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Making the Switch to
Electric Urban Delivery Fleets
in the GTHA

A step-by-step action plan for commercial electric vehicle deployment

April 2021

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A guide to going electric

So, you're interested in going electric. You're not alone — businesses around the world and across Canada are making commitments to reduce their environmental footprint by transforming their vehicle fleet and infrastructure. As a part of an overarching corporate sustainability strategy, the introduction of battery-electric vehicles (EVs) can allow businesses to significantly reduce their greenhouse gas (GHG) emissions and save on fuel costs for every vehicle, all year. From national courier companies with vehicles operating in cities to small local companies with a handful of cargo vans, all urban delivery fleets should consider making the switch, regardless of size.

The Greater Toronto and Hamilton Area (GTHA) is a region that has incredible potential for widespread EV adoption given that it is home to one of the fastest-growing metropolitan areas in both Canada and the United States. Furthermore, transportation-related GHG emissions continue to grow in the region, despite improvements in vehicle efficiency and the use of cleaner liquid fuels.[1] The North American Council for Freight Efficiency has identified that the Greater Toronto Area is one of the regions in North America that should prioritize future deployment of this technology based on technological advances, support for the technology and need.[2]

Integrating a new transportation and energy system into your operations is complex, and your approach, planning process and strategy will be unique to your business needs. Experience and lessons learned from early adopters show that the planning process for deployment is extremely important and should not be underestimated.

To help commercial fleet operators in the GTHA get started, this document includes a step-by-step guide and key tips to deploy battery-electric urban delivery vehicles (medium-duty, class 2b-3) with on-site depot charging. The action plan has been developed based on publicly available information and has been informed by the experiences of companies that have deployed EVs in other sectors or jurisdictions. It is important to note that this action plan is not intended to be an exhaustive list of actions that are required, given that your electrification strategy and approach will be highly dependent on context-specific conditions. However, companies operating in other regions in Canada may find many of the steps applicable.

20 steps to fleet electrification

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- ☐ Determine your preferred vehicle specifications
- ☐ Set a minimum vehicle utilization standard

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Understanding your needs

Step 1: Develop the business case for fleet electrification

In *Making the Case for Electric Urban Delivery Fleets in the GTHA: An assessment of the costs, energy demands, and environmental benefits of electric cargo vans*, published in conjunction with this report, the Pembina Institute examines some of the economic and environmental benefits of urban delivery electrification in the GTHA. We modelled the operations of an electric cargo van in the GTHA along routes that were informed by experiences of businesses as well as real-time data and found that, on average, businesses can expect to see a return on an investment in EVs in approximately seven to eight years. A switch to EVs is also expected to lead to annual GHG emission savings of 12 tonnes per year, on average, which is equivalent to taking 2.6 passenger vehicles off the road for one year.

While this analysis provides a baseline estimate of the various costs and benefits that a fleet operator in the GTHA making the switch to EVs can expect, the results will vary from one business to another. Developing a business case that is specific to your needs is important. Costs and benefits will vary depending on fleet size, vehicle model selection, charging schedule, the power of the charging infrastructure, and the electricity pricing scheme, among other factors. It is critical that a more comprehensive assessment is undertaken that is fine-tuned to your business's context in order to understand how the adoption of EVs will impact your finances, environmental goals, operations and infrastructure needs.

Step 2: Determine your preferred vehicle specifications

It is important to identify the minimum requirements for the EVs that you would like to procure. These specifications should be included in a request for proposals issued to potential vendors, which should be released as soon as your preferred vehicle models have been identified. This will also serve as useful information when working with relevant approval authorities. In order to develop these specifications, it is important to

have a thorough understanding of your vehicles and current operations (i.e. duty cycles). Consider:

- Vehicle type/model
- Gross vehicle weight rating
- Charging capabilities (e.g. Level 1, Level 2 and/or Level 3)
- Range
- Climate control (e.g. cabin heating or cooling)
- Transmission type
- Auxiliary electrical systems (e.g. automated doors, powered lift)
- Other auxiliary accessories (e.g. tire pressure monitoring)

Tip: Start early

It can take over a year to install charging infrastructure and procure the vehicle that best suits the needs of your fleet.[3] EVs are increasingly in demand, but supply is still relatively low.

