the City of Shanghai, China works with the federal government to operate an EV Demonstration Zone, which helps auto companies to engage a wide variety of consumers and collect consumer EV data. Elements of the Demonstration Zone include an EV service centre, an EV rental plan, promotion of EVs via a car sharing service, a network of charging stations, and free EV test drives.

4.7 Collaboration and Partnerships

Most municipality-led electric mobility strategies rely on partners to achieve the desired [35]shift to electric mobility adoption. Partnerships are important during implementation, but also during strategy development where they lay the groundwork for implementation and build the buy-in necessary to gain City approval. Utility companies are common allies, particularly with respect to charging stations and infrastructure as well as pilot projects. Other partners include various levels of government, automakers, real estate developers, technology companies, and transportation authorities, to name a few. Often, electric mobility strategies are supported by other city, province/state, and/or federal initiatives. Partnerships are a strong cornerstone for municipalities with high electric mobility uptake.

Innovative partnerships can be found in Vancouver's EV Ecosystem Strategy, which indicates that the city will partner with Carbon Neutral City cities with the intent of developing a carbon credit mechanism with respect to charging infrastructure. The intent is to create a stronger business case for private sector investment. The City of Vancouver also partnered with Telus to integrate EV charging with cellular monopoles at four locations.

[35] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

The City of Seattle plans on partnering with the Electric Power Research Institute (EPRI) to test a range of charging technologies on the city's fleet vehicles.

To implement its Electric Vehicle Strategy, the City of Edmonton plans on collaborating with the automobile industry and non-profit organizations to create learning opportunities for Edmontonians on local car sharing and ride sharing organizations to expand access to electric mobility options, utility companies and academic institutions to investigate impacts of EVs on electricity grid capacity or redesigning rate plans, and provincial and federal governments on the development of strategies and policies.

The City of Oslo's Vulkan project exemplifies how smart partnerships can provide templates of smart electric mobility design solutions for other cities. The Vulkan project is a public-private partnership between the city, a utility company and a real estate firm. Vulkan is a sustainable urban development project located on the city's outskirts and includes a smart charging hub equipped with multi-speed charging stations that offer smart charging, battery reserve and vehicle-to-grid technologies. Charging stations can be pre-booked by fleet operators and car sharing services.

4.8 Regulations and Policies

Quite often, electric mobility strategies are part of a larger suite of policies aimed at greening municipal operations. For example, Vancouver's EV Ecosystem Strategy is part of a broader suite of city policies meant to increase the transition to electric mobility. Supporting policies, for example, include the Renewable City Strategy, which commits the city to deriving 100% of its energy from renewable sources before 2050.108 The EV Ecosystem also aligns with the Greenest City Action Plan, Transportation 2040 and the Healthy City Strategy.

Effective electric mobility strategies include amending or implementing local regulations or policies to promote electric adoption.

For example, the City of Vancouver first amended the Vancouver Building By-law to require new developments to have electrical supply for EVs (20% of parking stalls in new apartment buildings, condos, townhomes and other buildings with three units or more must include a receptacle for charging cars and the electrical room must include enough space to install all equipment necessary to provide charging to all residents in the future). More recently, it was amended to allow for the use of electrical load management technologies as well as ensure minimum power outputs. Vancouver's Green Homes Program requires all new one- and two- family homes to be built to accommodate future green energy technologies, including powering the next generation of EVs. The EV Ecosystem Strategy includes a number of 'quick starts' that involve updating existing city policies, including updating Vancouver's Standards of Maintenance By-law to require reasonable access to existing EV charging equipment (including outlets for e-bikes and e-scooters) and removing the 200A panel exemption for new construction of one- and two- family homes under the Vancouver Building By-law.

Part of Montreal's Transportation Electrification Strategy is to implement the measures outlined in the Parking Policy (adopted in June of 2016). Proposed measures include providing on-street parking and charging for electric mobility, developing sustainable mobility options, creating pricing for EV charging, and evaluating the feasibility of an urban goods distribution centre that would focus on electric mobility for 'last kilometre' delivery.

San Francisco, California requires new residential, commercial and municipal buildings to have sufficient electrical infrastructure to charge vehicles in 20% of the parking spaces simultaneously.[36]

4.9 Incentives

Incentives, both financial and non-financial, can be part of a municipality-led electric mobility strategy. Cities with exceptional electric mobility uptake typically offer a number of incentives to consumers and drivers, which are often supported by other levels of government.

The City of Edmonton's Electric Vehicle Strategy recommends non-permanent financial incentives for residents. The intent of the incentives would be to 'kick-start' an increase in EV market share by addressing the cost barrier. The incentive would be reduced and ultimately eliminated as EVs gain popularity. The strategy also suggests free public access to city-owned Level 2 charging stations, which also could be tapered as adoption momentum increases. Additional incentives suggested in the strategy include a rebate towards an EV upon retirement of an older vehicle.

The City of Shanghai, China offers EV owners both financial and non-financial incentives. The city provides regional subsidies of up to 30,000 yuan renminbi (about $5,600 CAD) and EVs are exempt from the region's expensive and restrictive license plate auction system.

The City of Laval, Quebec is currently the only Canadian municipality that offers its citizens a purchase rebate on BEVs and electric bicycles. The City offers a rebate of $2,000 on the purchase of a BEV, and $400 on the purchase of an e-bike. When the rebate program began in April, 2018, the city of about 420,000 budgeted for 100 BEV rebates and 100 e-bike rebates. As of October, 2018 however, the program led to the sale of over 1,100 BEVs and over 200 e-bikes. The program's budget was increased to

[36] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

accommodate the greater than anticipated demand. The Government of Quebec offers $8,000 purchase rebates for BEVs, which means that citizens of Laval can receive a total rebate of $10,000.

4.10 Economic Development

Leading cities recognize that supporting the shift to low-carbon transportation may very well result in substantial economic benefits, potentially by becoming an electric mobility technology hub. Several municipality-level electric mobility strategies have specific goals/actions with respect to the potential economic windfall electric mobility could bring.

For example, Portland's Electric Vehicle Strategy aims to support Portland as a leader in clean technology development. The strategy includes actions to support employment opportunities by connecting EV manufacturers with qualified underemployed or unemployed residents, providing business development assistance to EV-related companies, as well as providing business opportunities for existing electric mobility firms. Further, the strategy aims to increase electric mobility sector networking by working with Drive Oregon, TriMet, Metro and Greater Portland Inc., and support efforts to bring major EV conferences to Oregon.

Montreal recognizes that its Transportation Electrification Strategy may result in substantial economic benefits. To maximize economic and technological benefits, the city will create and implement an economic development action plan for the electric/intelligent vehicle sector. The action plan will be used to identify high-impact sectors and actions, as well as guide decision-making with respect to electric mobility sector development. The city also plans on organizing events related to cutting-edge technologies and innovations for electric and intelligent vehicles.

Social Equity Considerations for Electric Mobility

Changes in transportation options and networks can both positively and adversely affect communities. Ensuring changes are made to benefit all people should be an important consideration when designing and implementing goals, actions, guidelines and policies to support the use of electric mobility options.

U.S. Executive Order (E.O.) 12898 focuses federal attention on the environmental and human health effects of federal actions on minority and low-income populations with the goal of achieving environmental protection for all communities.

