
Free Overnight Charging for EVs

2017-04-07

Electric Vehicles – Overview

- Historically, MTO is the only ministry with programs in place. This started with the Electric Vehicle Incentive Program (i.e. rebates at point-of-sale and on installation of certain charging devices), and was followed by the Electric Vehicle Charging Ontario program.
- Under the Climate Change Action Plan (CCAP), the province now has 30 different initiatives planned or underway that cover a full range of electric mobility topics. Many other ministries are now involved.

CCAP Low Emission Vehicle Initiatives

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Breakdowns

Fuels Only
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Passenger EV Categories

Fleets / Retail
/ Advertising
7Charging
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ENERGY support of MOI

- MOI is installing 70 charging stations at 35 locations over 2 years at Government owned or leased sites.
 - New charging stations will serve both OPS employees and the public.
 - There will be a mix of level 2 and level 3 stations (due to shorter length of stay).
- MOI also working with Metrolinx to install up to 600 publicly available charging points at 60 GO stations.
- ENERGY is supporting this initiative.
 - Engaging LDCs on feasibility assessment of sites.
 - IESO is an option for coordinating MOI installation program.
 - ENERGY met with MOI/IESO on 5 January 2017 [~~check date~~] to begin this dialogue.

Electric Vehicles – Overview (con'd)

- **These CCAP initiatives** will have an impact on the grid, industry stakeholders, and customers. The Ministry of Energy's mandate outlines a clear role to coordinate on all energy matters in the province and review the associated short- to long-term goals.
- The Ministry has already explored how it can support electric mobility through the lens of grid impacts and benefits. This includes:
 - Supporting several EV demonstration projects through the Smart Grid Fund that try to balance customer needs with system needs (Appendix A), and
 - Hosting the Power Providers Electric Vehicle Working Group, which engaged LDCs and other sector stakeholders to identify challenges & opportunities for EVs in Ontario (see Appendix B).
- The "Vehicle-to-Grid Roadmap" – another CCAP initiative – is an excellent opportunity for the Ministry to fulfill its mandate on an emerging set of technologies. Several LDCs have a very strong interest in V2G applications, and the Roadmap will provide industry with some clarity on Government's policies for integrating EVs.
- The LTEP is another opportunity to explore where the Ministry can contribute to electric mobility. Several policy concepts are being evaluated for further consideration. Current proposals include:
 - Work with other ministries on implementing EV initiatives to identify and mitigate grid impacts, and optimize grid benefits where possible.
 - **This work has already begun – ENERGY is supporting the Ministry of Infrastructure to implement its government building EV charging program, with assistance from the IESO.**
 - Examine how to enhance, support, and encourage mass transit electrification in a way that promotes early involvement of key electricity sector stakeholders.
 - Work with other ministries to gather and analyze data on EV use to support policy decisions across government.

Background – Free Overnight Charging

- The Climate Change Action Plan (CCAP) included the establishment of a 4-year free overnight charging for EVs initiative starting in 2017, and states Ontario intends to transition this into an optional enhanced time-of-day program.
 - CCAP announced intended funding of \$15M for this program.
 - In February 2017, MOECC confirmed that available funding would be no more than \$8.7M.
- EVs in Ontario at end of 2016 were about 9,200. EV sales in 2016 were around 3,000 and the CCAP has target for growth of EV sales to 14,000 sales in 2020.
 - If achieved, ENERGY forecasts 51,700 EVs on the road in 2020.
- Currently, the average cost to charge an EV at off-peak time-of-use (TOU) rates is less than \$1 per day. This will drop to about \$0.50, after the Fair Hydro Plan reductions. EVs.
 - This initiative could touch on and support several of these strategic themes.

Breakdown of Overnight Charging Concepts

Cabinet Minute:

- ENERGY work with MOECC and MTO to establish a 4 year **time-limited free overnight** EV charging program for residential and **affected** multi-unit residential customers/building, and report back to Cabinet in 2016.

CONCEPT	DESCRIPTION
<i>Overnight</i>	Implies load-shifting program objectives.
<i>Free</i>	Undefined. Constrained by funding allocation of \$8.7M over four years.
<i>Affected</i>	Undefined. Potentially constrained by the need for meters or other devices to verify EV owner charging.
<i>Time-limited</i>	Program is not intended to be permanent. CCAP contemplates transition to TOU rate class post-2020.

