

CHARGE MY CAR

"GETTING YOUR HOME READY FOR YOUR ELECTRIC CAR IS AS EASY AS 1...2...3"

JUNE 2014



Plug'n Drive is grateful for the support of the LDC Tomorrow Fund and the Mearie Group for CHARGE MY CAR, a program that is helping EV owners get connected with charging stations for their electric cars.

With the help of the LDC Tomorrow Fund and its LDC partners, Plug'n Drive has been able to expand the reach of Charge My Car across Ontario, through events, a website, on-line store and through the use of social media. The service provides consumers with Canada's largest selection of charging stations and exceptional customer service. We have simplified the process of choosing and installing a charging station, ensuring that customers use a licensed electrical contractor and are connected with their local utility.

Plug'n Drive has also been able to greatly expand its research capabilities, providing increasingly accurate information to consumers to break down barriers to adoption of EVs. Some of the highlights of how the LDC Tomorrow Fund's support of Charge My Car has assisted us include:

- Engaging in more than 40,000+ conversations and providing 2,000+ test drives at 150+ events in 20+ communities across Ontario. At every event Charge My Car has been promoted;
- Deploying a marketing strategy to reach customers across multiple platforms leading to nearly 100 charging station sales;
- Launching the Charge My Car Network of OCPP¹ compliant 'public' charging stations with a phone based payment system;
- Assisting condominium residents, boards and property managers to enable EV charging in condos;
- Meeting with the LDC partners to determine their needs and work with them to develop a plan to advance EV adoption in their territory;
- Working to assist auto dealers and sales staff improve the sales process; and
- Launching the EV Dealership Awards in collaboration with the Canadian Electricity Association.

As of June 2014, there are more than 7,060 electric cars in Canada and approximately 2,500 in Ontario and the industry is continuing to expand. With more than 15 electric car models available from 9 manufacturers, consumer choice has never been better and we believe we are on the cusp of a significant transformation in the automotive industry toward more sustainable transportation.

The report enclosed summarizes Plug'n Drive's efforts to accelerate EV adoption through its Charge My Car partnership. Thanks again for your support.

Sincerely,



Cara Clairman

¹ OCPP – Open Charge Point Protocol

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Plug'n Drive

Plug'n Drive is accelerating the adoption of electric vehicles (EVs) in order to maximize their environmental and economic benefits for Ontarians. We accomplish our goals by educating consumers and deploying the EV charging infrastructure at home and on the road.

Plug'n Drive began as an internal project of Ontario Power Generation in 2008 and became an independent non-profit organization in June 2011. Over the past three years, Plug'n Drive has established itself as the primary trusted source of unbiased information on electric cars, charging stations and the benefits of these technologies to the consumer and the Province.

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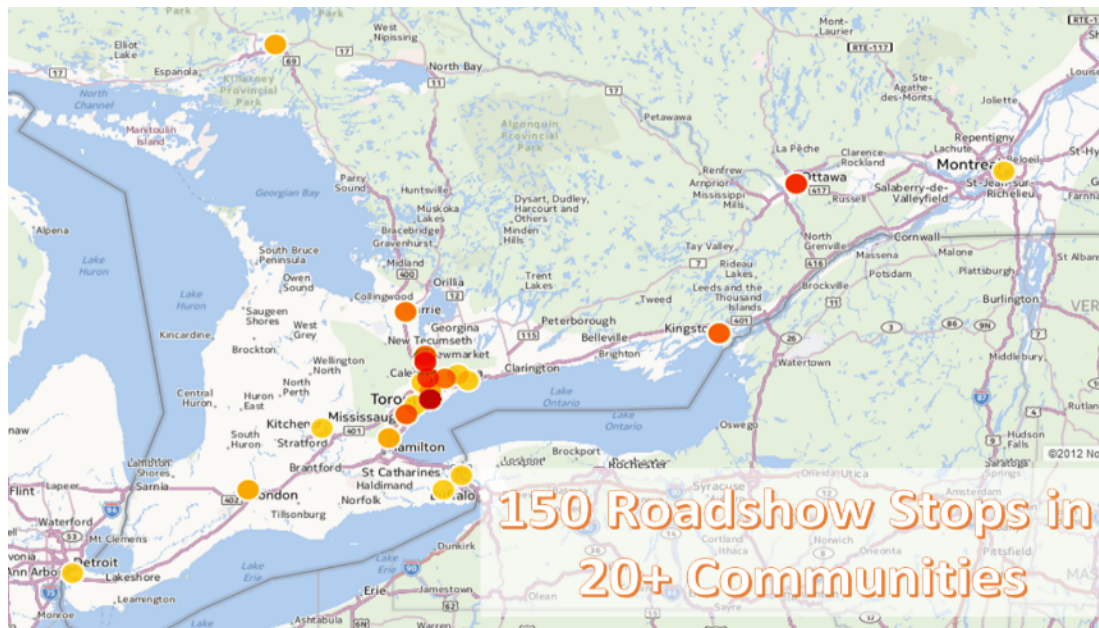
Plug'n Drive's EV Roadshow

Since 2011, Plug'n Drive has been engaging consumers, businesses and governments about the economic and environmental benefits of electric cars. Through the 'EV Road Show', Plug'n Drive has travelled to over 150 events across 20+ communities across Ontario, engaging in more than 40,000 conversations and delivering more than 2,000 test drives.