The U.S. Department of Transportation (U.S. DOT) outlines the following principles of environmental justice:

- To avoid, minimize, or mitigate disproportionately high and adverse human health or environmental effects, including social and economic effects, on minority populations and low-income populations.
- To ensure the full and fair participation by all potentially affected communities in the transportation decision-making process.
- To prevent the denial of, reduction in, or significant delay in the receipt of benefits by minority populations and low-income populations.
- A recent study identified four primary performance measures that could be used to formulate high-level discussions on various transportation options with respect to the social equity of a shared, autonomous and electric vehicle future. These metrics include:
- Cost: low-income households typically spend a larger percentage of income on transportation
- Access: lack of access to vehicles, public transportation and safe active transportation options reduces employment opportunities
- Public Health: the current transportation system is often most detrimental to disadvantaged communities (e.g., poorer air quality, longer commute distances)
- Employment: while a different transportation future may result in benefits, there may also be disadvantages including a reduction in the number of jobs and changes to the types of jobs available and skills needed to fill these positions

Some city-level electric mobility strategies specifically address social equity and include goals or actions to ensure municipalities are creating equitable solutions.

For example, Portland’s Electric Vehicle Strategy states that the city is “committed to creating mobility solutions that are equitable and empowering”. The strategy includes actions to research financing options for individuals with no or damaged credit, as well as a community mobility assessment to ensure that electric mobility solutions meet the needs of low-income populations and communities. Further, the City of Portland and Multnomah County developed a Climate Action Plan Equity Implementation Guide, which City and County staff can leverage to integrate equity into their work via tools and best practices.

The 2017 Drive Clean Seattle Implementation Strategy includes two actions dedicated to race and social justice, which are aimed at maximizing benefits for those most impacted by the air pollution associated with the current transportation system. These specific actions include partnering with the Environmental Justice Committee to “implement projects in Equity and Environment Initiative (EEI) communities which deliver racial equity outcomes identified in the Drive Clean Seattle Racial Equity Toolkit” and to "complete additional racial equity toolkits for major Drive Clean Seattle projects and policies." The Strategy also includes the results of a racial equity analysis and outlines important racial equity implementation actions for 2017. Examples of these racial equity implementation actions include utilizing creative and culturally relevant strategies and fostering community cohesion by connecting electric mobility and transportation programs to community centers, places of worship, and service providers; engaging the community to identify potential disadvantages of increased electric mobility infrastructure and working with the community and stakeholders to mitigate any negative impacts; and partnering directly with community-based organizations and service industry anchors.[37]

Vancouver's EV Ecosystem Strategy specifically addresses the issue of equity and environmental justice and aims to ensure that all residents are given opportunities with respect to electric mobility. The strategy indicates that Vancouver "will ensure that EV charging that is required in lower income housing presents options for reasonable and accessible technologies to the residents". It also indicates that the city will ensure that individuals will pay for their own charging and that cost is not passed onto other residents in multi-family situations. The strategy also acknowledges environmental justice considerations and states that "the most vulnerable members of society will have the biggest health benefits from improved air quality and a more stable climate."

In its Electric Vehicle Policy Task Force Draft Policy Recommendations, the City of Philadelphia, Pennsylvania briefly discusses social equity impacts and identifies that Philadelphia's demographics differ from those elsewhere in the U.S. Simply put, electric mobility does not currently offer a practical mobility solution for Philadelphia's low-income residents and much more needs to be done to encourage electric mobility use across the city.[38]

5 Planning for a City of Kawartha Lakes Electric Mobility Strategy

5.1 Grid Impacts

Understanding potential impacts to the City electrical grid due to the advancement of electric mobility is a critical preliminary step in the development of the Electric Mobility Strategy. Most near-term grid-related impacts are expected to result from the increased adoption of personal EVs by residents. While the adoption of EVs by major fleets will also pose potential challenges to the operators of City's grid, in most cases these challenges will be easier to manage, as fleet duty cycles tend to be predictable, and most fleet EVs will return to a 'home base' or centralized depot for charging overnight. Further, because fuel costs are a major concern for fleet managers, it is likely that steps

[37] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf
[38] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

will be taken to ensure that fleet vehicles are only charged during off-peak electricity usage hours and that adequate infrastructure for power supply be established prior to the adoption of EVs by fleets. This section explores potential risks to the grid that high EV adoption levels might pose, as well as the state of grid readiness in the City of Kawartha Lakes to accommodate loads from the charging of EVs.

Over 80% of all privately-owned EV charging occurs at the residences of owners during night-time hours. While EVs represent a major household power demand, the total amount of electricity used to power an EV for a year can be less than that required to power a water heater or air conditioner. However, because EVs are designed to draw a lot of power in a short amount of time (power consumed can be anywhere from 3.3 to[39] 19.2 kW at Level 2), they can pose risks to local grid stability if many households in the same area are plug in to charge at the same time.

As EV adoption levels have increased in recent years, concerns have been raised and have sometimes been aired in the popular news media, about a potential threat that EVs pose to local power grids. The typical concern revolves around multiple people on the same street, or drawing power from the same local distribution transformer, plugging EVs in to charge at the same time. If enough people in close enough proximity to each other did this, it could cause their distribution transformer to overload and potentially fail. Such a failure could stress other nearby transformers or potentially cause a localized power outage.

The analysis completed during the Assessment Phase suggests that as long as EV adoption continues to grow at a steady pace, no major grid capacity issues at the neighbourhood or municipality-wide levels are anticipated. The clustering of EVs within certain neighbourhoods will impose the first noticeable impacts on the local electricity distribution system. Typically, there are spikes in electricity usage during the late afternoon/early evening peak in demand. If there is a significant amount of EV charging during those peak times, there could be some transformer overloading in certain neighbourhoods and/or significant increases in peak demand. The overloading of distribution/street-level transformers could, in theory, spread to bigger distribution arteries. Electricity system operators would see the impacts on the main supply points feeding a city only after the secondary, neighbourhood-level distribution systems are impacted. By the time this would happen, however, electrical utilities would be able to see the new electricity usage trends developing and would take measures to avoid impacts at the municipal level.

Such measures would likely include, as a first step, upgrading or increasing the number of street-level distribution transformers in a given neighbourhood. This would happen

[39] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

when a particular transformer is consistently being overloaded, which would increase the risk that it could eventually fail. This is the typical approach taken by electrical utilities when they see an increase in electricity usage within a given area. The piecemeal approach to grid upgrades resulting from high levels of EV adoption means that it is not necessary at this time to identify areas of cities such as City of Kawartha Lakes that would need to be targeted for grid upgrades based on EV adoption projections. In addition to transformer upgrades or additions, if EV adoption occurs more rapidly than expected, electrical utilities would look into aggregating smart charging to defer net electricity consumption for EV charging. This would entail delaying the charging of participating customers from when they initially plug in to a time (overnight, for example) when electricity usage rates are lower and there is excess capacity in the system.

This deferment of charging is analogous to managing traffic congestion by taking measures to stagger the times at which people use highways, rather than simply adding more lanes to those highways. Peak hours of electricity usage are comparable to 'rush hour' traffic, and as a first step to managing such traffic it is ideal to utilize measures that are not capital-intensive (such as infrastructure expansion), but involve changes in people's behaviour to better utilize existing infrastructure. There is no reason why the majority of EV users need to charge their vehicles to full capacity as soon as they get home in the evening, especially if those vehicles still have an adequate amount of range for evening errands. The entire night will be available for charging without the risk of stressing the local distribution system.

Most electrical utilities in Canada have begun investigating behind-the-meter platforms to manage EV charging loads for residential customers. Such platforms would work similarly to smart thermostats that provide utilities with a degree of control over monitoring and managing temperatures in residences. These solutions give utilities added flexibility to manage demand during peak usage periods, without having to bring additional electricity generation options online. If participating customers were to permit their utility company to have a degree of control over the timing and/or rate of EV charging (within user-defined parameters, of course), it would provide the utility with much-needed flexibility to help accommodate peak loads with its existing asset base. In this case, if a utility detected that multiple households drawing power from the same distribution transformer plugged in EVs to charge at the same time, it would toggle the rate and perhaps the timing of charging so that net power output from the transformer would remain within safe operating parameters.