Step 3: Set a minimum vehicle utilization standard

If you are planning on purchasing EVs to replace existing internal combustion engine vehicles (ICEVs), you should assess your fleet operations in order to optimize the number of vehicles to best serve your operational needs. Based on experience from fleets, a replacement ratio of 1:1 is not always needed, so this is a good opportunity to downsize your fleet, if needed, by maximizing the number of kilometres travelled by each vehicle. For instance, a small fleet operator may determine that four vehicles instead of five vehicles are needed to meet their needs. In doing this, you can ensure that you are maximizing your investment and avoiding unnecessary costs.[4]

Tip: Select a project manager

EV deployment requires a fair amount of co-ordination and engagement with external stakeholders. You may want to assign a project manager to oversee the process and provide expertise to ensure successful implementation. You may want to consider hiring an external consultant that specializes in the deployment of electric vehicle supply equipment (EVSE).

Exploring what's available on the market

Step 4: Identify suitable electric vehicle models

When it comes to determining what solutions are available on the market to suit your business needs, experience shows that there have been three different approaches to "going electric" in this early adopter phase of EVs:

- Retrofitting existing diesel or gas-powered vehicles
- Procuring EV models currently available on the market
- Working with companies to create a custom solution

The avenue you take is highly dependent on your business needs and priorities. In terms of understanding what charging infrastructure and vehicle models are currently available on the Canadian market or are expected to be in the near future (within five years), Table 1 highlights some examples. (Start-up companies such as Bollinger are not included here but are expected to be manufacturing electric vehicles in the near future.) Take the time to identify an EV model that meets the preferred vehicle specifications you identified in Step 2.

Table 1. Electric vehicle models for urban deliveries

Vehicle type	Mfr.	Vehicle model	Max GVWR (kg)	Battery capacity (kWh)	Range (km)	Availability in Canada
Cargo van	GM	EV600	4,536	-	402	2022
Cargo van	Ford	Transit EV	3,800	67	203	2022
Cargo van	Lightning	Transit Cargo Van	4,699	86 / 105	225 / 275	Available
Cargo van	SEA Electric	Ford Transit Cargo Van	4,699	88	304	Available
Cargo van	Adomani	All Electric High-Top Cargo Van	6,400	106.2	200	Available
Cargo van	Green Power	EV Star Cargo	6,499	118	240	Available
Step van	Motiv	EPIC E-450 Step Van	6,577	106 / 127	160	Available
Step van	Motiv	EPIC F-59 Step Van	9,979	127	144	Available
Step van	Lightning	Ford F-59	8,845 / 9,980	128 / 160 / 192	175 / 225 / 270	Available
Step van	SEA Electric	Ford F-59	8,156	138	320	Available
Step van	Workhorse	C1000	5,670	70	160	Available
Step van	Workhorse	C650	5,670	70	160	Available

Developing a strategy

Step 5: Create a phasing plan that incorporates a trial or pilot period

Trial a vehicle

Vehicle original equipment manufacturers (OEMs) can be open to loaning out a vehicle for a few months. If possible, trial the vehicle model(s) that you are most interested in. During this trial period, you can have maintenance personnel inspect the vehicle to determine whether or not they will be able to fulfill maintenance requirements in-house or if they will need to outsource. If your maintenance personnel decide that they may need to outsource vehicle maintenance to another facility, consider giving that facility the opportunity to take a look at the vehicle, too.

Consider a pilot period

In addition to a trial, you may consider piloting a small number of EVs prior to making a bulk purchase. While a trial period is often very short and allows for only brief hands-on experience, a pilot period builds on the trial and can be used to measure performance over a longer term. A pilot period would give you the opportunity to collect data on how well an EV can meet your operational needs and can help inform future decision-making around EVs with lower risk (e.g. preferred charging strategies, locating charging infrastructure, etc.). You may consider piloting vehicles from a few different manufacturers to identify the vehicle model you like best. Be sure to pilot vehicles for at least a year in order to identify any seasonal impacts.

It's important to collect data and track performance during a pilot period. Here are a few metrics that might help you evaluate the performance of the vehicle you are piloting and also inform future infrastructure upgrade requirements:

- Vehicle average energy consumption
- Actual vehicle range in comparison to the manufacturer's reported range
- Impact of extreme weather on vehicle range and energy consumption
- Vehicle charging speed requirements
- Total power requirements for vehicle charging
- Driver feedback

Assessing facility and site infrastructure requirements

Step 6: Determine your charging strategy

When it comes to infrastructure, you'll need to determine your preferred charging schedule and develop a strategy around it. Assess your fleet's operational needs by considering the following questions.