In order to maximize the reach of the EV 'Road Show', Plug'n Drive engages both the consumer/public and corporate sectors. This dual approach helps create a supportive ecosystem for drivers where they live, work and play. The stops on the 'EV Road Show' are carefully chosen to reach Canada's potential EV buying demographic (\$100k+ median income; aged 30-55; environmentally conscious and tech-savvy, highly educated and professionally trained).

Some of the highlights of the Roadshow have included:

- 3rd Annual EV Day happened in Toronto on May 24, 2014 and has expanded for the first time into Guelph (June 21) and Hamilton (July 27) this year. Future EV days are planned for Burlington, London, Ottawa and Kingston. www.evday.ca;
- Primary source of EV information at the Canadian International Auto Show, Ottawa Auto Show & Green Living Show;
- Partnership with the Association of Power Producers of Ontario (APPRO); and
- EV lunch and learn and test drive programs at corporate head offices (in partnership with Smart Commute and WWF).





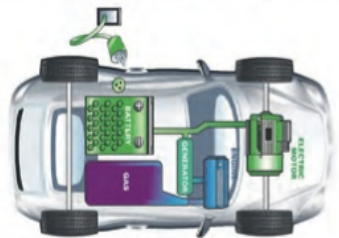
Electric Vehicles

An electric car or electric vehicle (EV) is powered by electricity stored in batteries and charged on the electrical grid. Some EVs are fully electric and use no gas, while others have a more limited electric mode and rely on a gas engine after the batteries are depleted. Below you will find a brief overview of the different EV technologies and how they compare to hybrid vehicles.



Battery Electric Vehicle (BEV or EV) or Fully Electric

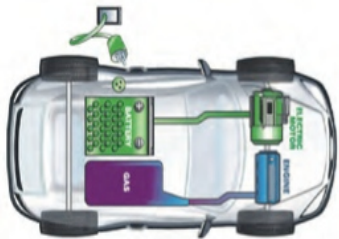
Powered entirely by a lithium-ion battery pack, BEVs produce no tailpipe emissions and very little noise pollution. Models available include: BMW i3, Chevy Spark, Ford Focus EV and, Mitsubishi i-MiEV, Nissan LEAF, Tesla Model S, smart fortwo EV and more to be released.



Series PHEV or Extended Range Electric Vehicle (EREV)

These vehicles are driven by an electric motor, powered by either a battery pack or the internal combustion engine and generator. Overall range is extended, but with higher emissions and driving costs.

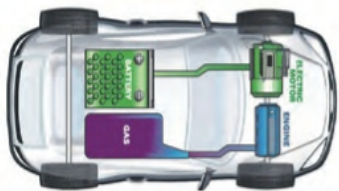
Models available include: Cadillac ELR, Chevy Volt, Porsche Panamera S E-Hybrid



Parallel PHEV

Essentially a hybrid vehicle that can charge its battery pack from the electrical grid, they run 'all-electric' for a given distance or speed before the ICE is initiated.

Models available include: Ford C-Max Energi, Ford Fusion Energi and Toyota Prius Plug-in