Participants in such a program would specify two things to their utility: the minimum state of charge of their EV battery at any time they are plugged in, and the time, typically in the morning, when they need their EV to be fully charged. For example, an EV user could specify that whenever they plug their vehicle in, they need it to charge to at least 25% of its capacity right away, but the remaining 75% of capacity could be charged at any time or rate before, say, 8:00 am (i.e., before they leave for work in the morning). This is just one of many possible emerging smart charging solutions. Another type of solution could include voluntary partnerships with EV owners to encourage or incentivize them not to charge during peak hours. As EV adoption and technologies continue to advance, so too will the number and efficacy of solutions to grid capacity issues.

Perhaps a bigger challenge than adapting to individual EV adoption will be for electrical utilities to work with major fleets on developing measures to transition vehicles such as transit buses to exclusively use electric power. Even with relatively short all-electric ranges, electric buses will be equipped with large batteries that will draw a lot of power and will likely require specialized charging platforms and equipment.

Supporting the roll out of public on-street charging stations will also be a major undertaking for electrical utilities as EV adoption continues to grow. Working on solutions for 'garage orphans' (residents limited to on-street parking) that will involve installing charging stations on sidewalks or utility poles will also pose challenges. Most utilities across Canada are also preparing to work with development and property management companies to provide any service upgrades that may be required to facilitate EV charging at workplaces or in multi-unit residential buildings.

The approach of most utility companies to handle local capacity issues stemming from EV use is, in short, to deal with them as they arise, on a case-by-case basis. No major disruptions to the local distribution systems are anticipated as a result of EV adoption. The replacement of ICE vehicles with EVs will take place gradually over the coming years and decades, and utilities will almost certainly have adequate time to respond to resulting increases in electricity demand. If EV adoption does accelerate faster than anticipated, utilities accept that they will simply have to devote more resources to preparing the grid. Generally speaking, utilities are ready, able and willing to adapt to an electric mobility future. Distribution transformers can be upgraded or added if and when such actions are required, the number of customers drawing power from each transformer can be reduced, and electricity system planners can monitor EV adoption levels and develop solutions that minimize the impact of EVs on the grid while optimizing grid asset utilization.

Utilities are particularly interested in understanding where they can deploy charging infrastructure investments that wouldn't be of interest to private businesses (e.g., residential on-street charging, MURB charging). Where there are opportunities for utilities to participate in EV charging solutions, their participation would be facilitated if there was a more straightforward business model for them to engage in. Further facilitating the work of utilities in the electric mobility space would be ensuring that they are provided with up-to-date data on factors such as: the number and location of garage orphans in their service areas, the addresses of registered EV owners, EV-related building code requirements and updates, transportation patterns in different regions, and transportation modes available to residents in different neighbourhoods.

A prominent barrier to the ability of electrical utilities to efficiently and cost-effectively accommodate increased EV charging is the fact that provincial regulations do not allow utilities to capture the costs of EV products and services within their rate bases (i.e., the value of a utility's assets, which is used by regulators to help determine electricity prices). Electric utilities from across Canada have been encouraging provincial regulators to amend the laws around what can be included in their rate bases since EVs became widely available. If a transformer fails due to many of the households drawing power from it plugging in an EV to charge, that transformer can be replaced and any costs can be passed on to a utility's rate base. However, if that utility wants to offer smart charging services to those same EV-using customers to avoid stressing local transformers, it is currently not allowed to do so under provincial law. An amendment in this area would greatly facilitate the provision of EV-related products and services by utilities.

Electrical utility companies should have no major issues dealing with current levels of EV adoption. As adoption levels increase markedly, however, having access to data on current and forecasted adoption levels will become more important. This will allow them to efficiently and affordably roll out an appropriate level of infrastructure to support EV use at the appropriate times. Emerging technologies such as smart charging will help utilities manage consumption behaviour and limit the costs of having to upgrade electrical infrastructure to accommodate electric mobility.[40]

5.2 Charging Infrastructure

5.2.1 Emerging Technology and Energy Trends

It is critical that the City continues to monitor key developments and considerations that could significantly influence the adoption rates, utility, and infrastructure requirements of electric mobility options. Several such developments and considerations are overviewed in this section, with the aim of ensuring the City's Electric Mobility Strategy is as future-proofed as possible. It isn't necessary that the Strategy explicitly address each of these considerations, but the City should be prepared to adapt the Strategy if there are significant advancements within any of these emerging developments and trends.

[40] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

5.2.2 Wireless charging

Wireless EV charging requires two pieces of hardware – a ground-based wireless charging pad that is connected to a charging station and a wireless receiver mounted on the underside of an EV. The wireless charging feature works similarly to wireless charging pads that are now available for a wide variety of smartphones. EVs park directly on top of the charging pad and the wireless receiver connects with the pad. Users can then initiate charging via remote or in-vehicle apps.

Wireless charging via current magnetic resonance technologies is slightly less-efficient than plugging in, as about 7-10% of the power provided is lost as it moves through the air. Even so, the convenience of wireless charging is expected to appeal to EV users, and as more research and development is dedicated to this area the technologies and efficiencies involved are expected to improve. For example, researchers at the U.S. Department of Energy's Oak Ridge National Laboratory recently announced that they are able to wirelessly provide 120 kW of power (the equivalent of some existing DC fast chargers) to an EV battery at an efficiency of 97%.

In 2017, the Society of Automotive Engineers (SAE), the leading global body for the standardization of automobile components, released a wireless charging standard for EVs that allows for the transfer of up to 11kW of power. The SAE is currently working on a bi-directional wireless charging standard that would allow for the transfer of energy from EVs to the local grid. The implementation of such standards across the automotive sector will lead to a better user experience for EV drivers and will simplify the decision-making process for charging infrastructure providers such as municipal governments.

At least seven major automakers currently produce vehicles and components that are compatible with wireless charging. Most other major automakers are developing such capabilities for their vehicles, so planners should expect to see wireless charging become commonplace in the medium term.

Research consortiums around the world have recently been exploring the idea of installing wireless EV charging hardware directly into roadways, so that EV users can charge while they drive. If implemented, this approach could allow for greater range and/or smaller batteries for EVs. However, due to a number of factors including costs, technological compatibility, and EV ownership levels, this technology is not expected to play a major role in EV deployment in the short or medium term. Companies that now provide wireless EV charging solutions include ELIX Wireless, Plugless Power, [41]

WiTricity, and Qualcomm. Jurisdictions currently exploring the possibilities of this technology include Israel, UK, the State of Illinois, and Paris, France. Charging cables

[41] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

are heavy, expensive, and in some cases pose possible safety hazards (e.g., tripping, obstacles for strollers or wheelchairs, damage from vehicles or snow removal equipment). Wireless charging pads without exposed wires may not only be more convenient for EV users, but could be the least intrusive option for all citizens of the City. Wireless charging is also expected to be complementary to autonomous vehicles, which would be able to navigate to a charging station on their own, but would require a human to actually plug them in to charge if plugging in was the only option available.

While implementing its Electric Mobility Strategy, the City should aim to ensure that the public charging stations it installs are able to be upgraded to wireless charging as this technology continues to mature and is rolled out in more production EVs.[42]

5.2.3 Distributed energy generation and storage

Distributed energy resources (DERs) are small, modular electricity generation units (such as solar panels at residences or businesses) and/or energy storage systems (such as batteries) that are interconnected with the grid at the distribution/street level. Examples of DERs include small-scale hydro, wind, solar, geothermal and biomass-based generation technologies. In some cases DERs are managed within self-contained micro-grid (or smart grid) settings like those used by large facilities such as universities or hospitals.

