

EVs: Should Ontario Electricity Utilities be Interested?

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Introduction

I recently attended a conference in Abu Dhabi called the World Future Energy Summit. My commitment to attending this conference was to come back with an area of study that might be of interest to the Electricity Distributor's Association and its members. Like most relevant conferences one can visit it had today's topics of renewable energy, energy storage, carbon capture and storage, energy strategy, sustainability sessions and the like. The overarching theme, which was highlighted in the various conference opening speeches, was how future energy solutions were needed and how they were going to help mitigate climate change. I couldn't help but sit there during those speeches and say, "Are we so sure about this?" Is climate change really an issue? Why energy based solutions? I had to catch myself though as these speeches were not just being delivered by self promoting energy solution providers but by dignitaries and high ranking officials from other countries. The debate in their minds was a foregone conclusion. Somehow, these individuals were convinced that energy solutions are the way to a healthier planet. So, who am I to argue with their point of view?

Let's put this into perspective. If these dignitaries, including the Secretary General of the United Nations, are at this conference which was filled with energy solution providers shouldn't I give them the benefit of the doubt and be listening? This was the place where the decision influencers had come to see and learn about the future energy solutions they believed their countries needed, wasn't it? Every country wants to be seen as doing something positive, right?

So, as they spoke I began to think about these potential future energy solutions. And from this vantage point I turned my attention to Ontario electricity utilities. Of all the solutions being proposed at this conference, was there one or two that stood out? To me there was one clear front runner; plug in electric vehicles. Why just this one? Why not wind, solar, biogas, energy storage etc? Frankly, utilities are fairly well versed in most of these other topics and solutions. We don't need to look far to see utility involvement in solar and biogas and in the facilitation of other renewable sources. So naturally I wanted to turn my attention to something a little less openly talked about and studied and that on the surface appeared to hold the most potential to once again change how we view our product and service delivery. In other words, how we may have to interact with our customers in the future. Clearly, micro generation has and is changing how we currently view our customers as is smart grids and the potential of smart homes. But what about all this hype and talk and now the full scale manufacturing of electric vehicles (EVs)? Is this innovation now set to become another game changer for utilities? Or, is it just something we should be noticing? To answer these questions requires some research.

After attending a few sessions and visiting some of the vendor and energy solution showcase booths it was clear that I should focus my research on a few

distinct European cases: Amsterdam, Ireland and Portugal. Before I delve into what is happening in each of these cases I will first define EVs. After reviewing the European experiences I will highlight Ontario's EV environment, detail some of the challenges and risks and close off with a look at EV market potential and possible utility opportunities. In the end I trust I will have answered the question I posed; should Ontario LDCs be taking notice of EVs?

EVs Defined

A quick search on the internet yields a wide variety of definitions and types of EVs. The differences are notable and for informational purposes the definitions from the "Electric Vehicle Technology Roadmap for Canada" (no author, June 2008, p. iii) are worth showing. See Table 1.

Table 1: EV Definitions

Term	Definition
Battery electric vehicle, BEV	A vehicle powered solely by energy stored in a battery or other on-board energy storage system
Electric vehicle, EV	A vehicle that depends on one or more electric motors for some or all of its traction
Extended range electric vehicle, EREV	A vehicle that functions as a BEV for at least 16 kilometres when driven at high speed or aggressively, and has an auxiliary energy supply that is only engaged when the battery energy is not available to sustain continued operation.
Hybrid electric vehicle, HEV	An EV for which an on-board internal combustion engine is the only source of electric power.
Plug-in hybrid electric vehicle, PHEV	An EV that can be refuelled with an off-board source of electricity and that has an onboard internal combustion engine to recharge the battery or provide traction, or both.
Plug-in electric vehicle, PEV	An EV that can be refuelled with an off-board source of electricity; it includes both BEV and PHEV.

Despite the definitions the only perspective to be dealt with in this paper are EVs that have a 'plug-in' feature.

The Experience of Others

As prefaced earlier there are a number of good EV pilots and technology rollouts taking place in Europe. What is common among them is the partnering between government, private companies and utilities or municipalities. All have customer incentives, charging infrastructure and clear milestones they want to achieve. Representatives from Ireland, Portugal and Amsterdam were at the conference and they presented their respective EV programs for the world to see. Portugal even displayed their project on the showcase floor.