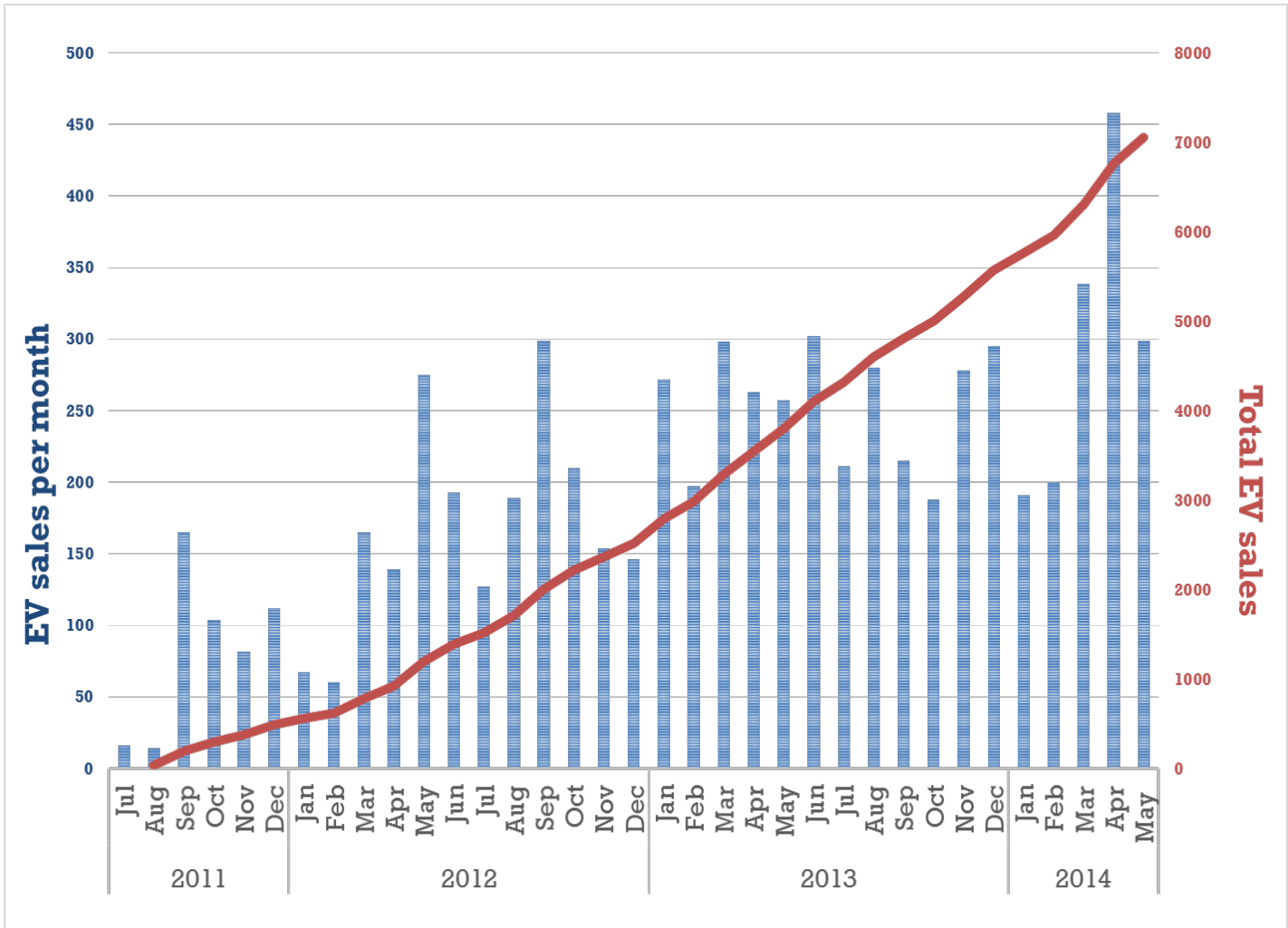


Hybrid Electric Vehicle

Technology advances and consumer adoption of hybrids has made the electric vehicle industry possible today. The first hybrid, the Prius was launched in 1997 and today nearly every manufacturer has a hybrid model available for sale.

Sales of EVs in Canada

There are approximately 7,060+ electric cars in Canada, with sales growing at a steady and growing rate. In general, as more manufacturers release electric cars models, consumer interest is increasing and sales will continue to climb.



Projected Sales

Plug'n Drive estimates that the 10,000th electric car will be sold in 2014 and Pike Research estimates 100,000 on Canadian roads by 2020. Estimates are difficult to make as right now they are strongly influenced by rebates and incentives provided in certain provinces.

