Electrification of Transportation

November 29, 2017

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OPG Leadership in Electrification of Transportation in Ontario

OPG is a pioneer in Ontario's EV sector

- OPG founded Plug n Drive and recently helped fund their EV Discovery Centre
- OPG partnered with GM to help launch the Volt EV in Canada

OPG has launched a 4-pillared strategy to support transportation electrification in Ontario:

1. Leverage our clean electricity to reduce GHG emissions
2. Enhance OPG's brand, social license & employee awareness
3. Maximize use of existing investments through electricity demand growth
4. Create commercial growth opportunities for OPG

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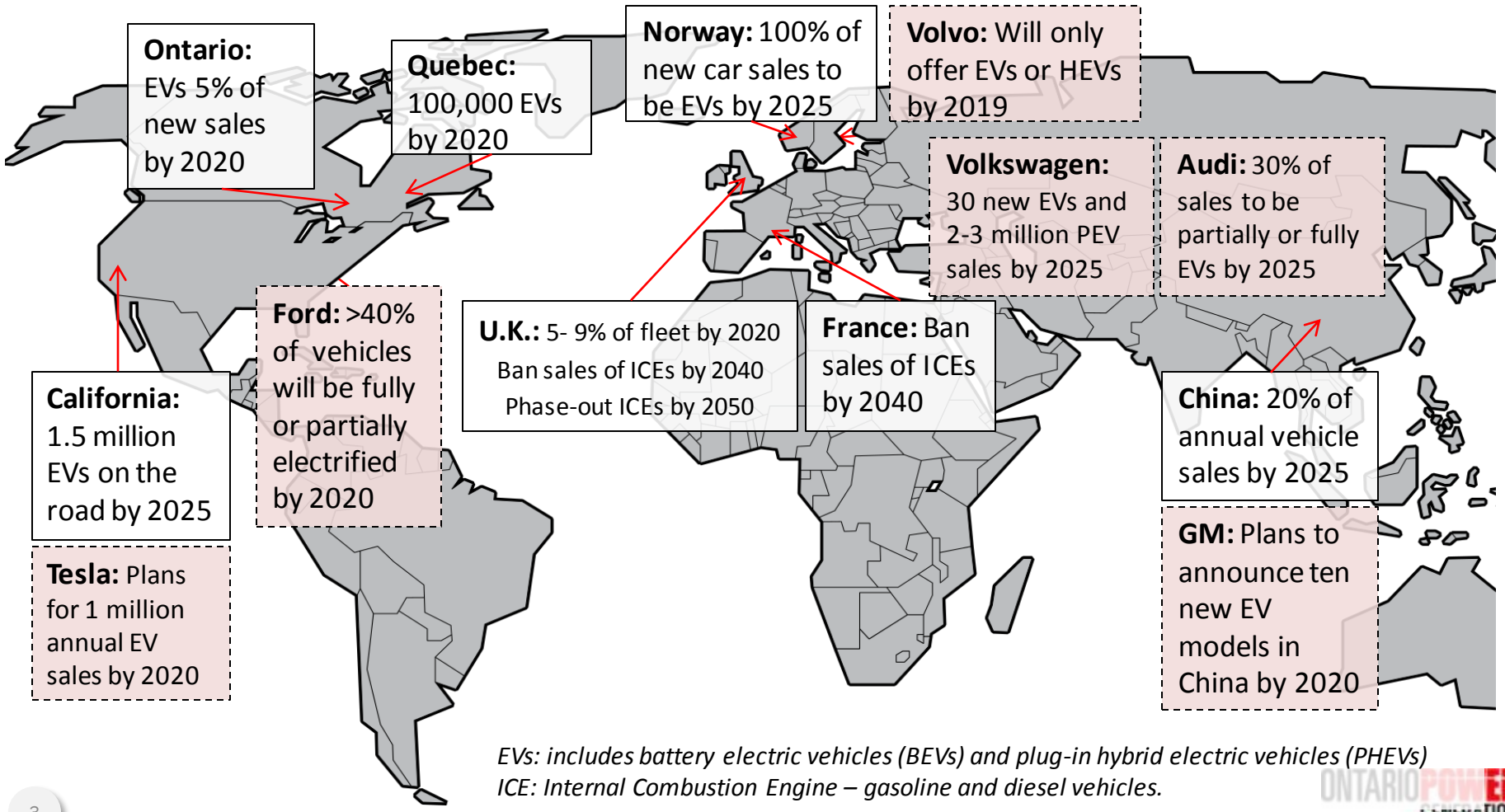
Global EV Targets & Policies

Global policies are driving EV growth and creating new economic opportunities



EVs: includes battery electric vehicles (BEVs) and plug-in hybrid electric vehicles (PHEVs)
ICE: Internal Combustion Engine – gasoline and diesel vehicles.