Ireland's Approach

Ireland's plan is that 10% of all cars will be fully electric by 2020. This represents approximately 230,000 vehicles. The country has chosen one distribution network service provider which is Electricity Supply Board (ESB) an Irish electricity utility who is working with government and car manufacturers to see the program through to fruition. ESB is responsible for open, accessible charging and recharging infrastructure and intends to install 3,500 (1,500 public, 2,000 home) charge points and 30 fast charge points with a goal of 2,000 vehicles on the road by end of 2011. In order to promote this vision, free home connection points are being offered for the first 2,000 vehicles that register for the program. Government grants are also available to be applied against Vehicle Registration Taxes on electric vehicle purchases. ESB has also developed an effective customer website with 'how to' videos and a map indicating all public recharging locations in the country. Appendix A details the program.

Portugal's Approach

Portugal's plan is a little more philosophical than Ireland. Instead of focusing on desired unit sales of EVs it is more concerned with the infrastructure and being an EV experimental playground. Its current approach is an open, networked charging and payment system that one day will be utility controlled for peak/off peak needs and to allow electricity discharging back to the grid. MOBI.E is the organization that is managing the program and the partnerships between car manufacturers and government. So far 25 municipalities and main highways are hosting the charging infrastructure. There is a plan for 1,300 slow charging stations and 50 quick charging stations. There are vehicle buyer incentives, vehicle scrap incentives, vehicle tax exemptions and personal and corporate income tax relief. MOBI.E has also set up a very good internet presence for existing and prospective customers. Figure 1 depicts MOBI.E's model.

Figure 1: The Model

Amsterdam's Approach

The project in the city of Amsterdam is called Amsterdam Electric and has the goal that virtually all car and scooter mobility will be electric by 2040. The shorter term vision is that there will be 10,000 electric vehicles by 2015. They foresee a network of public, semi-public and private recharging stations throughout the city. Incentives will include the elimination of vehicle taxes and road taxes. What is particularly noteworthy is the free parking and free charging that will be available at public charging stations. Parking is at premium in Amsterdam and currently costs over \$10/hour. So far over 300 registered charging passes have been handed out and 133 recharging stations have been built. The vehicle subsidies are currently closed to new applications. This project also has a decent website showing recharging locations and listings of qualifying vehicles.

Ontario Environment

The question to ask is whether or not there is a similar organized effort taking place in Ontario like there is in Europe. There are efforts but it's not quite the same. At the Federal level a technology roadmap document for electric vehicles exists. And, at the Provincial level there are incentives that apply to "new, highway-capable, plug-in hybrid (PHEVs) and battery electric vehicles (BEVs), purchased or leased on or after July 1, 2010" (2011, MTO website FAQ section). Driver HOV lane incentives also exist for a limited time. Please refer to Appendix B for more vehicle incentive information. In addition there are at least three pilots involving Ontario utilities taking place. However joint development and partnerships have not yet been developed to the extent seen in Europe and there doesn't appear to be a clear plan on widespread recharging infrastructure.

Some goals have in fact been set by the Provincial government. This information is available from the Automotive Strategy Branch of the Ministry of Economic Development. The first is that 1 in 20 vehicles will be electric by 2020. The

second is that 500 Ontario Public Service fleet vehicles will also be electric by 2020. Third, access to recharging points will be made available at GO stations. The Ministry of Transportation's Electric Vehicle page of their website is a good starting point for prospective car buyers and utility staff interested in learning more about the government's efforts. There is also a customer education campaign set to begin sometime in 2011 to combat consumer concerns about EV performance and to promote the benefits of EV driving.

Challenges

The single biggest challenge is vehicle availability. The province is just now on the cusp of seeing vehicles coming to market. Most manufacturers are focusing on the primary market in the US and then will turn attention to secondary markets like Toronto, Montreal and Vancouver. Smaller markets will be even further out in terms of delivery to dealers. The Chevy Volt won't be seen until 2012 and the Mercedes Smart Car is only in the trial/pilot stage with Toronto Hydro. The Mitsubishi Miev claims to deliver in 2011 but one cannot yet obtain website pricing. The Mini E is in trial only in the US and the Nissan Leaf won't become available until late 2011 or early 2012. So no hard data yet exists for utilities to gauge demand. How can they properly plan?

A second challenge for utilities and perhaps customers alike is the lack of coordinated equipment re-charging standards. Portugal and Ireland have overcome this obstacle with centralized program management. Ontario, for the moment, is left to wait and see results from pilots at Burlington Hydro, Toronto Hydro, Powerstream and Veridian. A related issue is the availability of recharging stations. Customers with range anxiety will likely be influenced by the ease with which they can access recharging points. Will they buy an EV without proper infrastructure in place? Or, can they be convinced to buy and that recharging only needs to happen at home? Or, do they buy in faith that recharging stations will appear over time?