Routing

- How long are the routes that each vehicle travels?
- Are routes predominantly city or highway driving?
- Do vehicles travel set routes or do routes change every shift?

Operations

- Do vehicles return to a garage or depot at the end of each shift?
- How much downtime do vehicles have between each shift?

External conditions

- What weather will vehicles be driving in and how will that affect vehicle range?

Once you've answered these questions, you can develop a charging strategy that may involve one or a combination of the following:

- **Depot charging:** private vehicle charging that allows for custom charging configurations in a fleet's depot.
- **Mixed-use charging:** charging infrastructure that is shared with non-fleet vehicles. Allows infrastructure costs to be distributed across multiple parties.
- **On-route charging:** charging of fleet vehicles that occurs on-route. Unlikely to be a primary charging strategy for fleets but can supplement depot and mixed-used charging.[5,6]

Tip: Know the key actors

There are a few key actors that you may need to engage when you deploy EV charging infrastructure. Here is a brief description of who they are and why they may need to be engaged:

Local distribution company (LDC): The local electricity utility, which will vary regionally across Ontario. LDCs are responsible for getting power to the end user. They can help businesses ensure that they have the electricity needed to meet on-site electric vehicle charging requirements.

Electrical Safety Authority (ESA): The group responsible for ensuring that projects in Ontario meet the Electrical Safety Code. You will be required to notify the ESA if you plan on installing charging infrastructure on-site.

Municipality: You may be required to obtain a building permit from your municipality during the charging infrastructure installation phase.

Electric vehicle supply equipment (EVSE) company: This is the company that will provide you with all of the hardware and software associated with your charging stations. You will need to engage an EVSE company once you've determined your charging station preferences.

Step 7: Identify your ideal ratio of chargers to vehicles

If you decide to deploy charging infrastructure on-site, you'll need to identify the necessary ratio of chargers to vehicles. Telematics data can be leveraged to determine where chargers should be located, as well as how many and what speed of chargers are required.[7]

Step 8: Identify your charging speed requirements

In addition to the number of chargers, it is important to identify your charging speed requirements. This may involve one or a combination of the charger types outlined in Table 2.

Table 2. EV charger types

Type	Description	Approximate unit cost[8,9]
Level 1 AC	Plugging in directly to a standard wall outlet (110 to 120 V). This is the slowest speed of charging.	$790 to $1,080
Level 2 AC	An EV charger that uses a 208 to 240 V system. Charges at a faster speed than Level 1 charging.[10]	$1,240 to $4,150
Direct current fast charger (DCFC)	An EV charger that uses a 400 to 1,000 V system, offering the fastest charging speeds.[11]	$37,690 to $185,770

Generally, the faster a vehicle needs to be charged, the more expensive the charging infrastructure and installation process will be.[12] Similarly, a networked charger (a "smart" charger that is connected to the internet) will be more expensive than a non-networked charger (one that is not connected to the internet).

Step 9: Consider smart charging as an option

Smart charging can help you better manage your energy use and electricity costs. Smart charging enables remote management of chargers, allowing fleet operators to turn chargers off entirely or adjust the rate of charging in response to grid conditions. By minimizing the use of chargers during peak periods, for instance, fleets can save on electricity costs.[13]

Step 10: Engage your local distribution company to create a power delivery roadmap

Once you have identified your preferred EV model, as well as your charging specifications and strategy, it's time to engage the relevant local distribution company (LDC) to help you develop a power delivery roadmap. Your LDC will play a key role in developing this roadmap — be sure to get in touch with them prior to installing any charging infrastructure. Table 3 provides an overview of the LDCs servicing the GTHA. As a part of the power delivery roadmap, you will need to determine the ability of the LDC to support new and future electrical loads, and identify the need for any transformer or grid upgrades.

