greenWR.org

An organization to promote Green Development Standards

Briefing Book, May 3, 2022

Contents

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Introduction

- **Canada has never met it's Climate Targets.**
- **It is unlikely that Canada will meet our Glasgow targets of 40% to 45% reduction in GHG below 2005 levels by 2030.**
- **It is also unlikely that we will Paris target of net zero GHG emissions by 2050 in order to keep global warming to 1.5 °C above pre-industrial levels.**
- **The Federal Government's 2030 Emissions Reduction Plan is unlikely to be successful since it is heavily dependent Carbon Capture and Storage (CCUS), an unproven technology.**
- **The Provincial Government has no climate action plan and has removed subsidizes on electric vehicles and is increasing the amount of non-renewable energy.**
- **The Region of Waterloo's Official Plan does not include any substantial amount of Net Zero buildings. Furthermore the Official Plan will very likely increase urban sprawl.**

The Ontario Building Code sets the minimum standards for construction to minimize the risk to the health and safety of the occupants of a building and to provide for the barrier-free accessibility into a building and the energy efficiency of that building [1].
The Building Code does not set standards for a healthy and vibrant community.

The Municipal Act, 2001, S.O. 2001, c.25, Section 147 [2], allows local municipalities to set their own standards that go beyond the Ontario Building Code.

> *"The Planning Act provides for municipalities to mandate sustainable urban design through site plan approvals. Municipalities must also consider matters of provincial interest, such as conservation of natural resources, energy and water efficiency, waste minimization, healthy communities, and promoting transit-accessible and pedestrian-friendly development."*
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> *"The Municipal Act allows municipalities to pass environmental protection and conservation by-laws. It also allows municipalities to participate in long-term energy planning for energy use in their community."*

Green Development Standards can be implemented by municipalities to address local concerns such as [3]:

- Maintaining the existing tree canopy
- Enhancing storm water quantity and quality
- Energy efficiency requirements for
- Water conservation requirements for buildings
- Waste minimization
- Protecting and integrating green space
- Promoting compact, mixed–use development

- Integrating access to active and public transportation
- Renewable energy generation and storage
- Access to public parks
- Electric Vehicle charging infrastructure
- Building resilience
- Bird–friendly design
- Pedestrian Infrastructure
- Conserving cultural heritage
- Material re–use and recycling
- Soil quantity and quality
- Connectivity

Green Development Standards

WHAT ARE GREEN DEVELOPMENT STANDARDS?

Green Development Standards (GDS) can be implemented by municipalities to address local concerns such as:

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Terra View Homes – Guelph On

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Clean Air Partnership: Municipal Green Development Standards [4].

BUILDING CODES

The National Building Code of Canada is the recommendation made by the National Research Council and sets the minimum building standards. The National Research Council is in the process of updating the National Building Standard so that all new construction will be Net-Zero by 2030 [5]. Although, the National Building Code has no legal status, it is used to form the provincial building codes.
The Ontario Building Code aligns with about 60% of the National Building Code. Currently it is being updated since the Canada Free Trade Agreement (2017) requires that the Province harmonize with more of the National Building Code [6]. Unfortunately, aligning energy efficiency standards is not required by the Free Trade Agreement and there is no guarantee that Ontario will accept the Net-Zero standard. Indeed, the proposed changes to the Ontario Building Code (2022) make no mention of Net-Zero buildings.

MUNICIPALITIES

Local municipalities are allowed to set their own standards that go beyond the Ontario Building Code.

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> Clean Air Partnership

Toronto implemented a voluntary GDS in 2006 and in 2010 brought in a tiered system with Tier 1 being mandatory and Tier 2 being voluntary. In subsequent years, a third tier was added and the GDS became mandatory for all Tiers in 2022.