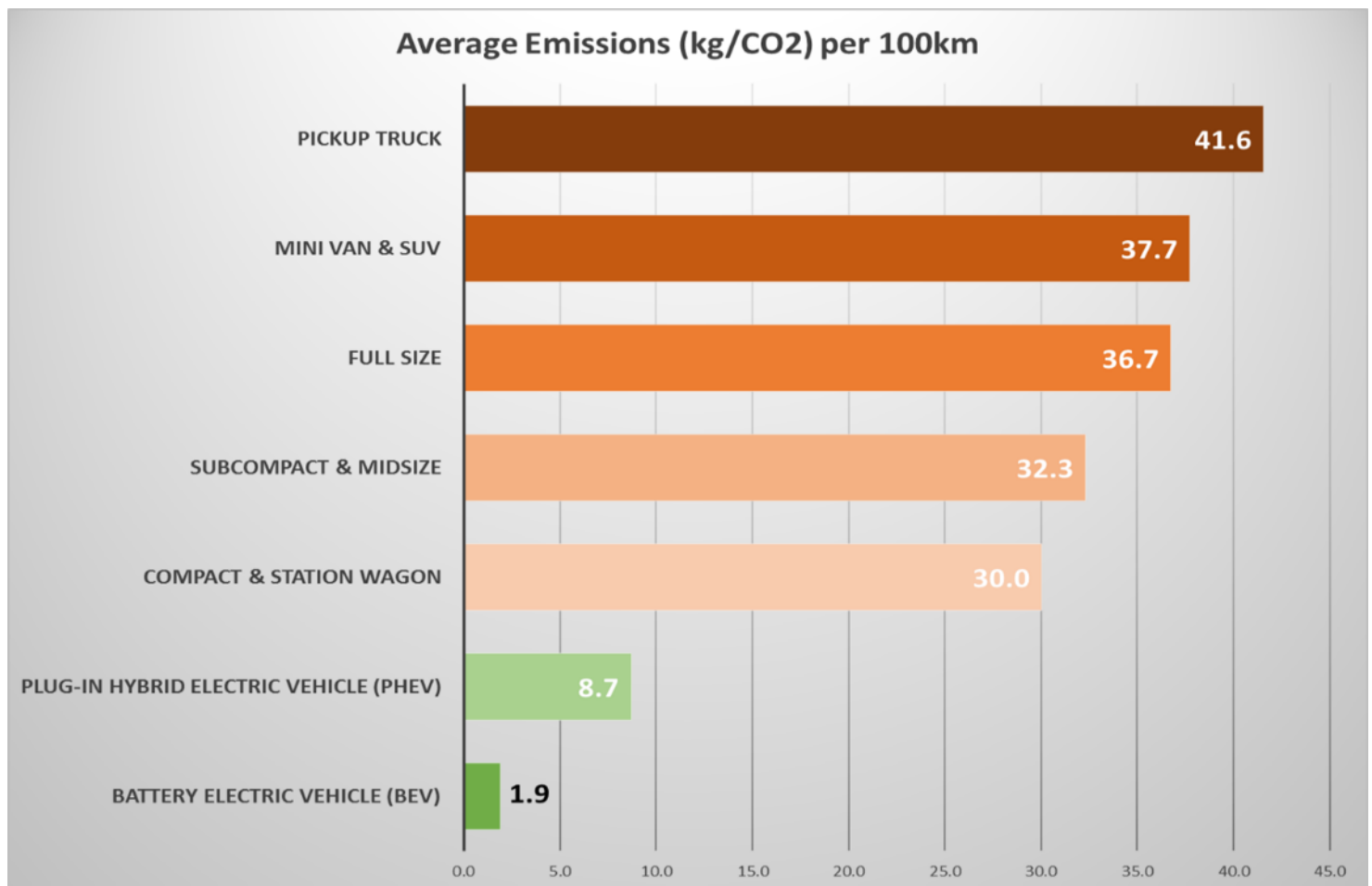
The Benefits of Electric Cars

Environmental Benefits

Transportation is Ontario's largest source of CO₂ emissions (31%) and one of the largest sources across the country. The 7.6 million cars (light duty vehicles) registered in the province use more than 16 billion litres of gasoline and emit 37+ million tonnes of CO₂ each year. In addition, they are responsible for 13% of volatile organic compounds (VOCs) and 27% of nitrogen oxides (NOx) released in the Province. (Source: Ministry of Energy and Statcan)

- Charging an EV emits about **90% less CO₂** than a comparable gas car in Ontario charging off peak, and even less VOCs and NOx.
- One litre of gasoline emits about 2.35kg of CO₂
- One kilowatt hour (kWh) of electricity generation emits 82 grams of CO₂ in Ontario – based on lifecycle analysis of generation sources by Plug'n Drive in accordance with the United Nations Intergovernmental Panel on Climate Change (ICPP) standards.

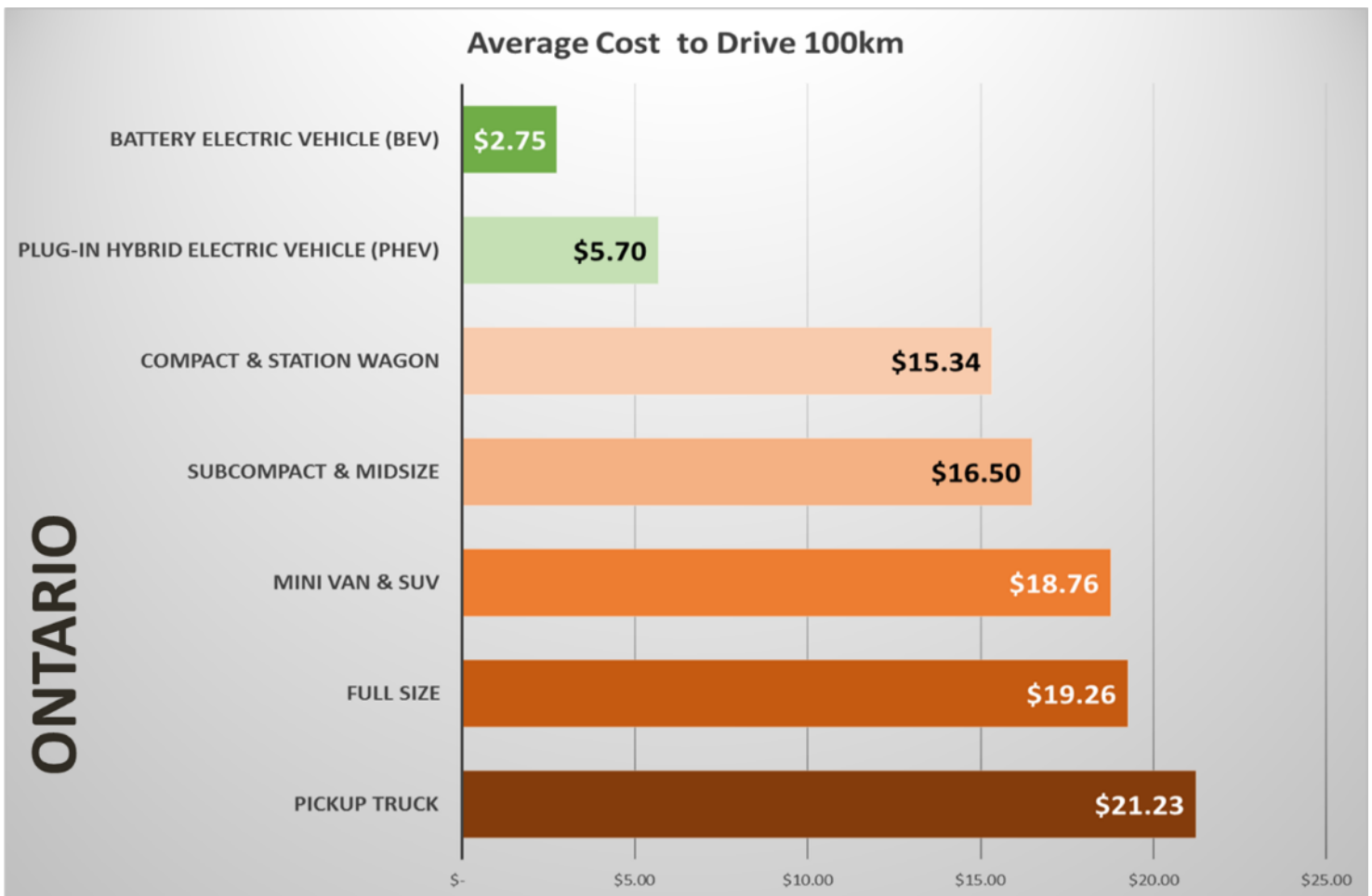
Below is a chart summarizing the emissions from gasoline and/or electricity generation required to drive 100km:



Economic Benefits

Operating an electric car costs about 1/6th as much as operating a gas car though this depends on the car model, driving patterns and when the car is charged. Consumers are incented to charge their vehicles at home during off-peak periods when prices are lowest and there is surplus base load generation.