Key Themes from Consultations

ENERGY staff have consulted with a number of stakeholders (see Appendix C and D), with key themes from these consultations reflected below:

Simplicity	Program should minimize administration and processing costs – should be kept as simple as possible.
Behavioural Change	Incenting charging behaviour is as important as incenting increased EV ownership. Provincial demand remains high when off-peak prices begin, and stakeholders and ENERGY defined overnight as 12 a.m. – 6 a.m.
Scope	Program should aim to be province-wide and apply to current and future EV owners.
Linked to LDC Accounts	Rebate should ideally be tied to customer utility accounts when smart meters are utilized – only charging at place of residence is compensated.
Additional Data	Although there are benefits to capturing additional data, this should be balanced against the costs of hardware to capture that data.
Multi-Residential	This will be an issue for program design. Practically, may be necessary to restrict to customers where charging is linked to personal account.

Considerations

Customer Rebate Amount	Based on off-peak prices of \$0.061*/ kilowatt hour (kWh), and EV daily demand of 8 kWh, the program's rebate portion alone would cost about \$26M over 4 years, assuming full participation, providing each customer about \$15 per month. Full participation and compensation would require additional GGRA funding.
Administrative Costs	Administrative and hardware costs vary based on the delivery model, but are higher when measuring consumer charging behaviour is included. LDCs were asked to estimate their administrative costs under different models, but have not shared this information to date.
CCAP Alignment	Work ENERGY completed for the MOECC's Greenhouse Gas Reduction Account (GGRA) Scorecard resulted in a score for this initiative of 0.66 out of 50, and forecast potential CO ₂ reductions of 13,200 tonnes, at a cost of about \$1,100 per tonne. Overnight charging defined as 12 a.m.- 6 a.m. to align with low demand.
Program Benefits	ENERGY staff note this program presents an opportunity to collect data on EV charging. This data collection could determine possible risks to local grids as EV uptake increases, provide insights on EV charging behaviours and how to influence them, and inform the design of an optional enhanced program once this initiative concludes. With little data on EVs in Ontario, this information could support broader EV policy across government.
Multi-Residential	The ability to include multi-unit residential customers in the program may not be possible in options 1 and 3 that follow.

*\$0.061 is the Ministry's estimate for the next overnight rate after implementation of the Fair Hydro Program.

Option 1: Simple Credits

Description

- This simplified model could provide a credit equivalent to a proportion of free overnight charging (<\$0.50 / day) to participants.
- The program would be based on an assumed charge level and does not measure charging, so the credit is received regardless of when participants charge.
- Delivery of the credit could be in different forms (e.g. cheque), although it would not be provided via utility bills.
- The program could require EV owners to provide access to their smart meter data to allow government to learn about un-influenced charging behaviour.

Option 1: Simple Credits

Considerations

- To ensure the program was within the CCAP funding of \$8.7M, the credits would have to be restricted. For example:
 - The program could be based on a first-come basis to allow credit amounts to approximate free overnight charging, This would provide credits to no more than 11,000 EVs (this approach better aligns with “free” concept); or
 - Credit amounts could be set at a level that would allow them to be to everyone for the entire 4 year period. This would provide credits of no more than \$5 per month (this approach does not align with either “free” or “overnight”).
- This model does not allow for the collection of data rich information, and provides no incentive to alter charging behaviour, although would likely be the least difficult of the options to implement.
 - This model would not support a reduction in GHG emissions.

Option 2: Measure Behaviour

Description

- This program design requires the use of a separate device to measure charging behaviour for a limited number of EVs in a chosen region of the Province.
- The device would record EV charging behaviour. This would allow for the credits to participating customers to be precisely aligned to the overnight electricity used in EV charging. The device could also potentially collect other information on EVs.
- Costs could vary depending on the number of participants in the program, and the device costs. It is estimated that less than 6000 EV owners could participate in this pilot-style program with \$8.7M.
- Delivery of the credit could be in different forms (e.g. cheque), although it would not be provided via utility bills.
- Implementation of this option would likely require a direct competitive procurement for devices and associated management services. Alternately, a TPA could be used to deliver the program through select LDCs.
 - PowerStream, now Alectra, applied for the OEB RPP dynamic pricing pilot program and included consideration of a special program for EV owners. This proposal could be enhanced / spread to other LDCs to maximize coverage with available funds.