In recent years, the prevalence of DERs in the GTA has grown significantly, as costs have come down and efficiencies have gone up for many emerging technologies. As electricity continues to become more of a distributed commodity (i.e., as technologies allow individuals and businesses to generate, store and share electricity at increasingly lower capital costs), it is expected that the value proposition of EV ownership will continue to grow. Instead of lining up at a gas station, EV owners could produce all the clean and renewable fuel their vehicle needs by investing in a modestly-sized solar array for their home. As EV ownership can save a typical Canadian driver $1,500-2,000 per year on fuel costs alone, the payback period on DERs like solar power generation and storage systems can now be as short as several years. A 3 kW solar array should be sufficient to provide all the power required by an EV each year, assuming average daily driving distances of about 44 km, and such an array would take up less than 28 square meters of surface area on a rooftop or ground-mounted pedestal.

A moderately-sized EV battery of 30 kWh stores roughly as much energy as an average household uses in one day. EVs themselves are therefore a type of DER whose benefits will become increasingly pronounced as adoption levels increase and smart energy technologies (such as bi-directional meters and home energy management systems) mature. A recent report from the U.S. Energy Storage Monitor concluded that

[42] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

by 2020 there will be more available energy connected to the grid via EV batteries than all of the generation capacity in the U.S. combined at any given time. And this projection was based on conservative estimates for EV adoption and average EV battery sizes of several years ago.

The same types of batteries that EVs use can also be used externally, as stationary energy storage units. Automakers such as Tesla, Nissan and BMW already offer home battery storage units to consumers, which are sometimes packaged with solar panels. Battery storage units would be particularly useful in jurisdictions, like Ontario, that offer time-of-use electricity pricing. Batteries can be recharged overnight, when electricity use is minimal and the grid is supplied by low-carbon renewable energy, and then during peak hours the batteries can be discharged. Such a pattern undertaken by a significant number of consumers would help to lower energy costs for producers, distributors and end-users alike, as well as optimizing the use of low-carbon energy. Tesla has even employed stacks of its batteries to provide grid-scale back-up power and load balancing to utilities in Australia, Puerto Rico and Belgium.

While developing and implementing its Strategy, the City could identify several optimal sites for DER EV charging pilots. If DC fast charging is provided at these sites, it should consider installing some high-capacity stationary energy storage (perhaps incorporating used EV batteries) to provide a buffer against large electrical loads. [43]

(Figure 10)

[43] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

Figure 10: Rendering of Sheridan College's Brampton Campus planned solar carport – a great example of the synergistic relationship between EVs and distributed energy generation

5.2.4 Ultra-fast charging

Current DC fast chargers typically provide power at rates between 50 and 120 kW. However, major advancements in charging technologies in recent years have led to several companies developing stations that can charge at rates up to and beyond 350 kW. Such rates would allow EVs to add over 200 km of range in as little as 8 minutes. Unfortunately there aren't currently any production vehicles with hardware capable of charging at such rates, but many automakers are developing vehicles that will be able to, with the first of these vehicles expected to begin rolling out in the next couple of years.

CHAdeMO, the DC fast charging platform developed by Japanese automakers, recently released a protocol for 400 kW charging.170 CCS (or Combined Charging System) is the DC fast charging platform most common in North America, and stations with the ability to charge batteries at a rate of 350 kW are already beginning to be installed. Tesla has a proprietary brand of DC fast chargers known as Superchargers, which currently provide charging at up to 120 kW. While Tesla's Superchargers are not compatible with non-Tesla vehicles, most, but not all, public DC fast charging stations are now compatible with both CHAdeMO and CCS charging.

Ultra-fast charging stations are designed to fully charge an EVs battery in less than 10 minutes. Because they draw such a large amount of power in such a short period of time, they are often used in conjunction with stationary energy storage. The implementation of ultra-fast chargers will not only improve the appeal of passenger EVs, as it will help to facilitate long distance trips via EVs, but it will also help pave the way for larger vehicles with much larger batteries to transition to electrification.

When selecting an appropriate vendor and equipment for Level 3 charging stations, The City could assess whether the chargers it installs are upgradable to ultra-fast charging (as these stations will likely be in operation for 10 to 15 years).

5.2.5 Battery energy density and costs

Batteries are both the heaviest and costliest components of EVs of all types. Costs of lithium-ion batteries have come down significantly since production EVs entered the[44]

market in 2010, from about $1,000 per kWh to about $200 today. Analysts expect these costs to continue decreasing as technologies continue to mature and economies of

[44] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

scale exert a bigger influence on EV production. Some suggest that battery costs could reach $100 per kWh in the next several years, and that this will mark the point at which production costs of EVs will be equal to those of conventional ICE vehicles.

Lower battery costs will also mean that prices for stationary energy storage units will further decrease in the near future.

- Lithium-ion battery advantages
- Lithium-ion batteries are low maintenance and hold their charge well compared to other battery types. They tend to have self-discharge rates of about 5% per month if unused.
- Lithium-ion batteries are stable and safe to use, which is why they've been the battery type of choice for laptop computers and cellphones since the 1990s. Most EV batteries are now protected under manufacturer warranties for 8 years or 160,000 km.
- Lithium-ion cells provide very high power output for energy-intensive applications such as driving.
- Modular designs for lithium-ion batteries mean that they can be easily scaled up or down for different applications, and that costs and weight can be minimized.
- Lithium-ion battery disadvantages:
- Although lithium-ion batteries have greater energy density than most other types of commercially-available batteries, their energy density is far lower than fossil fuels or pressurized hydrogen.
- As with the lithium-ion batteries found in consumer electronics, EV battery capacity deterioration is a major point of concern for potential EV owners. An ongoing study on the Tesla Model S, however, shows that battery capacity only declines by an average of about 8% after 200,000 kms driven. Some automakers have cautioned consumers to expect battery degradation in the range of 10-40% after 160,000 km driven.
- Battery charging and discharging rates are impacted by ambient temperature. Most EV batteries are now equipped with liquid heating or cooling to maximize efficiency in hot or cold temperatures.

A wide variety of alternatives to the prevailing lithium-ion battery are being actively explored by research institutes and businesses around the world. These alternatives are purported to have cost, capacity and/or performance advantages over lithium-ion. While the specific technical merits of emerging battery chemistry options are beyond the scope of this assessment report, some notable alternative battery chemistries worth monitoring developments on include: solid-state, lithium-sulphur, lithium-air, lithium polymer, sodium-sulphur, flow/vanadium redox, and magnesium-ion.

While none of the aforementioned battery chemistries may ultimately replace lithium-ion, features or individual components of them could be integrated into improved lithium-ion battery designs. For example, changes to materials used to construct or coat a battery's anode or cathode could significantly reduce degradation. Materials better-suited to ultra-fast charging or resistance to extreme temperatures could also be incorporated into existing battery designs.

The first production EV models only became available to consumers in Canada in 2010. As the average lifespan of passenger vehicles is in the range of 12 to 15 years, the first [45] generation of EVs haven't yet reached their retirement age. When they begin to, however, it is expected that an end-of-life market for EV batteries will emerge, and stakeholders such as electrical utilities may create a role for these batteries in stationary energy storage (to buffer EV charging loads) or even to provide grid-level backup power or load management functions. It is expected that retired EV batteries will retain approximately 50-70% of their original capacities, so they will still be useful in certain roles. Several automakers are actively exploring opportunities to utilize and re-market retired EV batteries for a variety of stationary energy storage applications. As existing EV fleets continue to age, it is important that stakeholders monitor and explore opportunities for the re-use of retired batteries.