Learn about Toronto's Green Development Standards here:
www.toronto.ca/city-government/planning-development/official-plan-guidelines/toronto-green-standard/

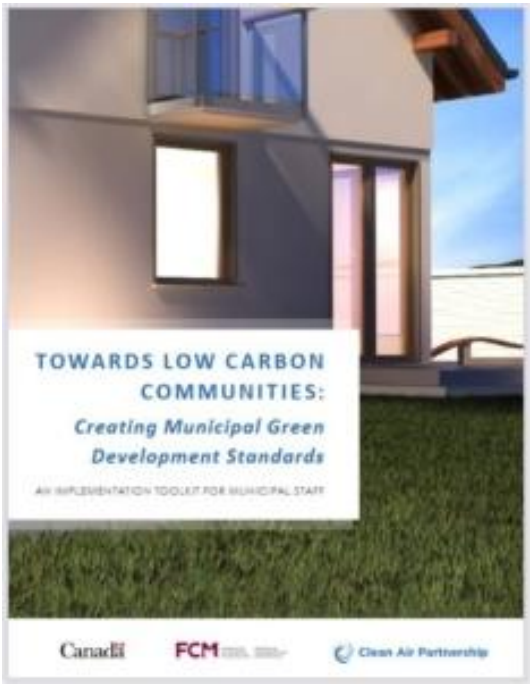
Learn about green buildings and communities in Edmonton here:
www.edmonton.ca/city_government/environmental_stewardship/green-buildings-communities

Existing Green Development Standards

It is not necessary for a municipality to create a Green Development Standard from scratch. There are several other options:

- Require developers and builders to pick from a list of existing standards (eg: Halton Hills, Whitby, Toronto, etc)
- Modify an existing generic standard such as the one developed for the Federation of Canadian Municipalities by the Clean Air Partnership

The Federation of Canadian Municipalities and the Clean Air Partnership's Clean Air Partnership - GDS-toolkit provides a detailed review of existing Green Development Standards in Ontario (page 54) and a framework to develop new plans (page 55).
Appendix A (page 103) has a Low Rise Residential development plan as well as a list of metrics which includes:



- Energy Efficiency
- Energy Management
- Pedestrian Infrastructure
- Green Buildings
- Tree Canopy
- Soil Quantity and Quality
- Natural Heritage
- Parks
- Storm water Management
- Solar Readiness
- Water Conservation

The Green Development Standard is directed towards urban centres and needs additional metrics for rural areas such as:

- Agricultural Nutrient Management
- Flood water protection
- Soil Erosion protection

The Green Development Standards can be incremental but it's important to get started. An approach might be to allow builders to choose from an approved list of existing standards while a local GDS is being developed.

MUNICIPALITIES WITH GREEN DEVELOPMENT STANDARDS

Green Development Standards have been developed and implemented in many communities, including several local municipalities.

- Federation of Canadian Municipalities [7]
- Mississauga [8]
- Municipality of Clarington [9]
- Ottawa [10]
- Toronto [11]
- Vaughan [12]
- Whitby [13]

THE TOWN OF HALTON HILLS

The Town of Halton Hills is a leader in applying Green Development Standards to supplement the Ontario Building code.

- Halton Hills' **Green Development Information Guide** can be found here: [14]
- Halton Hills' **Green Development Standards Study** – Final Report can be found here: [15]
- Halton Hills' **Green Development Standards Checklist** can be found here: [16]

Halton Hills – Checklist

The Checklist is a points-based system where the developer has to achieve a minimum number of points before a development application will be approved. The checklist is divided into 3 main sections: Low Rise Residential, Mid to High Rise, and Low Rise Non-Residential. The main sections are subdivided into different categories depending on the type of development.

Low Rise Residential

Low Rise Residential Green Development Standard Checklist

			Criteria	Points	Rationale	Implementation
Energy Conservation						
Energy Conservation	☐	1	**All ground-related dwellings shall be constructed in accordance with the most current version of Energy Star® requirements in place at the time of Building Permit application.**	**12.0**	By some estimates, 40% of energy use in North America can be attributed to the heating, cooling and maintenance of buildings. Building to the Energy Star® standard enables new homes to be approximately 20% more energy efficient that those built to the minimum requirements of the provincial building code and strikes a balance between the premium level of energy efficiency associated with the Energy Star® label and an acceptable incremental cost. According to Natural Resources Canada, an Energy Star® home reduces greenhouse gas emissions by about three tons per year when compared to a similar home build to the minimum building code. Energy Star homes meet minimum insulation requirements and minimum amounts of electrical savings. Due to their high energy efficiency, Energy Star® homes also reduce air pollution and lessen other environmental impacts such as climate change. Various energy conservation incentives may be available for eligible projects. Applicants are encouraged to investigate the availability of any such incentives, including contacting Halton Hills Hydro and the Ontario Power Authority regarding current incentive programs. Information on the SaveONenergy program for homes that install various energy efficient measures including: prescriptive; performance based; custom and training. Information is available at: https://saveonenergy.ca/Business/Program-Overviews/New-Home-Construction.aspx	Demonstrated at time of: Building Permit Secured by: Subdivision or Site Plan agreement