Table 3. Regions served by LDCs in the GTHA

Local Distribution Company (LDC)	Region(s) served
Alectra Utilities	Hamilton, Mississauga, Brampton, Vaughan, Richmond Hill, Aurora, Markham, Gwillimbury
Burlington Hydro	Burlington
Oakville Hydro Electricity Distribution	Oakville
Milton Hydro Distribution	Milton
Halton Hills Hydro	Halton Hills
Toronto Hydro	Toronto
Newmarket-Tay Power Distribution	Newmarket
Elexicon Energy	Pickering, Uxbridge, Ajax, Whitby,
Oshawa Power and Utilities Corporation	Oshawa
Hydro One	Caledon, King, Whitchurch-Stouffville, East Gwillimbury, Georgina, Clarington, Scugog, Brock

Source: IESO[14]

Determine the ability of the LDC to support new and future electric loads

A commercial EV fleet can impose a significant load on the electricity grid. Your LDC may encourage you to undergo a pre-assessment to identify expected daily power requirements and ensure that there is adequate grid capacity to support these new loads.[15] In this pre-assessment, you should be sure to consider expected changes to future demand, as well. If the pre-assessment is successful, you may then make an application to connect to the grid. In some cases, an impact assessment may be conducted prior to the connection.

Identify need for transformers or grid upgrades

Most sites can sufficiently power the equivalent of several Level 2 chargers, or a single 50 kW DCFC.[16] When more power is needed, it is increasingly likely that major

infrastructure upgrades will be required to supply the site with additional power. Some sites may only require a transformer upgrade, but in the case of sites that require over 1 MW of power, the distribution grid feeding the transformer may require an upgrade.[17] In most cases, the cost of grid upgrades will be the responsibility of the fleet.

It is important to identify necessary grid upgrades as early as possible as this can extend the timelines of your project significantly. Black & Veatch, a California utility provider, estimates that it takes approximately eight months to deliver power to a site without grid upgrades, whereas it may take 48 months or longer for a site with upgrades.[18] At this stage, it's also important for you to plan for expansion in order to avoid being charged the same capital costs each time an expansion is required.[19]

The cost of transformers or grid upgrades varies significantly from one site to another but can be prohibitively high.[20] Even upgrading transformers is considerably expensive. The U.S.-based clean energy research organization Rocky Mountain Institute estimates that transformer upgrades can cost US$35,000 for smaller transformers (150-300 kVA) and up to US$173,000 for large transformers (1,000+ kVA).[21] If the cost of upgrades is prohibitively high, you may choose to only deploy the maximum number of vehicles that your current power capacity can supply.[22]

Tip: Develop a thorough understanding of your electricity rate structure

Electricity rates across the GTHA are made up of three main categories of charges: the electricity commodity charge, the delivery charge and the regulatory charge.[23] A description of each of these charges can be found on the Ontario Energy Board's webpage *Understanding your electricity bill*.

There are different ways that you may be charged for the electricity commodity portion of your utility bill. Residential customers and small business owners (that use less than 750 kWh year-round) typically pay time-of-use electricity prices, with higher rates during peak hours of the day when demand for electricity is highest. These customers, however, now have the option to switch to tiered pricing in which customers are charged a lower rate up until a set threshold, after which the rate goes up.[24]

It is critical that you develop a thorough understanding of how each of the charges on your electricity bill are calculated. Certain charges, such as the delivery charge and global adjustment charge for Class B customers, are scaled according to peak demand. Multiple EVs charged in parallel or those that are charged using DC fast chargers will produce high peaks in electricity demand, which may cause some of these charges to surge. For smaller

fleets, this can be particularly problematic as the cost is spread out across fewer vehicles.[25] If this is the case, consider working with an EVSE expert to find ways to adjust your charging schedule in order to minimze costs. Smart charging solutions may also allow you to program your charging schedules so vehicles are not all charging simultaneously.