Electricity is locally made. This means that by purchasing it you are investing in Ontario's electrical grid and Ontario's workers. In addition, the Province of Ontario offers rebates on electric vehicles and charging stations in order to further reduce barriers to adoption.



Other considerations:

- Electric cars require less maintenance; they don't need spark plugs, oil changes, air filters, transmission fluid, coolant flushes or exhaust. Also, many insurance companies offer reduced rates on electric vehicles, a telling sign of their reduced maintenance costs and high safety ratings.
- In the future, Plug'n Drive is working to develop a more comprehensive tool for estimating the overall cost of ownership in order to inform future car buying decisions for consumers and fleets.

Charging Stations

Every electric car needs a charging station, or at least an electrical outlet, whether at home, at work or on the road. The term 'charging station' is a misleading term for the equipment that provides electricity to the car; it's more of an intelligent extension cord communicating with the car to manage the charging session and provide power. The actual 'charger' is located in the car and this determines the actual draw of the vehicle, which varies by make and model from 2 kW to 20kW.

Level 1 (110v, 12-15a)

All electric cars come equipped with a portable charging station (cord-set) that is found in the trunk. These cord-sets are equipped with a three-prong household outlet (NEMA 5-15) and can be ideal for PHEVs but is typically not an ideal permanent solution for BEV owners.

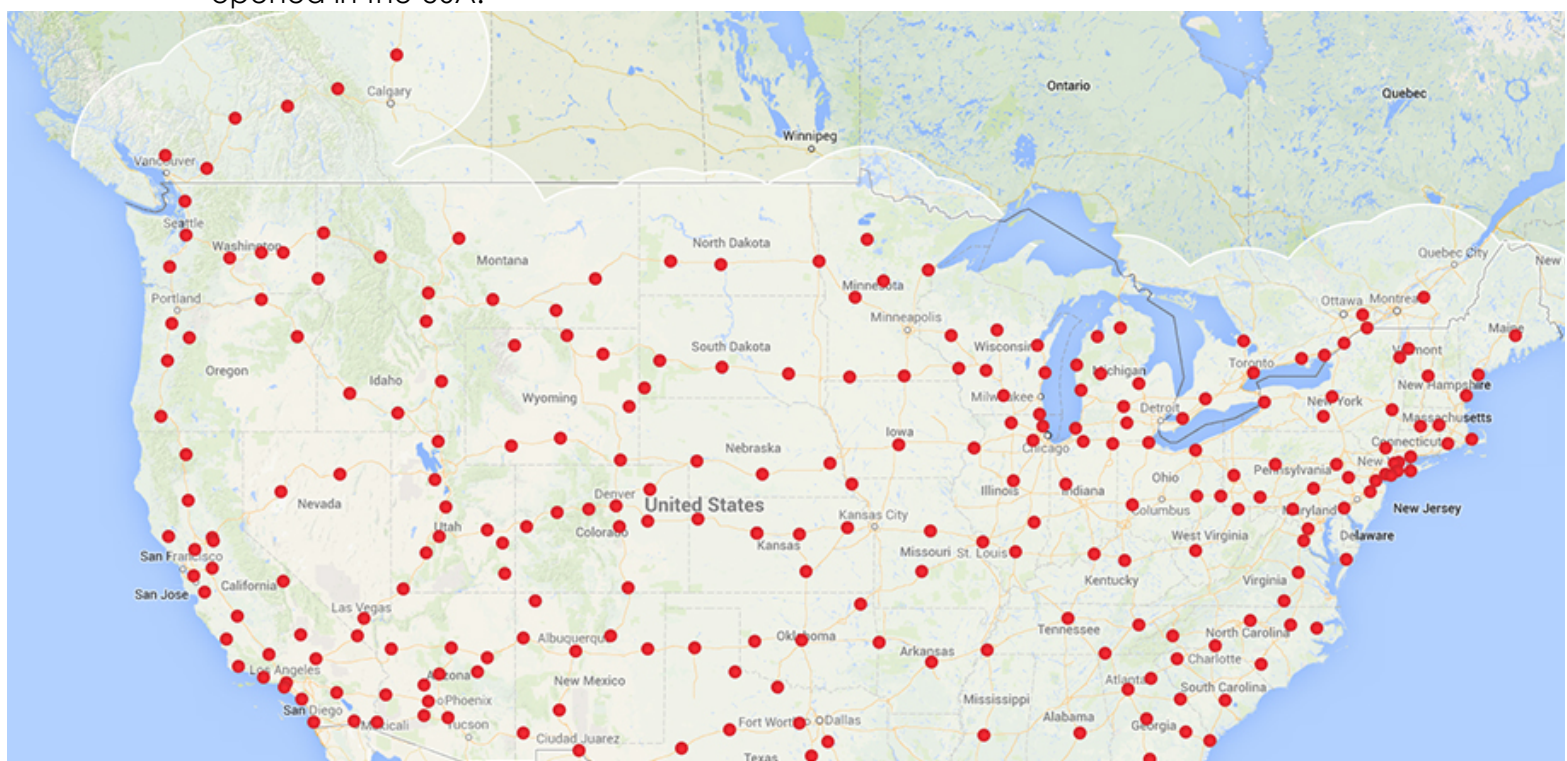
Level 2 (208-240v, 16-100a)

A 240v outlet is similar to the outlet used for a stove or dryer. Charge times are reduced for EVs when provided with a 30amp station, providing 5.7kW energy to the car's internal charger. The Tesla Model S has an optional internal charger that can draw up to 20kW via a 100amp station.