Low Rise Residential Green Development Standard Checklist 1
Town of Halton Hills

- Energy Conservation
- Water Conservation and Quality
- Community Design
- Air Quality
- Innovation & Green Features
- Waste Management
- Communications

Mid to High Rise:

			Criteria	Points	Rationale	Implementation
Natural Environment						
Natural Environment	☐	1	**Use low-maintenance, drought resistant, non-invasive plant material native to Halton Region for a minimum of 50% of the landscaped areas (including vegetated roofs).**	**2.0**	Reduces the demand for potable water which can increase by as much as 50% during the summer months placing a strain on potable water systems. For a list of native species refer to Conservation Halton Landscaping and Tree Preservation Guide Appendix 1 found at http://www.conservationhalton.on.ca/ShowCategory.cfm?subCatID=898 or the Credit Valley Conservation Plant Selection Guideline Document found at: www.creditvalleyca.ca/wp-content/uploads/2013/04/Credit-Valley-Conservation-Plant-Selection-Guideline-FINAL-March-2013-_2_.pdf	Demonstrated at time of: Site Plan approval Secured by: Site Plan agreement
	☐	2	**Plant a minimum of 1 tree native to Halton Region for every 30 sq metres of post development site area covered by soft landscaping or for a constrained site, plant some of the trees in nearby public open spaces.**	**2.0**	This enhances the urban forest which provides shade to reduce the heat island effect, cleans the air by filtering some air born pollutants, provides oxygen, and improves slope stability through their root base.	Demonstrated at time of: Site Plan approval Secured by: Site Plan agreement
	☐	3	**Provide triple the typical tree pit size of high quality soil per tree with a minimum depth of 0.8 m.**	**1.0**	This helps to ensure that planted trees survive and thrive which increases the tree canopy in order to improve the environment and the streetscape. High quality soil is well drained, un-compacted soil comprised of 5 to 15 % organic material with a pH level of 6.0 to 8.0.	Demonstrated at time of: Site Plan approval Secured by: Site Plan agreement

Mid to High Rise Green Development Standard Checklist
Town of Halton Hills

10

- Energy Conservation
- Water Conservation and Quality
- Transportation
- Air Quality
- Natural Environment
- Innovation & Green Features
- Waste Management
- Communications

Low Rise Non-Residential:

			Criteria	Points	Rationale	Implementation
Waste Management						
Waste Management	☐	1	**Ensure that a least 5% of a project's materials (based on value) comprise salvaged, refurbished or reused materials.**	**1.0**	This will decrease the amount of construction material generated and maximize the recycling of non-hazardous construction and demolition debris.	Demonstrated at time of: Building permit Secured by: Site Plan agreement
	☐	2	**Ensure that at least 15% of a project's construction materials (based on value) comprise recycled content.**	**1.0**	This reduces the demand for virgin materials and therefore the environmental impacts associated with their extraction, processing, manufacturing and transportation.	Demonstrated at time of: Building permit Secured by: Site Plan agreement
	☐	3	**Where wood based materials and products are used, utilize a minimum of 25% that are certified in accordance with the Forest Stewardship Council's principles and criteria for wood building components.**	**2.0**	The Forest Stewardship's Council ensures sustainable harvesting and replanting practices.	Demonstrated at time of: Building permit Secured by: Site Plan agreement
	Maximum Possible Points In Waste Management			**4.0**		

Low Rise Non-Residential Green Development Standard Checklist
Town of Halton Hills

11

- Energy Conservation
- Water Conservation and Quality
- Transportation
- Air Quality
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These checklists were developed for the Town of Halton Hills and rural communities will have different criteria for green development. For example, for Community Design, a substantial number of points would be given for infilling and intensification in order to preserve farmland.

Retrofit Buildings

Green Development Standards are typically focused on new buildings and how they affect the community, but the standards can be applied to retrofits. The Ken Sobel Passivhaus in Hamilton was built in 1967 and was in a state of disrepair. Options included demolition or repair however, the owner decided to retrofit the building [17].