Step 11: Identify need for site infrastructure updates

In general, it is preferable for vehicles to be charged in a parking lot. However, for many businesses, parking lots are strategically located near a conveyer belt or in a yard, which may be a significant distance away from an adequate power source. Bringing power to the vehicle may therefore require notable infrastructure updates, such as excavation, conduits, cabling and repaving.[26,27] Identifying the need for these infrastructure updates at an early stage in the deployment process is crucial as they may take anywhere from several days to a year to complete.[28]

Determining your financial strategy

Step 12: Find out if you're eligible for funding grants

Look to the federal and provincial governments, as well as non-governmental organizations, to identify any funding grants that you might be eligible for. While there currently aren't any applicable provincial grants, federal grants available for companies Canada-wide include:

- Zero Emission Vehicle Infrastructure Program (ZEVIP): provides funding for traditional Level 2 chargers and fast chargers with power outputs of 50 kW and above. Contributes up to 50% of the total project costs up to a maximum of $5 million per project. Light, medium- and heavy-duty vehicle fleets are eligible.[29]
- Federal tax write-off: 100% tax write-off for zero-emission vehicles for businesses. Includes light-, medium- and heavy-duty vehicles purchased by a business between March 19, 2019 and January 1, 2024.[30]
- Accelerated Investment Incentive: includes full expensing of eligible property in Classes 43.1 and 43.2, which includes electric vehicle charging stations.[31] Property that comes into use before 2028 will receive a 100% deduction in the first year.[32] The deduction will gradually phase out starting in 2024.
- iZEV Program: Canada's iZEV program provides a maximum incentive of $5,000 for new vehicles with a maximum manufacturer's suggested retail price (MSRP) of between $45,000 and $60,000 depending on configuration.[33] Currently, only light-duty passenger vehicles are eligible.

Step 13: Select your preferred financing or leasing option

Several financing options for vehicle procurement are available, including direct purchase, loan financing and vehicle lease. See Table 4 for a breakdown of the pros and cons of each option.

Table 4. Financing options for vehicle procurement

Financing type	Description	Pros	Cons
Direct purchase	A single payment made upon receipt of the vehicle. Ownership immediately transferred.	Generally, the least expensive method of financing. No restrictions on resale.	Upfront capital costs can be prohibitively expensive, particularly when a company is purchasing several vehicles. Fleet assumes any risk associated with technology and residual value.
Loan financing	Several payments made over a pre-determined period. Interest charges apply to the financed portion. Ownership of the vehicle is not transferred until all payments are made.	Reduces upfront costs by spreading payments out over a longer period.	Loan interest and processing fees add additional costs. Company assumes any risk associated with technology and residual value.
Vehicle lease	Monthly lease payments made over a pre-determined period based on initial vehicle price minus predicted residual value. Leasing company retains ownership of vehicle. Company has opportunity to purchase or re-lease vehicle after lease period.	Reduces upfront costs by spreading payments out over a longer period. Allows company to evaluate performance of vehicle over several months without taking ownership. Technology and residual value risks are assumed by leasing company.	Loan interest and processing fees add additional costs. May be difficult to terminate contract early. Some agencies may have no-lease policies.

Source: Mike Harrigan and David Head[34]

Seeking external approvals

Step 14: Obtain approval from Electrical Safety Authority

In the GTHA, you are required to undergo an Electrical Safety Authority (ESA) inspection if you plan on installing EV charging systems.[35] Prior to installing any EV charging infrastructure, you are required to file a notification of work to the ESA. A Certificate of Acceptance will be issued if the installation meets the Ontario Electrical Safety Code.

Step 15: Obtain building permits

You may be required to obtain a building permit from your municipality during the charging infrastructure installation phase. If you plan on deploying battery storage systems on-site, you may also be required to undergo a fire inspection.

Deploying charging infrastructure

Step 16: Install hardware

There are a number of hardware components that you need to install when deploying EVs: not only the charger itself, which includes the electronics, dispenser and meter, but also what some refer to as “make-ready” components, such as transformers, feeders and the service drop. In the GTHA, a licensed electrical contractor must complete this installation process.[36]

Step 17: Install software

You should consider investment in fleet management software to track fleet inventory and usage data, such as vehicle kilometres travelled, energy consumed, vehicle state of charge, charge times, charge durations, etc.[37] To facilitate fleet data management, you should consider adopting EV-specific on-board diagnostic or telematic systems.

Training your employees

Step 18: Train your drivers

Drivers need to be trained on the optimal and safe operation of EVs. Training covers safety procedures involved with plugging a vehicle into charge, such as inspecting charging cords for frays.[38] As well, since EVs produce significantly less noise than an ICEV, drivers of EVs require training on how to be mindful of pedestrians who may not be able to hear an EV approaching.