Some production EV models can already surpass 500 km on a single charge, and on average ranges are increasing by about 10% every year. As ranges increase, the need for public EV charging may decrease, with the possible exceptions of inter-city corridors and neighbourhoods with high concentrations of garage orphans. Over 80% of charging already occurs at home, and this percentage may increase further as EV batteries and charging solutions continue to evolve.

When building out a network of public charging stations, the City should examine how increased EV range due to battery enhancements might impact the location and type of public charging stations required in a given area. It may also want to explore stationary energy storage opportunities for retired EV batteries, perhaps tied to DERs. [46]

[45] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf
[46] https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

6. About Green Fleet Plans, City of Kawartha Lakes GHG Situation & City of Kawartha Lakes Transition to EVs and EV Charging

6.1 About Green Fleet Plans – An Overview

In Canada and around the world, leading companies and all levels of government have developed Green Fleet Plans to set out their short and long term carbon reduction targets; some may also include strategies for air/land/water pollution reduction.

A Green Fleet Plan may also include the fleet's green initiatives for its maintenance or parking garages. For fleets that outsource maintenance, plans may also define eco-standards for contractors, such as third-party suppliers. In this section, we describe some options for fleet operations. [47]

Situation

We are living in a period of transportation history as the world quickly and steadily transitions away from fossil-fuelled vehicles powered by internal combustion engines (ICEs) and toward electric vehicles (EVs). It has been referred to as the "end of the ICE age".

Globally, the end of ICEs has already been legislated. Germany and California have both passed legislation, the latter now requiring all trucks to be zero-emission vehicles (ZEVs) by 2045.

Unlike ICE fleet vehicles, EVs do not require costly fuels like gasoline and diesel. They have far fewer moving parts, do not require tune-ups, oil changes or filter replacements; and require far less brake friction lining replacements, if ever.

All sizes and types of on-road vehicles in the municipal context can benefit from electrification. With that stated, the question for municipalities with a fleet of low kms-travelled vehicles becomes whether payback periods for low utilization units will be protracted and if there will be return on investment (ROI).

EVs currently cost more than ICE vehicles. With higher levels of usage, the potential ROI improves as the increased cost of capital for an EV is offset by the reduced cost of fuel, repairs and maintenance. Vehicles with very low kms-travelled are, therefore, not ideal candidates for replacement with EVs.

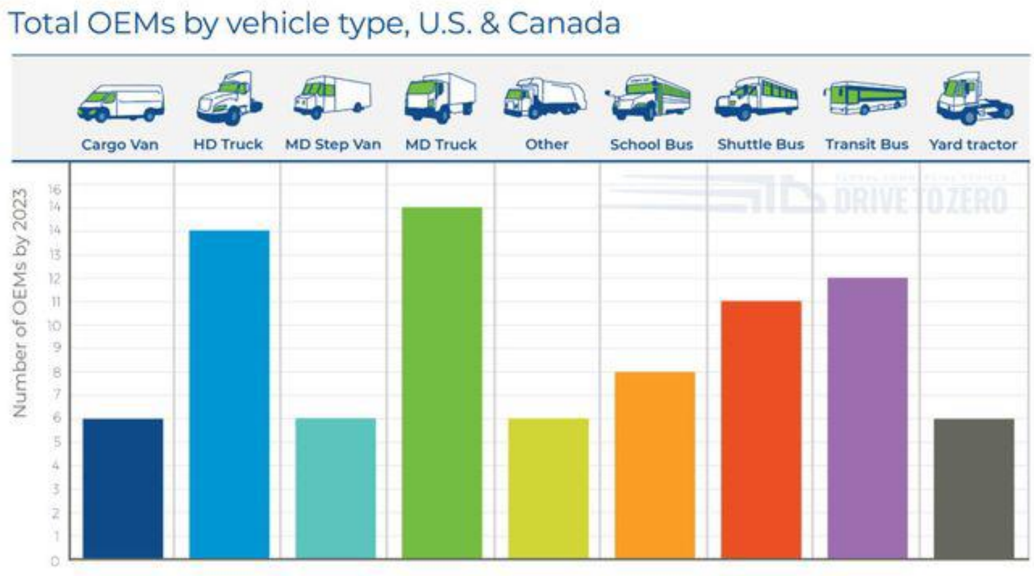
[47] https://www.kawarthalakes.ca/en/municipal-services/resources/Grants-and-Funding/January-11-2021-Final-Report---City-of-Kawartha-Lakes-Fleet-Review.pdf

Municipally operated Class 8 ICE trucks (Plow Trucks) burn fuel at a staggering rate – anywhere from 50 to 100 litres per 100 km or even more. As a general rule of thumb, the larger a vehicle is, and the higher its utilization rate, the better the business case for replacement with an EV. [48]

6.2 Current and Emerging Electric Vehicle Categories

Most vehicle original equipment manufacturers (OEMs) are working rapidly to develop EVs of all categories. Seemingly almost daily, new makes and models of EVs are announced. Battery-electric vehicles (BEVs or EVs) are available now in the light-duty vehicle categories, such as cars and SUVs. For municipalities everywhere, a mainstay of their fleets is pickup trucks; on average, 46% of all Canadian municipal fleet vehicles are pickups. Seven EV pickup models are slated for availability within the next two model years for purchase.

(Figure 11) Total EV Truck & Bus OEMs by 2023 (Source: Calstart)



In addition to EV pickups that are soon to emerge, in the Figure above- Total EV Truck & Bus OEMS by 2023 we see that the OEMs are quickly ramping up with other types of commercial EV trucks (medium- and heavy-duty truck categories) that are suited for municipal work environments.[49]

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[48] https://www.kawarthalakes.ca/en/municipal-services/resources/Grants-and-Funding/January-11-2021-Final-Report---City-of-Kawartha-Lakes-Fleet-Review.pdf

[49] https://www.kawarthalakes.ca/en/municipal-services/resources/Grants-and-Funding/January-11-2021-Final-Report---City-of-Kawartha-Lakes-Fleet-Review.pdf

6.3 The ‘Messy Middle’

Green, low-carbon fleet planning began many years ago. Leading fleet managers have been taking action to reduce their fleet’s carbon footprint for more than 15 years but the reality of a day when all vehicles are zero-emissions is well into the future.

The period of time we are now in has been referred to as the “messy middle”, a time in which fleet managers seeking to reduce emissions must turn to a confused jumbled collection of interim solutions, some of which are challenging and potentially costly to implement. Today’s interim solutions include, but are not limited to, transportation demand management, alternate and renewable fuels, and technological enhancements.

6.4 Electric Vehicle Training Requirements

Should CKL Fleet and Transit Services decide to move ahead toward vehicle electrification, fleet technician training is recommended. In Ontario, research has found just two community colleges that currently offer EV technician training; One is Centennial College in Toronto.

While there is some availability for EV technician training in Ontario, due to the rapid onset of electric mobility we suspect that reality will soon change. Before EVs are deployed in CKL’s fleet to any great extent, we recommend high voltage training for technicians.

Published high-voltage guidelines specific to vehicle technicians servicing EVs are not readily available through traditional sources. However, we suggest that anyone working with high voltage in any format, including EVs, should be provided guidance on applying Occupational Health & Safety Management System fundamentals. This includes a ‘plan, do, check, and act’ philosophy while working with energized electrical equipment. Such training is available for non-electrical workers from Lineman’s Testing Laboratories (LTL) of Weston, Ontario. LTL offers an awareness level course for non-electrical workers which is claimed by the company to provide a basic level understanding of workplace electrical safety.