The cost to demolish and rebuild a similar structure was estimated to be between $45 and $50 million. The retrofit of the building cost less than $25 million. There was very little landfill and very little embodied carbon compared to a demolition and new construction.
The upgraded building emits less than 94% of the GHG of the original building.
There are 145 units and each unit can be heated with the equivalent of three 100 watt incandescent light bulbs.

Tower in Ontario becomes world's tallest retrofitted Passivhaus structure

There are 2,000 similar structures in Toronto with more than 1 million inhabitants that could be similarly upgraded to meet to Passivhaus Standards [18].

PASSIVE HOUSE

Passive Houses (or PassivHaus) are not Net-Zero, but because of the design, GHG emissions are substantially reduced. Passive House designs can be for new or renovated construction, and can be for single family, townhouse or multi use residential buildings, as well as buildings like the Ken Sobel Tower.
Passive House Building Certification is an international building certification program. In Canada, it is administered by Passive House Canada [19].
For more information on Passive House design see [20].

Ken Soble tower is the tallest retrofitted Passivehaus in the world. Photo by Codrin Talaba

EMPIRE STATE BUILDING, NEY YORK

The Empire State Building has reduced its carbon emissions by 50% [21]. The goal is to be Net-Zero by 2030.

New York Post - Getty Images

The retrofit cost $13.4 million (US) and saved $4.4 million in energy costs in the first 3 years. The retrofit was the result of Local Law 97 which mandates New York's largest buildings cut their emissions by 40% by 2030 and 80% by 2050. Non compliance can result in fine of $1 million per year [22].

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Terra View Homes – Guelph On

- Material re–use and recycling
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Clean Air Partnership: Municipal Green Development Standards [23].

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Embodied, Emitted and Committed Carbon

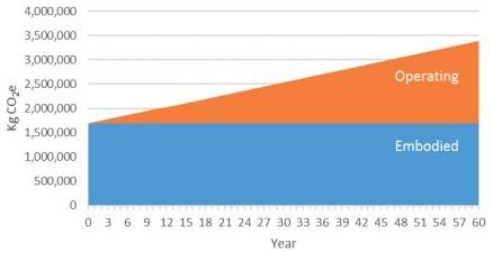
There are 2 classification of Carbon Dioxide Equivalent (CO2e) emissions: embodied and emitted. There is also committed carbon, which is the carbon that will be released if a project is approved. It's important to distinguish, and measure, the various types in order to develop an effective action plan.

Embodied carbon is usually not included in the CO2e of imported items which is problematic because it encourages outsourcing manufacturing to countries with poor environmental standards.

Committed carbon means that purchasing decisions made today have a long lasting effect on climate change and efforts to mitigate the effects of CO2e emissions.

EMBODIED CARBON IN BUILDINGS

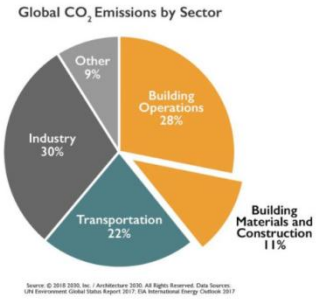
Embodied carbon (also known as upfront carbon) is the CO2e released during the manufacturing or construction process of an item and includes the production and transportation of the raw materials and sub assemblies, as well as the CO2e released due to warehousing, marketing and demolition or disposal. This is the carbon footprint before the item becomes operational.



This image from The Atmospheric Fund, shows the carbon in a typical 5 story apartment in Vancouver. It takes 60 years for the carbon emitted by heating and cooling the building to exceed the carbon emitted in the construction of the building [26].

It's difficult to measure the actual ratio between embodied and operating CO2e but embodied carbon will become a larger percentage of total building emissions as the operating emissions decrease.

As operating carbon is reduced because of Net-Zero or Passive House construction, the impact of embodied carbon becomes greater. Embodied carbon from current construction practices are about 50% of the total GHG emissions over a 30 year period. In Net-Zero construction, because the operating carbon emissions are sp low, the embodied carbon is about 90% of the total GHG emissions over 30 years [27].



About 40% of all carbon emissions come from the building sector [28]. Approximately 50% comes from embodied carbon and the majority of that comes from concrete [29].

A typical house has somewhere between 25 and 60 tonnes of embodied carbon [30].