Option 2: Measure Behaviour

Considerations

- This program design does not address all the elements of the CCAP action but does have the following benefits all of which would help ENERGY to meet policy goals:
 - While only a portion of EVs could participate in the program, this model would collect valuable at-home charging data specific to the EVs;
 - If the measurement device is fitted to the EV, then additional valuable data such as driving patterns, and information on charging information away from home (workplace charging, use of public charging stations) could be collected:
 - This data would provide a more comprehensive understanding of EV charging activity; and,
 - This data could also help inform where public charging locations should be placed, and the times of day they would be used, as well as other EV policy.
 - This model could engage customers, resulting in significant change in charging behaviour; and,
 - EVs at multi-unit residential complexes could be included using this model.
- Reliance on a separate device to measure behaviour does raise risks related to accuracy, and reliability which would need to be managed.
- Given costs of the measurement device, this option would need to limit participants.
 - Limitations on number of participants could be reduced if participants are required to contribute towards the cost of the measurement device.

Option 3: Use Customer Smart Meters

Description

- Under this framework, overnight consumption is measured using customer's existing smart meters, and a kWh threshold must be met during the overnight period (e.g. 12 a.m.-6 a.m.) for EV owners to qualify for the rebate.
- The threshold is set based on typical non-EV demand (e.g. fridge, other baseloads) during this period, and the desired amount of EV charging during this period, incenting a change in behaviour.
 - For example, average residential non-EV overnight demand (12 a.m.-6 a.m.) is about 3-5 kWh, and an EV driven the average daily distance would require 8 kWh of charging:
 - a threshold set at some amount between 5 kWh and 13 kWh would provide an incentive for the average customer with an EV to charge during this time period to ensure they exceed this cap.
- Costs could vary depending on the size of the credit, the geographic region, and whether it is provided on a first come basis.
- The rebate would be a flat amount be delivered through monthly utility bills.

Option 3: Use Customer Smart Meters

Considerations

- In order to capture participants who diligently charge from 12am-6am but drive very little, the threshold would have to be set so low that those with typical non-EV 12 a.m. -6 a.m. demand may qualify for the rebate without charging their EV during this period.
- Although utilities have not responded to requests for approximate implementation and IT costs related to this model, these administrative costs are likely to be significantly more than 10% of total program costs.
- With CCAP funding of \$8.7M, if 90% of program costs are available for rebates then province-wide coverage would lead to monthly customer rebates of about \$4 (approximately $\frac{1}{4}$ of the free charging amount), potentially minimizing participation. Higher administration costs would reduce the available rebate even further.
- This model allows for the collection of some data, although this would be less useful than the information available under Option 2.

Option 4: Full Program

Description

- The option described here is a full version of Option 2 as this is the approach that attempts to achieve the two main policy objectives to the fullest extent:
 - Providing the equivalent of free power for the commodity charge associated with charging an EV (approximately \$15 per month), and
 - Precisely tracking the charging behaviour of EV owners to incent them to charge overnight in order to receive a credit.
- This program design requires the use of a separate device to measure charging behaviour for EVs.
- The device would record EV charging behaviour. This would allow for the credits to participating customers to be precisely aligned to the overnight electricity used in EV charging. The device could also collect other valuable information on EVs.
- The program costs of \$63M would exceed the CCAP allocation of \$8.7M:
 - Rebates of overnight electricity costs are estimated at \$25M.
 - Management costs are estimated at \$38M
 - Administration, measurement devices, and data management for all participating EVs at \$750/vehicle over 4 years (based on conversations with stakeholders)

Option 4: Full Program

Considerations

- The device used to monitor charging activity (a small plug-in that can be installed in all EV types) could collect additional valuable data, such as driving patterns, power usage during driving, away-from-home charging activity and location, and the power flows / times / charge state of any charging activity.
- This data would provide a more comprehensive understanding of EV charging activity and usage, filling a critical information gap in the design of government EV policies and programs.
 - As with all other options, consent to use of data would be a critical element of program enrolment.
- This model could engage customers, resulting in significant change in charging behaviour. Further, this model is easiest to include EVs owners in multi-unit residential complexes.
- Reliance on a separate device to measure behaviour does raise risks related to accuracy and reliability. To address this risk and associated federal regulatory issues, it is recommended that a fixed rate be used to deliver the program.
- Although such devices already exist – the open procurement process necessary to implement this program is likely to prevent the program implementing in 2017.

Next Steps

- ~~Meeting with MOECC staff in early April to discuss these options and the associated constraints given the available CCAP funding~~
- MIN / CoS / DM discussions between ENERGY and MOECC in late February / early March re: challenges related to delivering on CCAP objectives for overnight charging. Ministry staff are continuing this discussion with MOECC staff.
 - First meeting on April 5 – ENERGY provided overview of its technical analysis and associated costs as they relate to “free” and “overnight” concepts. MOECC provided feedback on expectations and will test some ideas / concepts with senior management (e.g. option 2 – targeted deployment that achieves both objectives).
 - Will arrange further meetings to continue discussion. May include additional ministries doing EV CCAP projects to help scope the full spectrum of incentives – this will help frame how overnight charging lines up against other activities.
- Receive approval for a specific program design, and take this design to Cabinet and Treasury Board/ Management Board of Cabinet
- Continue stakeholder consultation to identify and resolve detailed implementation challenges in preferred program design.
- Seek subsequent program approvals related to preferred program design.