Aside from awareness training, fleet technicians should also have access to, and be trained on the use of electrical-specific personal protective equipment (PPE). Such PPE would include tested and certified non-conductive gloves as well as non-conductive tools and equipment as a last line of defence, ensuring all such gear is appropriately used and maintained. Protective gloves and other PPE, as well as non-conductive tools, must be re-tested periodically to ensure safety.[50]

6.5 Synopsis - Electric Vehicles, Green Technologies, Alternate & Renewable Fuels

Electric vehicles (EVs) are coming in the types the City requires. Planning should begin now for the transition to EVs in the CKL fleet.

While awaiting the expected availability of EVs of the types required by the City, planning, budgeting, and installing EV charging equipment should begin in the near-term. Funding for the EV charging infrastructure may be available from NRCan and other sources including the FCM Green Municipal Fund.

Recommendations:

- Prioritize the purchase of battery-electric EVs and plug-in hybrids that are available now in the light-duty categories (cars, SUVs).
- Seek funding for an EV charging infrastructure from NRCan and other sources including the FCM Green Municipal Fund.
- For an interim solution for reducing fleet's GHG emissions, consider the use of renewable fuels, including biodiesel (B20 in summer and B5 in winter) and higher blends of ethanol (E85) in all factory-designed "flex-fuel" capable vehicles.
- Invest in idling-reduction technologies such as auxiliary cab heaters and power units, extra auxiliary batteries for DC loads, or solar charging options.
- In the medium to long-term future, consider hydrogen fuel cells as this technology evolves and becomes commonly available, and once "green" H2 source(s) are in place.

6.6 City of Kawartha Lakes Current GHG Situation

In 2015, the City of Kawartha Lakes' residents, businesses, institutions, and industries produced approximately 647,470 tonnes of CO2e (carbon dioxide equivalent) or 7.8 tonnes of CO2e per person – equivalent to nearly 137,370 cars driven for one year. This includes emissions from activities taking place within the City's boundary, including fuel and electricity use (from transportation and buildings), waste generated, and livestock emissions.[51]

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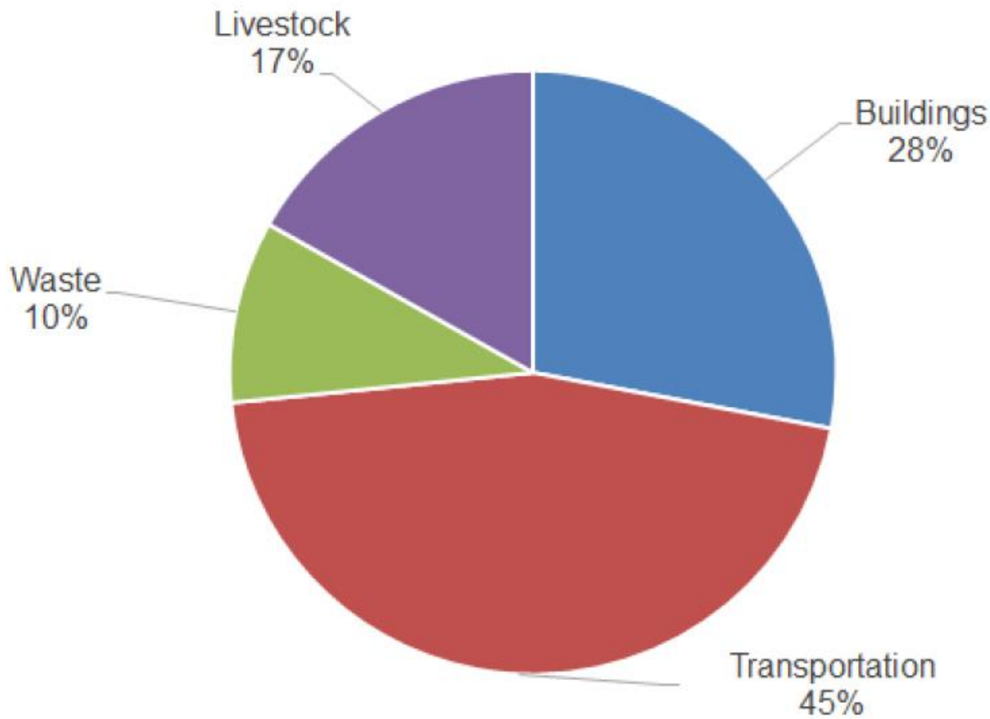
[50] https://www.kawarthalakes.ca/en/municipal-services/resources/Grants-and-Funding/January-11-2021-Final-Report---City-of-Kawartha-Lakes-Fleet-Review.pdf

[51] https://www.kawarthalakes.ca/en/resourcesGeneral/Documents/Healthy-Environment-Plan-Long.pdf

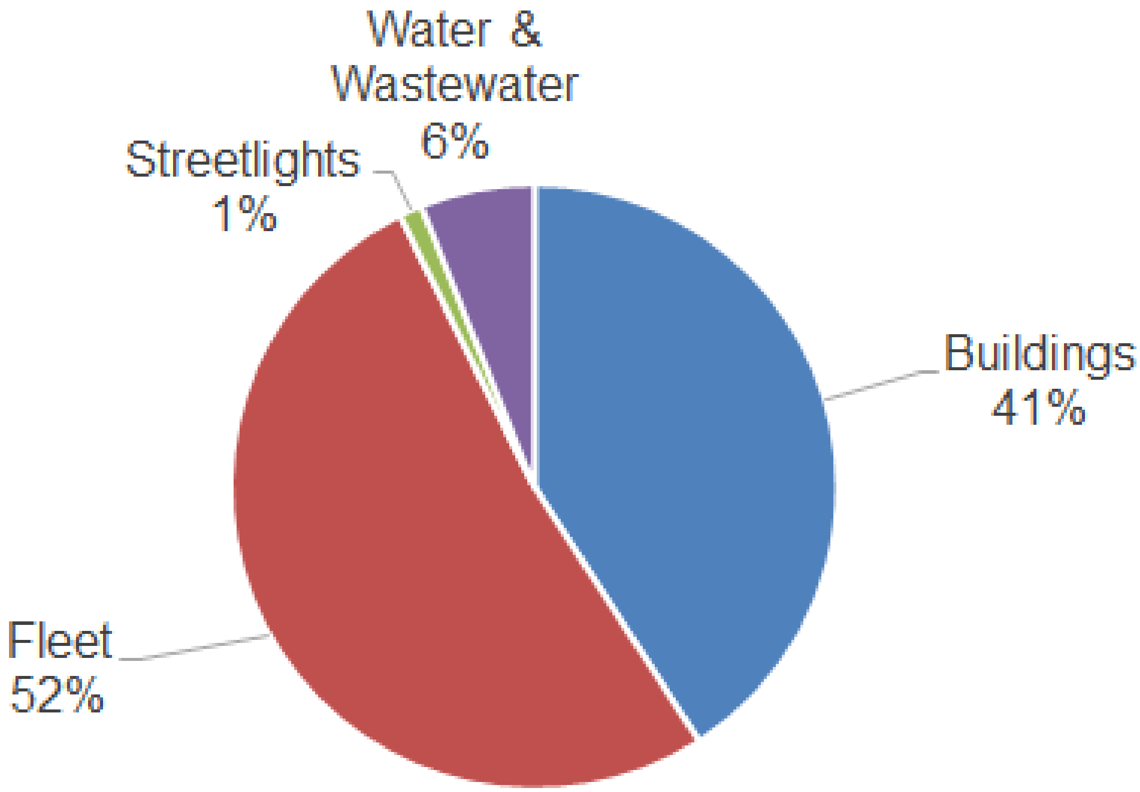


(Figure 12)

Community GHG emissions in the City of Kawartha Lakes in 2015, by community sector.