For reference, using the low estimate of 25 tonnes of CO2e per unit, a sub-division such as the proposed Cachet Development in Baden would have about 12,500 tonnes of embodied CO2e just for the residential units. It's difficult to estimate the amount of embedded carbon in the office buildings but one study shows that embodied carbon is about 116 kg per square metre [31]. The proposed office space was 66,426 square meters, therefore the embodied carbon would have been an additional 7,700 tonnes for a total of 20,200 tonnes of CO2e.

EMITTED CARBON IN BUILDINGS

The average Canadian home heated with natural gas uses 88.4 gigajoules per year [32] and emits 4.9 tonnes of CO2e annually [33]. If heated with renewable energy and heat pumps, the CO2e emissions would be essentially zero.

COMMITTED CARON IN BUILDINGS

The embodied carbon in buildings must be reduced significantly. Municipalities must establish a carbon budget and all application for building permits must include both the embodied carbon and the operating carbon.

Embodies carbon in buildings can be reduced by [34]:

- renovating instead of demolition
- use low carbon concrete
- limit carbon intensive materials (aluminum, plastic and foam)
- use carbon sequestered material (wood frame construction)
- use recycled material (steel rebar)
- building design to minimize waste.

Emitted carbon can be reduced by:

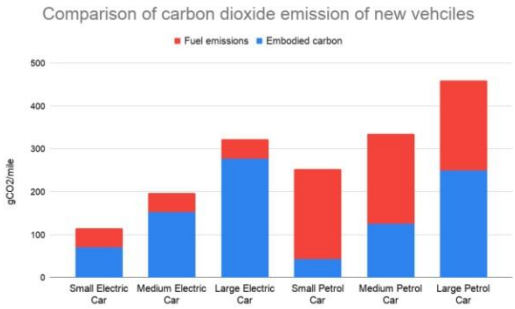
- Net-Zero certification

- Banning of natural gas.

ELECTRIC VEHICLES

Transportation accounts for 25% of Canada's GHG and about half comes from cars and light duty trucks. As of February 4, 2022, the Federal Government has mandated that 100% of all cars and light trucks be electric by 2035 [35].

EMBODIED CARBON IN VEHICLES



The manufacturing of a small car releases 6 to 8.5 tonnes of CO2e, a medium size car releases 17 tonnes of CO2e, and a large car releases 35 tonnes of CO2e [36].

The manufacturing of a small electric car, including the battery, releases 14 tonnes of CO2e [37].

The embodied carbon of an electric car is almost twice that of a comparable gasoline powered car, however, the operating carbon is significantly less.

EMITTED CARBON IN VEHICLES

The average gasoline powered car in Canada emits about 206 grams of CO2e per kilometre [38].

In Canada, a car is driven on average 15,200 km per year [39] and releases about 3.1 tonnes of CO2e per year. Over the 13 year lifetime of a typical Canadian car, this amounts to 40 tonnes. The total CO2e, including both the manufacturing and operation of a small car over its life is approximately 50 tonnes. An average sized car will emit about 46 tonnes of CO2 over its life.

A small electric car has a larger embodied carbon footprint but, if charged with renewable energy, the emitted carbon is essentially zero. However, renewable energy has its own embodied carbon (about 20 to 30 grams CO2/kWh) [40]. A small electric car gets 6.5 km per kWh, and uses 2,340 kWh per year. 0.07 tonnes of CO2e is released each year and over the 13 year life of an electric car, the total embodied and emitted CO2e is 14.9 tonnes, 37% of the carbon released by an equivalent gasoline car.

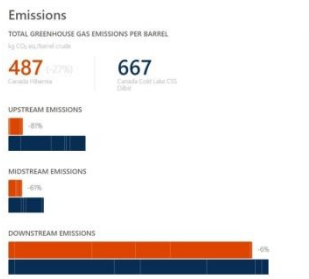
COMMITTED CARBON

If you purchase an average size car today, you are committing to the release of 46 tonnes of CO2e. If you purchase an electric vehicle today, you are committing to release 15 tonnes of CO2e.

The Federal Government has *"has set a mandatory target for all new light-duty cars and passenger trucks to be zero-emission by 2035"* [41]. Currently, there is a limited supply of electric vehicles but this will improve in the near future. Electric vehicles are also expensive but the price will come down as volumes increase. The Federal Government has a $5,000 subsidy for the purchase of an electric vehicle. The current Provincial Government has removed its subsidy on electric vehicles.