A third challenge is the seemingly misaligned industry forecasts and government targets. Despite recognizing the industry forecasts of 130,000 to 360,000 (Graham, 2009), the government has still targeted 380,000 (1 in 20) by 2020. Significant promotion, incentives and education will be required to reach these levels. Will this be the job of government or car manufacturers? And, how do utilities properly plan when vehicle uptake is still a guessing game?

EV Risks

Beyond some of the obvious challenges there are some inherent risks for utilities and EVs. First what are the risks of doing nothing? What if utilities just let the EV market develop without injecting itself into the process? What if utilities blindly let things happen?

Likely the biggest risk of this approach is that consumers may view utilities as unsupportive of GHG emission reduction targets which may result in utility brand deterioration. Most utilities have spent significant time promoting themselves as green, corporate responsible citizens who are concerned for the environment. Renewable energy initiatives and participation in CDM are two clear ventures that support this important consumer view.

A second risk is that sitting idle allows private companies to come in and develop and own the recharging infrastructure. Here there is a lost opportunity for rate of return on recharging assets. There is also the missed opportunity for utilities to use EV programs to promote their brand to consumers; to even use renewable DG to power the recharging stations.

Another risk is the missed opportunities for partnering and learning with car manufacturers and recharging service providers from the beginning and to gain early knowledge and expertise regarding EVs. Related to this would be the missed opportunity that utilities might be prepared for EVs from a distribution system planning perspective.

There are also some risks of proceeding into the EV market for utilities at this early stage of the game. The first is a financial one: the research and development dollars required to learn about EVs and their impact on distribution systems. Some utilities have ventured down this pilot path. A second risk is that the EV market does not materialize to the extent required to realize profits. A third risk is that utilities end up 'wearing' poor EV performance by virtue of their partnerships with car manufacturers.

Not proceeding at this stage doesn't pose any significant risks for most utilities. And frankly there simply just isn't enough information and experience to warrant anything beyond pilot studies. At this point there is very little risk of seeing what transpires over the next year.

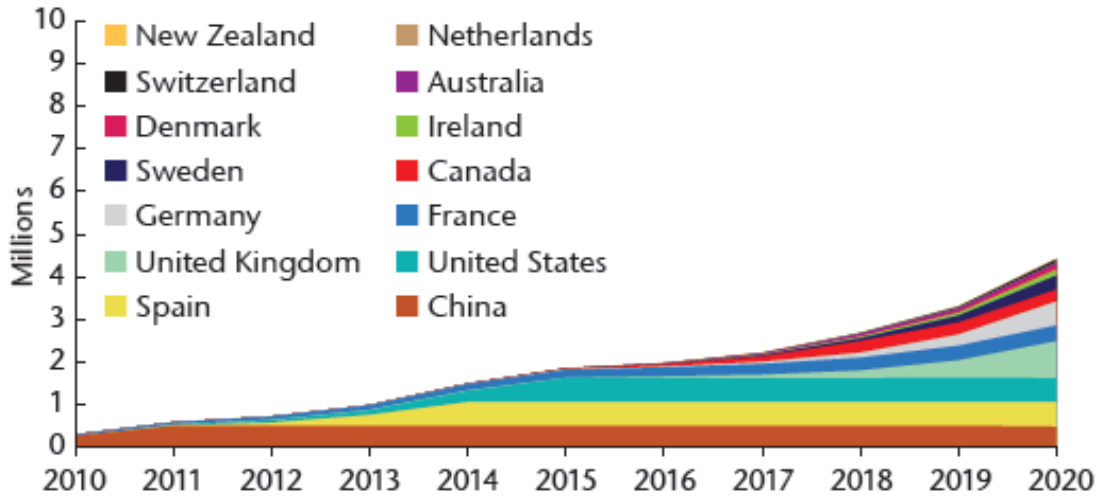
Market Potential

Perhaps all the discussion about challenges and risks mean very little without trying to determine if there is even any realizable market potential for utilities. If one accepts industry forecasts of 130,000 to 360,000 EVs by 2020 what kind of revenues are utilities likely to see? Could utilities own and earn a rate of return on recharging infrastructure?

Part of the problem in looking at market potential is that the Ministry of Economic Development admits that 2020 industry forecasts are based on US market figures. Readily available market data doesn't exist without spending significant dollars on expensive market research. So, will Canadian customers follow US trends? Heather Graham from the Ministry of Economic Development states that "Market analysis for North America suggests that EVs will account for less than 0.1% of new vehicle sales by 2010, less than 2.5% by 2015 and less than 9% of

new vehicle sales by 2020” (2009). And, the International Energy Agency (IEA) estimates that EV and PHEV sales in Canada will perhaps be as little as 200,000 (2009, p. 19). See Figure 2. The IEA goes on to forecast that 50% of light duty vehicles will be EV and PHEV by 2050 (2009, p. 4).