Drivers can also benefit from training on EV driving techniques that can help maximize fuel efficiency. Eco-driving habits, such as limiting acceleration, driving at the optimal speed, and minimizing time spent idling can maximize the range of the vehicle and reduce unnecessary wear and tear. It's also important to train drivers on the importance of charging schedules. Drivers may be required to plug an EV in to charge at the end of each shift to ensure that the vehicle is sufficiently charged for the next shift.

Tip: Educate and communicate with staff

Most major corporate transitions will involve some internal resistance to change. Be sure to proactively mitigate this. To ensure that a transition to electric vehicles is as successful as possible, consider developing a change management strategy that includes listening to staff feedback.

You might also consider doing a show-and-tell of electric vehicle models with your operations and maintenance staff. Education and communication, as well as participation and involvement are critical success factors in change management.[39]

Step 19: Train your maintenance staff

A critical question to ask yourself is whether you're going to establish an in-house EV maintenance team, or instead rely on outsourced maintenance personnel. Either way, it's important to ensure that technicians are properly trained on EV maintenance. While organized training opportunities are currently fairly limited, colleges in and around the GTHA have started to offer courses to train mechanics and service technicians on EVs. For instance, Niagara College delivered a specialized course on hybrid/electric vehicles for service technicians in 2019.[40]

Evaluation

Step 20: Evaluate your EV performance

Your efforts shouldn't stop once you've procured your preferred EVs and deployed the necessary charging infrastructure. Once you've reached this stage, it's critical to monitor and evaluate the performance of the EVs that you have deployed. Leverage your fleet management software or telematics systems to track each vehicle's performance, such as its state of charge or rate of energy consumption, both in real time and across an extended period. Work with your project team to develop a set of key performance indicators (KPIs) that will allow you to measure the success of your EV deployments over time (see Step 5 for a list of suggestions).

Congratulations — you've reached the final stage of EV deployment! Take some time now to reflect on your experience and share key learnings. There are many other companies that would benefit from hearing about your experience. By working together, we can help advance an EV ecosystem across Canada that helps keep businesses competitive and results in emission reductions and improvements to local air quality.

Additional resources

PG&E's Checklist for Vehicle Fleet Charging (see page 35)

Black & Veatch's Electric Fleets: 8 Steps to Medium and Heavy-Duty Fleet Electrification

CALSTART's Drive to Zero Zero-Emission Technology Inventory

Endnotes

[1] Maryam Shekarrizafard and Juan Sotes, *Reality Check: Carbon Emissions Inventory for the Greater Toronto and Hamilton Area 2018* (The Atmospheric Fund, 2021), 11. https://taf.ca/wp-content/uploads/2021/02/TAF_RealityCheck-Emissions-Inventory-2018.pdf

[2] Jessie Lund and Mike Roeth, *High-Potential Regions for Electric Truck Deployments* (North American Council for Freight Efficiency, 2020). https://nacfe.org/emerging-technology/electric-trucks/high-potential-regions-for-electric-truck-deployments/

[3] Jessie Lund and Mike Roeth, *High Potential Regions for Electric Truck Deployments: Guidance Report* (North American Council for Freight Efficiency, 2020), 9. https://nacfe.org/report-library/guidance-reports/

[4] Electrification Coalition and Meister Consultants Group, Inc., *Fleets for the Future: Electric Vehicle Procurement Best Practices Guide* (2018), 13. https://www.electrificationcoalition.org/wp-content/uploads/2018/06/ElectricVehicleProcurementBestPracticesGuide.pdf

[5] ChargePoint, *Fleet Charging Solutions* (2018), 2-3. https://www.chargepoint.com/files/brochures/br-fleet.pdf

[6] *Fleets for the Future*, 10.

[7] *Fleets for the Future,* 11.

[8] Michael Nicholas, *Estimating Electric Vehicle Charging Infrastructure Costs Across Major U.S. Metropolitan Areas* (2019), 2. https://theicct.org/sites/default/files/publications/ICCT_EV_Charging_Cost_20190813.pdf

[9] Depends on the number of chargers per pedestal and whether the charger is networked or non-networked. These estimates do not include installation costs.

[10] *Estimating Electric Vehicle Charging Infrastructure Costs Across Major U.S. Metropolitan Areas*, 2.