Bay du Nord

Bay du Nord is an example of why embodied and committed carbon needs to be examined before approving a project. The Federal Government ignored the original forecast that the approval of the oil field would cause the release of 130 MT of carbon in the future [42] and claimed that oil would be clean. The extraction may be cleaner than tar sand oil but the problem is the downstream emissions when the oil is burnt.



It is now estimated that 400 MT of carbon will be released from this oil field [43].

Committed carbon must be included in any plans to reduce GHG emissions.

Electric Vehicles

Federal Mandate

Transportation accounts for 25% of Canada's GHG and about half comes from cars and light duty trucks. As of February 4, 2022, the Federal Government has mandated that 100% of all cars and light trucks be electric by 2035 [44].

Embodied Carbon

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Embodied carbon is usually not included in the CO2e of imported items which is problematic because it encourages outsourcing manufacturing to countries with poor environmental standards.

EV Charging

There are several ways to charge an EV. All cars have an onboard charger which limits how fast the car can be charged. Cars plug into a device called an Electric Vehicle Supply Equipment (EVSE). The EVSE controls the current available to the onboard charger as well as providing safety lockout fault detection and scheduling. All cars can use Level 1 and Level 2 charging systems. Some EVs can use Level 3 chargers and Telsa cars can use Superchargers.

Level 1 Charging

Level 1 chargers use a standard 120 volt AC household connection and a cable that usually comes with the car.

The cable has a standard SAE J1772 plug (also known as the J Plug) on the car end and a standard 120 volt plug on the other.

The EVSE is built into the cable to provide over current protection.

Level 1 chargers can charge at a rate of 7 to 12 km per hour depending on the car.

Level 2 Charging

Level 2 charging uses 240 volts AC and also requires an EVSE. The EVSE are normally residential units but they can be found at public charging locations.

As well as wall mounted EVSE devices, portable devices that plug into standard 220 volt outlet (dryer outlet) are also available. In either case, the cable plugs into the car with a standard J plug.

Wall mounted Level 2 ESVS can charge at a rate of 35 to 60 km per hour depending on the amperage of the onboard charger. There are several versions of the Level 2 ESVE that can supply either 40 amps, 48 amps or 80 amps [46]. The portable units are limited to approximately 30 amps.

Wall mounted Level 2 EVSE normally have a Bluetooth, Wi-Fi, or Ethernet connection to allow for off-peak scheduling and remote battery monitoring.

Level 3 chargers (also known as fast chargers) use 480 volts DC and the EVSE are considered gas station replacements.

Level 3 chargers can charge at the rate of 5 to 30 km per **minute (**300 to 1,800 km per hour).

Level 3 chargers can charge most cars to 80% battery capacity in an hour.

There are 3 types of plugs used for Level 3:

- CHAdeMO used by most Asian cars
- SAE-Combo used by most North American and European cars
- Tesla have their own plug.

Most Level 3 EVSE have both SAE-Combo and CHAdeMO plugs. Adapter cables are available.

Tesla Superchargers EVSE only work with Tesla cars. Charging rates vary: Model 3 282 km in 15 minutes, Model Y 525 km in 30 minutes.

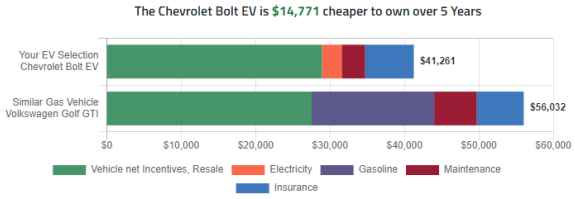
Charging Times [47]

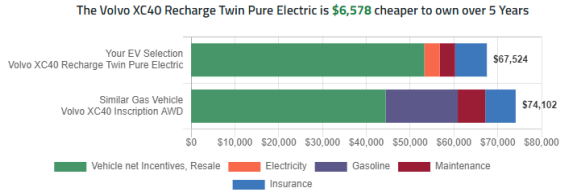
Car	Range	Level 1	Level 2	Level 3
Hyundai IONIQ	274	35.5 hrs	6 hrs	54 min
Chevy Bolt	417	66 hrs	9.9 hrs	77 min
Nissan Leaf	240	30 hrs	8 hrs	40 min
Volvo XC40	359	40 hrs	8-10 hrs	50 min

For current information on electric vehicles available in Ontario, see https://ev.plugndrive.ca/