Appendix A: Smart Grid Fund EV Projects

EV Grid Impacts and Smart Charging Demo

Recipient: CrossChasm

LDC: Toronto Hydro

- Network-enabled vehicle data loggers (chips installed in the vehicles) and chargers installed on approximately 30 EVs for visibility into grid impacts of EV charging loads & driver behaviour
- “Smart Charging” by optimizing charging loads based on grid capacity and user/utility preferences.

EV-Grid Monitoring & Planning Tool

Recipient: Tech Mahindra

LDC: Niagara on the Lake Hydro

- An integrated hardware-software solution that will allow utilities to gather data on EV driving patterns, loads, and transformer performance.
- Help LDCs plan for future EV impacts on the distribution system, and through an In-Home Display would help consumers manage energy usage.

Three Smart Software Applications

Recipient: University of Ottawa

LDC: Hydro Ottawa

- Charging control and secure payment app
- Customer-cited renewable generation to EV charging optimization app
- Re-charging app with interactive maps, charging station status & reservation along route

Appendix B: Power Providers EV Working Group

- In Spring 2015, the Ministry endorsed a proposal from EV stakeholders to help establish and host a Working Group.
- Facilitated by Josipa Petrunic, Executive Director of the Canadian Urban Transit Research and Innovation Consortium. Final report submitted in February 2016.

Membership

- Plug'n Drive
- Pollution Probe
- OEB / IESO
- MTO, MEDG, MOECC
- Electrical Safety Authority
- Toronto Hydro
- PowerStream
- Burlington Hydro
- Hydro Ottawa
- Several other LDCs (full size range)
- Special presentations

Topics

- Ontario's EV landscape
- EV Integration
- Utility Revenue Generation
- Regulatory Issues
- Residential / Commercial charging
- Commercial / public fast charging
- Storage / Vehicle-to-Grid Considerations
- Electrified transit

Format / Results

- Meetings structured as focus group consultations to identify Opportunity, Challenge, and Solution
- Strong attendance and positive feedback from participants
- Mid-term report prepared in December 2015
- Early reports submitted to MOECC / MTO to support CCAP / GIF policy and program design

Appendix C: Participating Stakeholders

Direct Stakeholder Engagements	EDA Operations Community Participants	Overnight Charging Working Group
• IESO • OEB • Plug'nDrive • Pollution Probe • Energy Exchange • Toronto Hydro • PowerStream • Burlington Hydro • Enercare • Niagara Peninsula Energy • Measurement Canada • FleetCarma • Tech Mahindra • Savage Data • Canadian Condominium Institute • MTO • MAH • MGCS	• Hydro Ottawa • Halton Hills Hydro • Brantford Power • Energy + • Peterborough Utilities • Veridian • Burlington Hydro • Oshawa PUC • North Bay Hydro • Horizon Utilities • Guelph Hydro • Enwin • Milton Hydro • Kitchener-Wilmot Hydro • Orangeville Hydro • PowerStream • Waterloo North Hydro • Whitby Hydro	• IESO • OEB • Guelph Hydro • PowerStream • Hydro One • Burlington Hydro • London Hydro • Hydro Ottawa • Veridian • Toronto Hydro • Hydro Brampton • Horizon Utilities • MOECC • MAH • MEDG • MGCS • MTO

Appendix D: Consultations to Date

- Stakeholder consultations took place:
 - Direct Stakeholder Engagements including key LDCs began July 2016;
 - First Overnight Charging Working Group meeting on 22 September 2016 with participation from 10 LDCs, IESO, OEB, and ministry partners;
 - Second Overnight Charging Working Group meeting on 8 November 2016 with participation from more than 10 LDCs, IESO, OEB, and ministry partners; and,
 - Working Group meeting with NGO's, including Energy Exchange, Plug'nDrive , Pollution Probe on 19 December 2016.
- Continuing to work closely with other Ministries:
 - MTO – delivers other EV incentive programs; may be opportunity to align program delivery;
 - MEDG / MGCS / MAH – leading other CCAP EV initiatives; providing advice on multi-residential considerations;
 - MOECC – will provide guidance on alignment of options with CCAP objectives.