Figure 2: IEA Forecasted National EV and PHEV Sales Targets



What would a best case scenario in EV sales yield for utilities? The most optimistic would be that all EV purchases would be BEVs. Of course this is not realistic considering that a number of EVs will still have range extending internal combustion engines. In March of 2011 Ecometrica produced some careful analysis in this regard which is shown in Appendix C. Average consumption as forecasted by the car manufacturers is only about 200kWh/month per vehicle. Is this number large enough to excite utility professionals? Probably not but where else is there an opportunity to increase revenues while selling the fact that EVs drastically reduce GHGs? Of course if utilities owned recharging infrastructure there might be opportunity for additional rate of return impacts.

Opportunities

There are a number of very positive opportunities for utilities. First, there is plenty of time to prepare. EVs will likely not have any substantial uptake in the Ontario market until at least 2014 or 2015. Utilities therefore have time to get out in front of EV purchases and make contact with car manufacturers and local dealers regarding charging technical requirements. A second opportunity that could be taken advantage of is the partnerships that could be established. Utilities for brand building purposes could start establishing relationships with car manufacturers and dealers; all parties want the same thing and that is sales. Thirdly, utilities could start showing their support for EVs; declaring to consumers the benefits and thus showing individual social responsibility. Another opportunity exists for utilities to build some sort of industry position on EVs and

promote this position to government; that utilities are supportive of government GHG reduction goals and perhaps that utilities want and need to be in the EV business however that gets defined. Finally, there is the opportunity for utilities to look at greening their corporate fleets; a chance to prove corporate social responsibility.

Recommendations

Considering the above comments there are a number of recommendations for Ontario utilities. The first is that the utility industry needs to formulate its position on EVs. Does the position involve infrastructure ownership or not? Does it play a facilitation role through incentives? Second the industry needs to take this position and get out in front of the EV market and present this position to government and show the value the utility industry brings to the EV market. Third, the utility industry should be researching EV recharging standards to better prepare for infrastructure needs. Fourth, the utility industry should begin researching the much talked about vehicle to grid supply of electricity. The European cases are already headed in this direction. The fifth recommendation is much simpler and that is for utilities to establish relationships with EV manufactures and dealers to enable future promotional and partnership opportunities. Finally, the utility industry should look into establishing a standard calculation for utility websites on GHG calculations, fuel cost savings and EV links for consumers. This is important for continued utility brand building. In the end Ontario utilities ought to be interested in the future of EVs.

Appendix

Appendix A: ESB Milestones



Milestones

By 2020 it is projected that every tenth car on Irish roads will be fully powered by electricity. For the ecar roll-out to enjoy maximum success, buy-in and commitment from all stakeholders is essential and already significant milestones have been achieved.

2008	November	<p><u>Government announces Electric Vehicle Target for 2020</u></p> <p>The Government's plan for EVs in Ireland is a target of 10% of all vehicles on the road (i.e. 250,000 cars) to be powered by electricity by 2020.</p>
2009	April	<p><u>Collaboration between Irish Government, ESB & Renault-Nissan</u></p> <ul style="list-style-type: none"> All parties signed a Memoranda of Understanding which will create favourable conditions for the distribution of electric vehicles to the Irish market. Irish Government to provide incentives ESB to deliver a nationwide infrastructure Renault-Nissan to secure early supply of ecars to Ireland
	October	<p><u>Irish Government include electric vehicles in the 'Programme for Government 2009'.</u></p> <ul style="list-style-type: none"> Fianna Fáil and the Green Party include electric vehicles in the 'Programme for Government 2009' The Irish Government state that they will "work with the ESB and international motor companies to see a deployment of some 6,000 electric vehicles over the next three years."
2010	March	<p><u>Ireland's First Charge Point is Launched in Dublin</u></p> <ul style="list-style-type: none"> Ireland's first ecar charge points were unveiled in Dublin city centre on March 26th 2010 This marks the beginning of a nationwide infrastructure that will revolutionise motor transport in Ireland.
	April	<p><u>Government, ESB and Renault-Nissan announce comprehensive partnership to position Ireland as a Leader in Electric Transport</u></p> <ul style="list-style-type: none"> Government announces €5,000 incentive for electric vehicles ESB to roll out 3,500 charge points and 30 fast charge points Renault-Nissan Alliance to provide Ireland with electric cars
	May	<p><u>Collaboration between Irish Government, ESB & Mitsubishi</u></p> <ul style="list-style-type: none"> Irish Government, ESB and Mitsubishi Motors, MC (Automobile) Europe and MMC Commercials sign a Memorandum of Understanding to further promote ecar industry ESB announces first ecar trial programme for Ireland in conjunction with Trinity College Dublin Mitsubishi Motors identify Ireland as ideal test environment and announce the supply of electric cars for the trial
	July	<p><u>Ireland's first ecar trial Participants Receive their ecars</u></p> <p>The two-year ecar trial being conducted by ESB ecars in conjunction with Trinity College Dublin commences. Trial participants throughout Ireland received their Mitsubishi iMiEV ecars and charge points were installed in their homes. The customer behaviour and attitudes</p>