[11] Ontario Ministry of Transportation, "About Electric Vehicle (EV) Charging." http://www.mto.gov.on.ca/english/vehicles/electric/charging-electric-vehicle.shtml

[12] CALSTART, *Electric Truck & Bus Grid Integration* (2015), 19. https://calstart.org/wp-content/uploads/2018/10/Electric-Truck-and-Bus-Grid-Integration_-Opportunities-Challenges-and-Recommendations.pdf

[13] Chris Nedler and Emily Rogers, *Reducing EV Charging Infrastructure Costs* (Rocky Mountain Institute, 2019), 19. https://rmi.org/wp-content/uploads/2020/01/RMI-EV-Charging-Infrastructure-Costs.pdf

[14] IESO, "Find your local distribution company." https://www.ieso.ca/Learn/Ontario-Power-System/Overview-of-Sector-Roles/Find-Your-LDC

[15] Toronto Hydro, "Grid Connection process." https://www.torontohydro.com/grid-connections/connection-process

[16] *Reducing EV Charging Infrastructure Costs*, 21.

[17] *Reducing EV Charging Infrastructure Costs*, 21.

[18] Black & Veatch, *Electric Fleets: 8 Steps to Medium and Heavy-Duty Fleet Electrification* (2019), 11. https://www.bv.com/sites/default/files/2019-11/Electric_Fleets_Ebook_2019.pdf

[19] ChargePoint, *What it Takes to Manage an EV Fleet*, 4. https://info.chargepoint.com/what-it-takes-to-manage-an-ev-fleet.html

[20] *Reducing EV Charging Infrastructure Costs*, 21.

[21] *Reducing EV Charging Infrastructure Costs*, 22.

[22] *Electric Truck & Bus Grid Integration*, 19.

[23] Ontario Energy Board, "Understanding your electricity bill." https://www.oeb.ca/rates-and-your-bill/electricity-rates/understanding-your-electricity-bill

[24] Ontario Energy Board, "Choosing your electricity price plan." https://www.oeb.ca/rates-

and-your-bill/electricity-rates/choosing-your-electricity-price-plan

[25] *Electric Truck & Bus Grid Integration*, 16.

[26] *Fleets for the Future*, 11.

[27] *Electric Truck & Bus Grid Integration*, 18.

[28] *Electric Truck & Bus Grid Integration*, 18.

[29] Government of Canada, "Zero emission vehicle infrastructure program." https://www.nrcan.gc.ca/energy-efficiency/energy-efficiency-transportation/zero-emission-vehicle-infrastructure-program/21876

[30] Transport Canada, "Zero-emission vehicles." https://tc.canada.ca/en/road-transportation/innovative-technologies/zero-emission-vehicles#/find/nearest?country=CA

[31] Government of Canada, "CCA classes." https://www.canada.ca/en/revenue-agency/services/tax/businesses/topics/sole-proprietorships-partnerships/report-business-income-expenses/claiming-capital-cost-allowance/classes-depreciable-property.html

[32] Government of Canada, "Accelerated Investment Incentive." https://www.canada.ca/en/revenue-agency/services/tax/businesses/topics/sole-proprietorships-partnerships/report-business-income-expenses/claiming-capital-cost-allowance/accelerated-investment-incentive.html

[33] "Zero-emission vehicles"

[34] Mike Harrigan and David Head, *Ready, Set, Charge, Fleets! EV Fleet Deployment Strategies* (2015), 27. http://baclimate.org/wp-content/uploads/2015/10/Ready-Set-Charge-Fleets-EV-Fleet-Guide.pdf

[35] Electric Safety Authority, "Electrical Vehicle Charging Systems." https://esasafe.com/home-renovation-buying-and-selling/ev-charging-systems/

[36] "Electrical Vehicle Charging Systems"

[37] *Fleets for the Future*, 13.

[38] *Fleets for the Future,* 11.

[39] John Kotter and Leonard Schlesinger, "Choosing Strategies for Change," *Harvard Business Review*. https://hbr.org/2008/07/choosing-strategies-for-change

[40] Jessica Torok, "Niagara College Plugs into Local Need, Offers Hybrid and Electric Vehicle Course to Service Technicians," *Inside NC*, September 23, 2019. https://www.niagaracollege.ca/insidenc/2019/09/23/niagara-college-plugs-into-local-need-offers-hybrid-and-electric-vehicle-course-to-service-technicians/