DC Quick Chargers (480v) & Tesla Super Chargers

These units are large and can provide up to 50kW directly to the battery of the car, these stations can charge a vehicle to 4/5th capacity in about 20 minutes. The market is still developing for these commercial stations and their eventual deployment will be important for the continued growth of the EV industry by enabling long distance driving.

Below is a map of Tesla's projected Super Charger deployment by 2015, with each dot representing the location of multiple Super Charger stations, including as many as 10 in Ontario and 17 across Canada. Already more than 97 have opened in the USA.

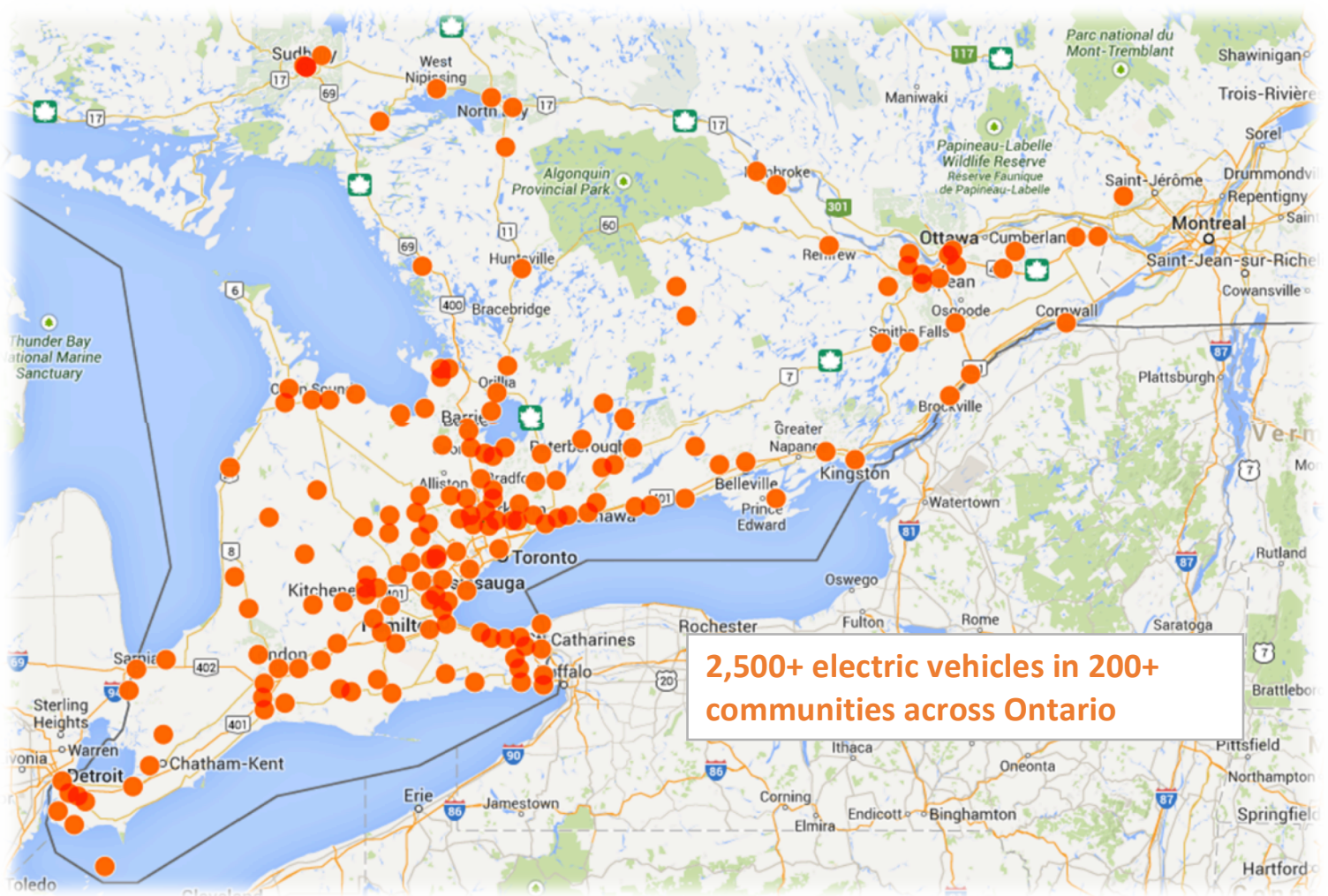


Home Charging

Experience from Ontario and other jurisdictions has illustrated that approximately 80% of charging happens at home where it is convenient for owners. They are of course encouraged to charge their cars during off peak periods when prices are lowered and emission from generation tends to be lower. Further work is needed to understand Canadian EV charging/driving patterns but it is expected to be similar to the pattern identified in jurisdictions across the USA.

Plug'n Drive is developing an EV Owners Club, an opportunity to engage EV owners and develop market research based on their experiences. This will also provide an addition avenue to connect EV owners with their local utility partner.