Looking at municipally-owned buildings and facilities, fleet vehicles, street and traffic lights, and energy used during the delivery and treatment of water and wastewater (Figure 12), the City generated a total of 7,500 tonnes CO2e. The City's emissions represent only 1% of the total emissions in the community, highlighting the need for a community-wide response to climate change and action by all in Kawartha Lakes.[52]

[52] https://www.kawarthalakes.ca/en/resourcesGeneral/Documents/Healthy-Environment-Plan-Long.pdf



(Figure 13)

Corporate GHG emissions in the City of Kawartha Lakes in 2015, by sector.

While emissions from municipally-owned assets account for a very small portion of the total emissions in our community, areas where the City has a significant influence such as transportation, land use planning and waste management all are captured within the community inventory.[53]

Transportation Goals from City of Kawartha Lakes Healthy Environment Plan

GOAL 14. Cultivate sustainable, low-carbon transportation options which adhere to responsible, environmentally friendly transportation operations.
GOAL 15. Minimize the potential for disruption to transportation networks from climate change impacts and extreme weather events.[54]

[53] https://www.kawarthalakes.ca/en/resourcesGeneral/Documents/Healthy-Environment-Plan-Long.pdf

[54] https://www.kawarthalakes.ca/en/resourcesGeneral/Documents/Healthy-Environment-Plan-Long.pdf

6.7 City of Kawartha Lakes Transition to EVs

The City of Toronto has set goals from their EV Strategy as follows;

The EV Strategy's ultimate objective is having 100% of light-duty vehicles being zero emitting by 2050. To monitor progress towards this goal, a pathway was developed to understand if the City is on track:

- By 2025, 5% of registered personal vehicles are EVs;
- By 2030, 20% of registered personal vehicles are EVs; and
- By 2040, 80% of registered personal vehicles are EVs. [55]

If the City of Kawartha Lakes was to follow a similar implementation plan both for personal and municipal fleet vehicles it would be feasible with the understanding that funding to support the charging infrastructure will be required.

The transition of the City fleet to match the above goal is shown in Figure 14.

EV Implementation		
Year	% of Fleet	Units
By 2025	5%	10.2
By 2030	20%	40.8
By 2040	80%	163.2

(Figure 14)

[55] https://www.toronto.ca/wp-content/uploads/2020/02/8c46-City-of-Toronto-Electric-Vehicle-Strategy.pdf

Figure 15 shows the City of Kawartha Lakes current fleet of vehicles. The chart depicts each category and quantity, their percentage of the entire City fleet, average annual mileage and the departments they are assigned to.

City of Kawartha Lakes Non Emergency Fleet				
Vehicle Type	**Quantity**	**% of CKL Fleet**	**Average Annula KM's**	**Primary Operating Locations**
Cars/Small SUV	20	10%	12,669	Development Serivces, Public Works
Trucks	68	33%	19,956	Public Works, Community Services & Engineering
Vans	26	13%	11,515	Public Works, Community Services, Engineering, Corporate Services
Medium Duty Trucks	20	10%	19,915	Public Works, Community Services
Buses	11	5%	27,888	Public Works
Tandem Axel Trucks	47	23%	569hrs	Public Works
Single Axel Trucks	12	6%	567hrs	Public Works
Total	204			

(Figure 15)

The below chart (Figure 16) depicts the City of Kawartha Lakes Non Emergency procurement plan from 2024 to 2030. You can see between cars, vans and pick up truck we have 16 units to be replaced as per the fleet policy in 2024 and 8 units in 2025. If the City committed to procuring half (50%) of those units as EVs the 5% goal for 2025 would be achieved.

7 Year Fleet Procurement									
Project Title	**Category**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	**Total**
Buses	Transit	2	1	1	1	1	1	1	8
Medium Duty Trucks	Fleet	2	2	2	1	1	2	1	11
Cars	Fleet	3	3	0	0	1	1	2	10
Pick up Trucks	Fleet	6	3	1	0	2	3	7	22
Single Axle Trucks	Fleet	1	0	1	1	0	1	2	6
Tandem Trucks	Fleet	4	7	4	4	5	5	0	29
Vans	Fleet	7	2	1	0	1	6	1	18
Grand Total		**25**	**18**	**10**	**7**	**11**	**19**	**14**	**104**

(Figure 16)

Buses

The City of Kawartha Lakes current bus fleet is 11. The conventional buses accumulate the largest amount of kilometers of any City unit annually. By converting these units to electric, the City will reduce GHG emissions significantly and this would be our greatest opportunity. There are many municipalities and transportation authorities that have made considerable commitments to Electric Bus Adoption. There are a few barriers that hinder the implementation of E-Buses

Key Technological Barriers

Lack of Knowledge : In general, cities lack the information needed to make informed decisions at almost all stages, from establishing an initial discussion to scaling up e-buses.

- The proper inputs required for an initial cost-benefit analysis of the e-buses and infrastructure
- Strategies and techniques to optimize the design and implementation of an e-bus project
- The operational characteristics, limitations, and maintenance requirements of e-buses available on the market
- Infrastructure planning needs to be completed prior to adoption

Technical Limitations of the E-Buses and Charging Infrastructure : Technological limitations exist in all three components of the
e-bus trade space:

- Vehicles and batteries produce limited range and power relative to conventional buses. The battery manufacturing industry, emerging and immature, faces a learning curve in its effort to produce reliable, road-tested products.
- Agencies and operators lack the knowledge needed to adopt new operation models to accommodate for the range and power limitations of e-buses.
- Grid and charging infrastructure are also new and evolving technologies that face limitations and stability challenges.

Difficulties for Agencies in Changing Procurement Practices: Transit agencies and government institutions typically use rigid financial management models, which incentivize low-cost, low-risk procurement. Most procurement models do not consider the unique cost structure (more expensive up front but cheaper to operate than conventional buses) and uncertain risks inherent in e-buses and their corresponding infrastructure.[56]

The approach that would benefit the City of Kawartha Lakes is to proceed into the E-Bus market in a conservative and careful fashion, working with our neighbouring and larger municipalities that are leading the implementation. Based on the City's fleet management plan between 2026 and 2030 five (5) buses are identified for replacement. The plan would be to continue to monitor both the E-Bus industry and the implementation of charging stations and the power grid within the City and commence with E-Bus procurement in 2026 if all factors align.

Pickup Trucks, Medium Duty Trucks, Tandem and Single Axle Trucks

E-Pickup truck and larger electric vehicle technology is progressing well and at a rapid pace. Uptake has been limited in north America in these categories partially as there are limited options available. The ideal approach for this category would be to monitor the technology and slowly procure units starting with pickup trucks, and progress into the larger units as options become available. 2025-2026 is recommended as the beginning of the EV pickup truck procurement and asses the progress from there.

Passenger Vehicles

This category of vehicle has made multiple advancements and the diversity and availability of the units has increased dramatically. The capital cost of the EV units has also become closer inline with their ICE comparators. That combined with the fuel cost increases we are experiencing and the cost of ownership for EV being potentially less than their ICE counterpart makes the transition to EV units feasible. The limiting factor for our region will be the charging infrastructure and the lack thereof in the City. It's feasible for the City of Kawartha Lakes to make a shift in procurement to EVs starting in 2024 and 2025 with 8 and 4 EV or hybrid solutions respectively.

[56] https://wrirosscities.org/sites/default/files/barriers-to-adopting-electric-buses.pdf

7. Summary and Action Plan

The time is now for EV and EV charging implementation. The industry has now moved from being leading edge or new to main stream as 6.2% of all passenger vehicles purchased in Canada for 2020 were of EV configuration. Brands and models are more readily available and capital cost are coming in line with their internal combustion engine counterparts. The two main challenges for the City of Kawartha Lakes is the geographical size of our municipality and the existing charging station network and or the lack thereof. Without a robust charging network both municipal and private EV uptake/transition can not take place.