- research by TCD will be vital in understanding how people choose to use their ecars.
- October** Intel and ESB announce ecar Research Collaboration
- ESB ecars and Intel's Sustainability and Enterprise Services Lab signed a Memorandum of Understanding to collaborate on joint innovation and research programs.
 - Intel also had a charge point installed on their premises and are trialling ecars as part of ESB ecar trial.

- November** Government, ESB & Toyota Sign Agreement
- Toyota Ireland introduced a new Plug-in Prius Hybrid car to Ireland, as part of an memorandum of understanding (MOU) with the Irish Government.
 - Three vehicles will be based in Ireland which will be placed with a number of leading Irish and multinational companies in order to test vehicles and the recharging infrastructure as well as providing valuable information on customer usage patterns, behaviour and attitudes.

2011 **February** The First Nissan LEAF ecars arrive in Ireland

The first delivery of Nissan Leaf ecars will be delivered in February and will mark the arrival of the first ecars available on the Irish Market.

December ESB ecars Infrastructure Rollout Target by End of 2011

Our goal is to have a network of charge points around the country including:

- 1500 public charge points
- 2000 home charge points
- 30 fast charge points

There is a target to have at least 2,000 ecars on the road by the end of 2011.

2020 Government ecars Goal for 2020

Announced in 2008, the Government hope that 10% of all vehicles will be electric-run within 12 years.

Appendix B: Electric Vehicle Program Incentives



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Electric Vehicle Program Incentives

Battery Electric Vehicles (BEVs)

Manufacturer, Model Year, Model Name, Body Type	Battery Size (kWh)	Grant Value for Purchase (\$)	Grant Value for 1 Year Lease		Grant Value for 2 Year Lease		Grant Value for 3+ Year Lease	
			Personal Use	Fleet Use	Personal Use	Fleet Use	Personal Use	Fleet Use
Tesla Motors Inc, 2010 Roadster Convertible	53	\$8,500.00	\$2,830.50	\$0	\$5,669.50	\$0	\$8,500	\$8,500
smart Canada, 2011 smart fortwo	16.5	\$8,365.00	\$2,785.55	\$0	\$5,579.45	\$0	\$8,365.00	\$8,365.00

Plug in Hybrid Electric Vehicles (PHEVs)

Manufacturer, Model Year, Model Name, Body Type	Battery Size (kWh)	Grant Value for Purchase (\$)	Grant Value for 1 Year Lease		Grant Value for 2 Year Lease		Grant Value for 3+ Year Lease	
			Personal Use	Fleet Use	Personal Use	Fleet Use	Personal Use	Fleet Use
(none)								

Only vehicles available for general sale in Ontario are listed. There may be vehicles currently operating in Ontario as part of a pilot study or test program with green plates but do not qualify for an electric vehicle incentive.

Vehicles eligible for green plates are also eligible for an Electric Vehicle Incentive Program incentive provided they meet additional program conditions.

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Appendix C: Ecometrica Input Data for Emissions Calculations

Nissan Leaf

Battery size	24	kWh
Range	109	miles
Efficiency	0.2202	kWh/mile
Efficiency	0.1368	kWh/km

Mitsubishi i-Miev

Annual consumption	2700	kWh
Annual mileage	12000	miles
Battery size	16	kWh
Range	71.1	miles
Efficiency	0.2250	kWh/mile
Efficiency	0.1398	kWh/km

Renault Fluencz EV

Battery size	22	kWh
Range	100	miles
Efficiency	0.2200	kWh/mile
Efficiency	0.1367	kWh/km

Average EV Efficiency

Efficiency TTW basis	0.2217	kWh/mile
Efficiency TTW basis	0.1378	kWh/km

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