The map below illustrates municipalities where EV owners have registered with the Ministry of Transportation for a vehicle incentive. It is evident that consumer interest is strong across the Province, particularly in the Greater Toronto Area and in Ottawa but it should be noted that EV owners can be found across the Province, including North Bay and beyond.



Charge My Car is a partnership between Plug'n Drive and 14 local distribution utility partners, providing a one-stop-shop for Ontarians interested in electric cars and charging stations. Via website, social media, 1-855 number and online, customers are helped through the process of obtaining and installing a home charger.

The service provides customers with answers to their questions in a pressure free environment. Free advice is complimented by a large selection of chargers in a variety of configurations. Dealership sales staff are not trained on the nuances of EV charging and competing online retailers such as Amazon or Home Depot offer limited selection and lack the customer service expertise capabilities. Plug'n Drive also works with the customer to ensure that they work with a certified electrical contractor and have the opportunity to connect to their contact with their local utility partner, keeping the LDC in the loop on the expansion of the EV market in their territory.

Visit chargemycar.ca or call 1-855-3PLUGIN

1. **Choose** from Canada's largest selection of CSA approved charging stations
2. **Buy** a charger online through our secure store

Charge My Car Partners:



Charge My Car was made possible with the support of an initial group of eight utilities and the Ontario Centres of Excellence through their Social Innovation Program. With the assistance of the LDC Tomorrow Fund, the program was expanded and programming developed to reach customers in new communities and provide regional expertise through new partnerships. These contributions allowed for the development of a new website, online store, research and the deployment of a marketing strategy to increase sales. The contributions of the Charge My Car partners are recognized on all literature and online as well as in slide decks and other promotional activities.

LDC Benefit

This partnership with the LDC community enables Plug'n Drive to leverage its expertise in electric vehicles and provide its LDC partners with a variety of benefits, including:

- PND provides a customer service role to assist with customer inquiries;
- LDC partners are involved in the process and have access to the location of EV installations (with customer permission), allowing for grid impact intelligence;
- Enables the LDCs to engage with EV owners and explore future opportunities;
- Helps ensure that installations comply with ESA standards and are installed by a licensed electrical contractor

The electricity sector as a whole benefits from having increased intelligence about electric vehicle penetration, driving habits, charging locations and charging patterns. This information can enable better management of the grid and supporting infrastructure. It is important for the LDC to have information about EV charging as they represent a significant draw of electricity.. Each model of electric car has different specifications but in general, they draw 2-20kW continuously through the charging station.

Apartments/Condominiums and Townhouses

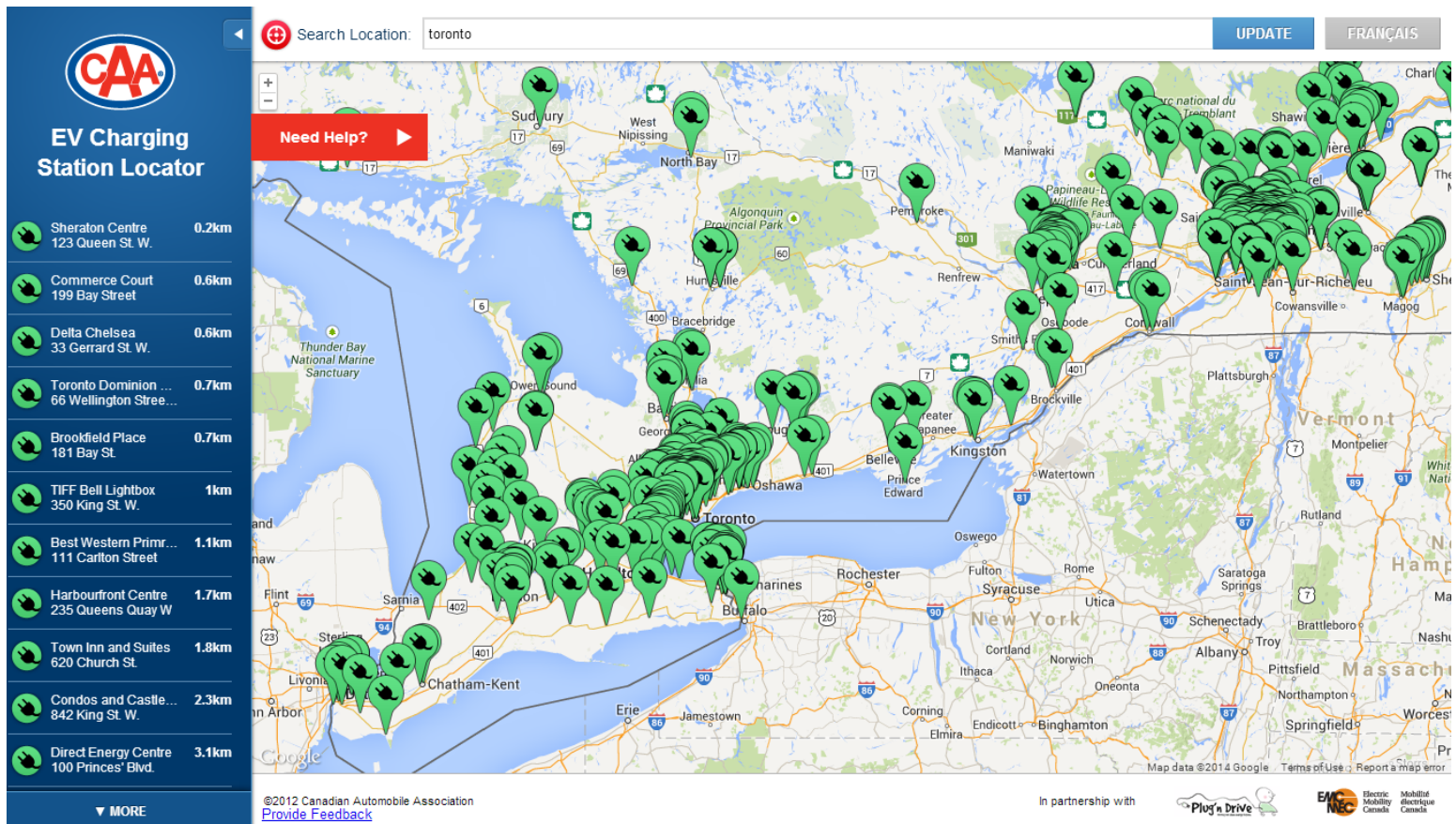
Nearly 50 percent of new home construction in Ontario is now in the form of multi-dwelling units, be they apartments, condos or townhouses. It is increasingly important that efforts be made to help residents of these buildings through the process of getting charging stations installed, as the condo board and property management communities are not coordinated or as knowledgeable with regard to this new technology. Installation costs in underground parking garages can be much more expensive than single family home installations and the shared services model in most condominiums is a barrier to EV adoption.