COST OF EV'S

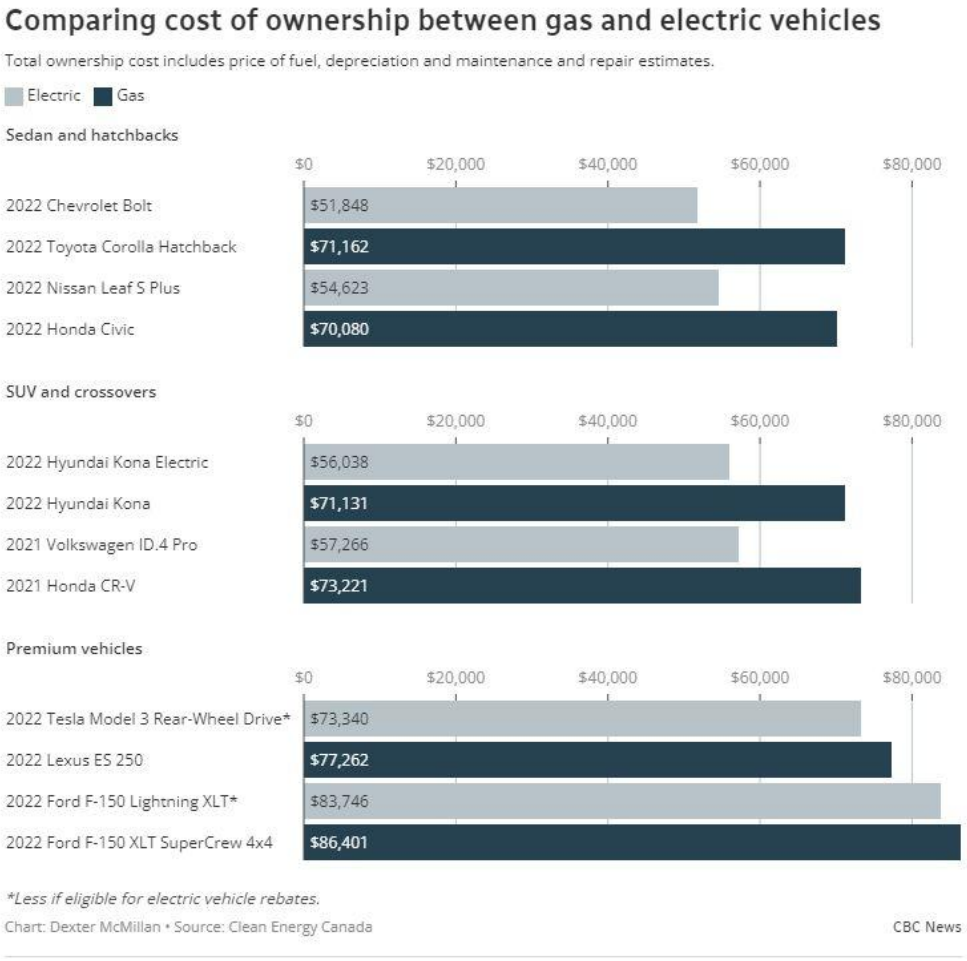
The purchase cost of EV's is significantly higher than gasoline powered cars, however, if the cost of fuel is included in the total cost, the actual cost to own an EV for 5 years is comparable to owning a gasoline car [48].

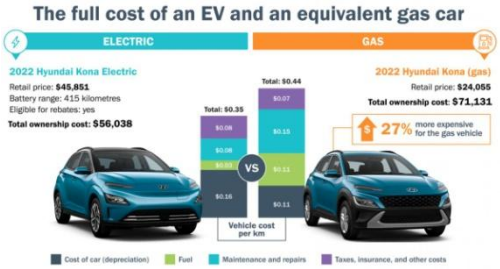




The examples from Plug 'N Drive shows the comparative cost of several cars. The comparison includes the Federal subsidy of $5,000 for Zero-Emissions Vehicles [49].

These comparisons assume that there will be little or no re-sale value for a used gasoline car in 5 years.





For an analysis of the cost of owning an electric car, see the Clean Energy Canada report "The True Cost" [50].

The price of gasoline and the cost of owning a gasoline car will increase as the tar sands producers are forced to clean up their industry and as the carbon tax increases.

[1] http://wWw4.oboa.on.ca/ibswmaster/BuildingCode.pdf
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