Municipalities with large populations like the City of Toronto completed an Electrical Mobility Strategy in 2018 followed by an Electric Vehicle Strategy in 2019. Both were referenced and utilized as a resource for this report.

https://www.toronto.ca/wp-content/uploads/2019/05/9685-EMS-Assessment-Phase-Final-Project-Report.pdf

https://www.toronto.ca/wp-content/uploads/2020/02/8c46-City-of-Toronto-Electric-Vehicle-Strategy.pdf

These important documents combined with this report can be utilized to move the City of Kawartha Lakes forward into an EV and EV Charging Implementation plan. The City of Kawartha Lakes can reference and leverage the standards set and the expertise gained by some of our neighbouring municipalities that have already embarked on the EV journey. This will allow us to forgo some steps and conserve resources and funds for the actual implementation of the infrastructure.

7.1 The EV and EV Charging Implementation Plan

To support EV uptake both for the City's fleet and our community a capital investment will be required. As a pilot or starting point, 20-40 ports should be considered. The capital investment would be between $300,000 and $750,000. This would allow for both level 2 and some level 3 charging. Grant applications are currently available through NRCan and this project would be in line with the required criteria. Assuming the City received the 50% funding from NRCan, the City's capital investment would be reduced to between $150,000 and $375,000. The EV and EV charging transition is imminent and it would be ideal and wise to benefit from these grant programs while they are available.

Provided Below are two charts (Figure 17- Procurement Schedule) that depict what the fleet replacement plan would look like if the City met the EV uptake goal for passenger vehicles set out above. Figure 18- shows the percent of passenger vehicle goal accomplishment. *Busses and medium duty trucks are excluded from the total**

7 Year EV Fleet Procurement																
Project Title	Category	2024		2025		2026		2027		2028		2029		2030		Total
		ICE	EV	ICE	EV	ICE	EV	ICE	EV	ICE	EV	ICE	EV	ICE	EV	
Buses	Transit	2	-	1	-	1	-	-	1	-	1	-	1	-	1	8
Medium Duty Trucks	Fleet	2	-	2	-	2	-	1	-	1	-	1	1	-	1	10
Cars	Fleet	1	2	-	3	0	-	0	-	-	1	-	1	-	2	8
Pick up Trucks	Fleet	6	-	1	2	-	1	0	-	-	2	-	3	-	7	15
Single Axle Trucks	Fleet	1	-	0	-	1	-	1	-	0	-	1	-	2	-	6
Tandem Trucks	Fleet	4	-	7	-	4	-	4	-	5	-	5	-	0	-	29
Vans	Fleet	2	5	-	2	-	1	0	-	-	1	-	6	-	1	17
Total		**18**	**7**	**11**	**7**	**8**	**2**	**6**	**1**	**6**	**5**	**7**	**12**	**2**	**12**	**93**
Grand Total			**25**		**18**		**10**		**7**		**11**		**19**		**14**	**104**

(Figure 17)

EV Implementation			
Year	% of Fleet	Units	Actual
By 2025	5%	14	7%
By 2030	20%	40	20%

(Figure 18)

Please keep in mind the below is a high level plan that will require approval and refining but can be utilized as a starting point and step forward in the process.

The following departments should be included in the planning process as they will be a stake holder in the end. I would also suggest that other departments would need to support the process as subject matter experts in their designated fields.

Stakeholder Group

- **Office of Strategy Management- Process Leader**
  - Experts in Facilitating meetings
  - Experts with organizing
  - Implementing & streamlining process
  - Mining and interpretation of data
- Clerks Office
  - Municipal Law Enforcement
    - Public Parking Lots
- Community Services
  - Parks and Recreation
    - Recreation Facilities
    - Open Spaces
    - Parking Lots
    - Community Halls
  - Building and Property
    - Buildings
    - Staff Parking
- Library Services
  - Parking Areas
- Public Work
  - Fleet & Transit
    - Staff Buildings
- Engineering and Corporate Assets
  - Capital Project
  - Future infrastructure
  - Subdivision development
- Corporate Services
  - Information Technology
    - Support and guide technical requirements
  - Communications
    - Educate Staff and public
    - Communicate our strategy

- Development Services
    - Economic Development
        - Tourism
    - Planning
        - Residential development
        - Standards implementation
        - Commercial development
- Human Services
    - KLH Housing Corp.
        - Buildings
        - Parking Lots

Subject Matter Experts Required

- Mayor & Council
    - Discussion on needs and input from the community
- Revenue & Taxation
- Treasury
- Procurement
- Building and Septic Division
- Hydro One
    - Review local Hydro Grid Capabilities
    - Identify issues

Below is a task list with timing for the implementation of charging stations followed by a fleet EV implementation time line. The times identified are high level and somewhat aggressive. To achieve EV implementation into the City's fleet by 2024 this is the time line required.

7.2 EV and EV Charging Implementation Timeline

Action Plan and Deliverable			
Task or Activity	Responsible Department	Completion	
		Timing	Year
Select and Confirm Committee Members	CAO, PW Director, Office of Strategy Management, Fleet Manager	Q1	2022
→ Discussion with department Directors and Manager			
→ Select and Confirm Committee Members			
→ Identify all stake holders			
Arrange Kick off Meeting	Office of Strategy Management	Q1	2022
→ Pick Meeting Date & Time (Zoom)			
EV Implementation Work Group Meeting	All Stakeholders	Q1	2022
→ Identify Potential EV Charging Locations		Q1	2022
→ Define Roles and Responsibilities (Who is doing what)		Q1	2022
Develop and Submit Grant Application to NRCan	Treasury, Office of Strategy Management, Fleet Manager	Q1	2022
Meet With Hydro One	Engineering, Office of Strategy Management	Q1	2022
→ Discuss Hydro Grid Limitations/Challenges			
→ Develop Plan to Improve Hydro Grid Where Needed		Q2	2022
Review Build Electrical Capacity and Infrastructure Capabilities	Engineering: Asset management Supported by Departments		
→ At Designated Charging Locations		Q2	2022
→ At all CKL Facilities		Q2	2023
→ Confirm Hydro Grid Capacity For Designated Charging Locations		Q2	2022
Confirm Hydro Grid Capacity For All CKL Facilities		Q2	2023
Budget for Charging Stations At Designated Locations	Engineering, Office of Strategy Management, Fleet Manager		
→ Get Estimates Development Budget Costs		Q2	2022
→ Get Estimates & Development Budget Costs Hydro Grid Upgrades		Q2	2022
Permit and Internal Technical Review	Building & Septic Division, Office of Strategy Management, Engineering, Fleet Manager	Q4	2022
Charging Station Procurement	Procurement, Office of Strategy Management, Fleet Manager		
→ Specification Development		Q3/Q4	2022
→ Procurement Release		Q4/Q1	22/23
→ Award Procurement		Q1	2023
→ Construct/Install Charging Units		Q2	2023
Budget for EV Fleet- Part of Typical Capital Budget Process	Fleet Manager	Q2	2023
EV Passenger Vehicle Procurement	Procurement, Fleet Manager		
→ Specification Development		Q3/Q4	2023
→ Procurement Release		Q4/Q1	23/24
→ Award Procurement		Q1	2024
→ Build EV Units (8 month - 1 year Build)		Q1/Q2	2024
→ Delivery of EV Units		Q4/Q1	24/25
EV Implementation Work Group Meeting	All Stakeholders	Q1	2024
→ Review EV Charging Locations			
→ Review Charging Station Data			
→ Identify Challenges			
→ Identify Additional Charging Locations If Any			
→ Define Roles and Responsibilities (Who is doing what)			