By visiting plugndrive.ca/condo, consumers are provided with the latest information about EV charging in condominiums. A significant effort has been made to address the legal and logistical barriers through consultation with industry stakeholders, including EV owners, condo owners and board members, property managers, lawyers and electricians. This work on condos was done in cooperation with Canadian Condominium Institute and WWF Canada with support provided by the Automotive Recyclers of Canada.

Public Charging

The availability of public charging stations will have a tremendous impact on the adoption of electric cars as drivers look to extend their trips and reduce *range anxiety*. While there are more than 350+ charging locations and 400+ stations across the Province, they are mostly at dealers and in parking lots of organizations looking to differentiate themselves from their competitors and attract good customers.

In order to help make it easier to find a charging station, Plug'n Drive partnered with CAA to create a map and smartphone app of all the of the 2,000+ charging stations across Canada. The online version is found at: caa.ca/evstations/



Networked Charging Stations: Charge My Car on the Road Network

The majority of charging stations available today are not networked, meaning they do not show up on a smart phone or a GPS. It is often much less expensive to install these 'dumb' charging stations, but that means the customer has no easy way to find the station or to know if it is in use or not.

A preferred option is to install a networked charging solution that allows for advanced information on charger and provides more information to drivers in terms of their availability so that they can plan their trips. A network also allows for revenue generation should that be desired by the owner of the station.

There are many options available today, but as there is no established leader in Canada, Plug'n Drive is looking to fill this void. In the summer of 2013, Plug'n Drive conducted its own RFP to determine what the most current and most affordable technology – and the one that is best for EV drivers. As a result, PND has developed a set of recommendations for those considering the installation of a public charging station:

1. *Open Network* – The network is phone based and open source as it is compliant with Open Charge Point Protocol (OCPP), an international communication standard for managing charging stations. We are working with Greenlots as the network provider for the system, bringing years of experience and a technological lead to the network.
2. *App* - Drivers can pay via a smartphone app that will allow them to find charging stations, inquire about their availability and pay for their usage in one package. No RFID tag or memberships are required, reducing complexity and costs of having RFID readers on each unit.
3. *Charging Stations* – Currently working with Eaton Corporation and other OCPP compliant charger manufacturers;
4. Partners purchase units and install on their property, in turn they keep the revenues, if any, from drivers using the station.



This open network an ideal solution for municipalities, schools, shopping centres, hotels, restaurants, offices, public parking lots, theatres, convention centres and airports. This is because Charge My Car on the Road offers many unique benefits including:

- Units are the lowest cost chargers compared to other industry leaders;
- Hardware backed by strong warranty;
- Open source operating system by a third part ensures greater user flexibility across all systems and 'future proofs' the charging station; and
- Smart phone user access allows for easy user access without credit or RFID cards, simplifying and reducing cost of charging.

Conclusion

The support of the LDC Tomorrow Fund has been instrumental in Plug'n Drive's success in expanding Charge My Car. Consumers have benefited from the increased variety of charging stations as well as the customer service and support provided by Plug'n Drive staff. Through its stakeholder engagement, Plug'n Drive has been able to help ensure that the service remains focused on the needs of Ontario's local utilities and their customers. From extensive discussions with the LDC community and the citizens that live in their territories, we have identified the following as important issues remaining to be addressed:

1. Smart Charging – Work to enable utility intelligence and ability to throttle/delay/stop charging sessions according to market conditions. Will eventually allow for vehicle to grid (V2G) applications such as using EVs for distributed storage;
2. Dealership Engagement – Work is underway to work more closely with car dealerships and sales staff to assist consumers through the sales process;
3. EV Owners Club – Aggressively expand the EV owners club and develop a survey to learn more information about driving and charging habits;
4. CMC Expansion – Expansion is planned into new communities and new utility partners; Develop a cross-municipal charging network potentially led by the OPA in cooperation with regional LDCs based on an open network;
5. Work to accelerate the deployment of public charging stations; and
6. Engage with municipalities to plan for EVs and include EVSEs in community energy plans as well within the OPA and OEM frameworks.