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OPG's Internal Electrification Plan

1. Transitioning of OPG's vehicle fleet to electric is currently underway providing cost savings & GHG reductions

Phase 1 - 2017/18

Cars and Minivans

Continue transition to plug in hybrid and proceed to full battery electric models

Phase 2 - 2018/19

SUVs

Increase adoption as additional vehicle options become available

Phase 3 – 2018/19/20

Pick up Trucks

Develop a pilot project to gain user acceptance

Transition trucks based on vehicle availability

2. **Electric Boat Pilot - 2018**
OPG will pilot electric outboard motors in 2 locations in early 2018 and will look for additional locations 2019-onward.

3. **Workplace Charging for Employees – 2017/18**
OPG is installing work place chargers in 2017/18 at key sites across our operations.

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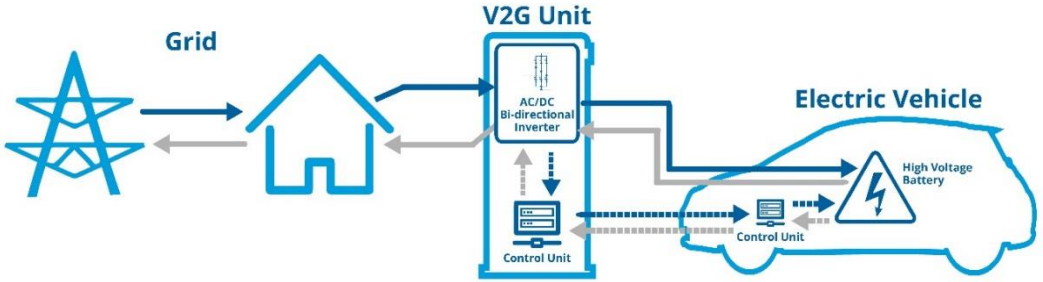
New Business Opportunities

OPG is also pursuing **new business opportunities** that arise from transportation electrification:

- OPG is interested in vehicle-grid integration
  - OPG is planning near-term projects that pilot VGI on commercial fleets



- OPG is also investigating potential for hydrogen fueled vehicles
  - OPG is actively evaluating electrolysis projects to produce hydrogen using clean electricity
  - OPG has offered our electricity system analytics capabilities to Metrolinx and its consultants as they assess Hydrail

- These new business opportunities are well aligned with the 2017 LTEP

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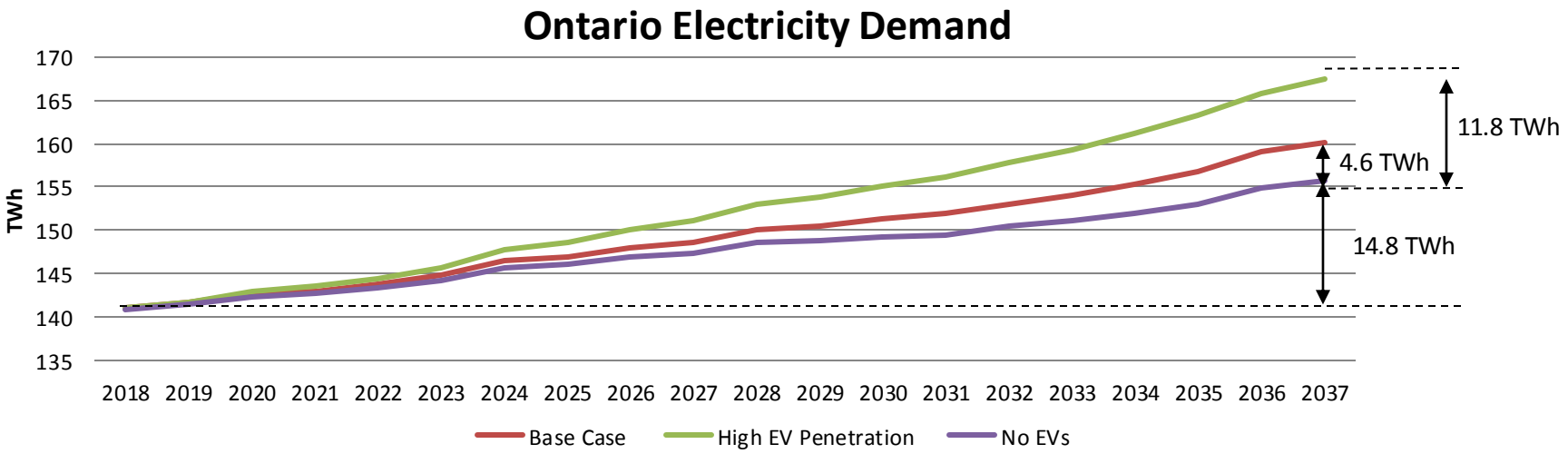
Electricity Demand Growth

- Electricity demand is expected to remain relatively flat (0.5% growth per year) over the next 20 years
- Electrification of transportation offers a key opportunity to introduce a major new electricity use, boosting electricity demand in the long-term, lowering the price of electricity and reducing GHG emissions
- OPG forecasts that 25-45% of electricity demand growth over the next 20 years could come from EVs
  - This is supported by the IESO's Ontario Planning Outlook which forecasts EVs to provide just under 60% of demand growth in Outlook B and ~25% in Outlook C



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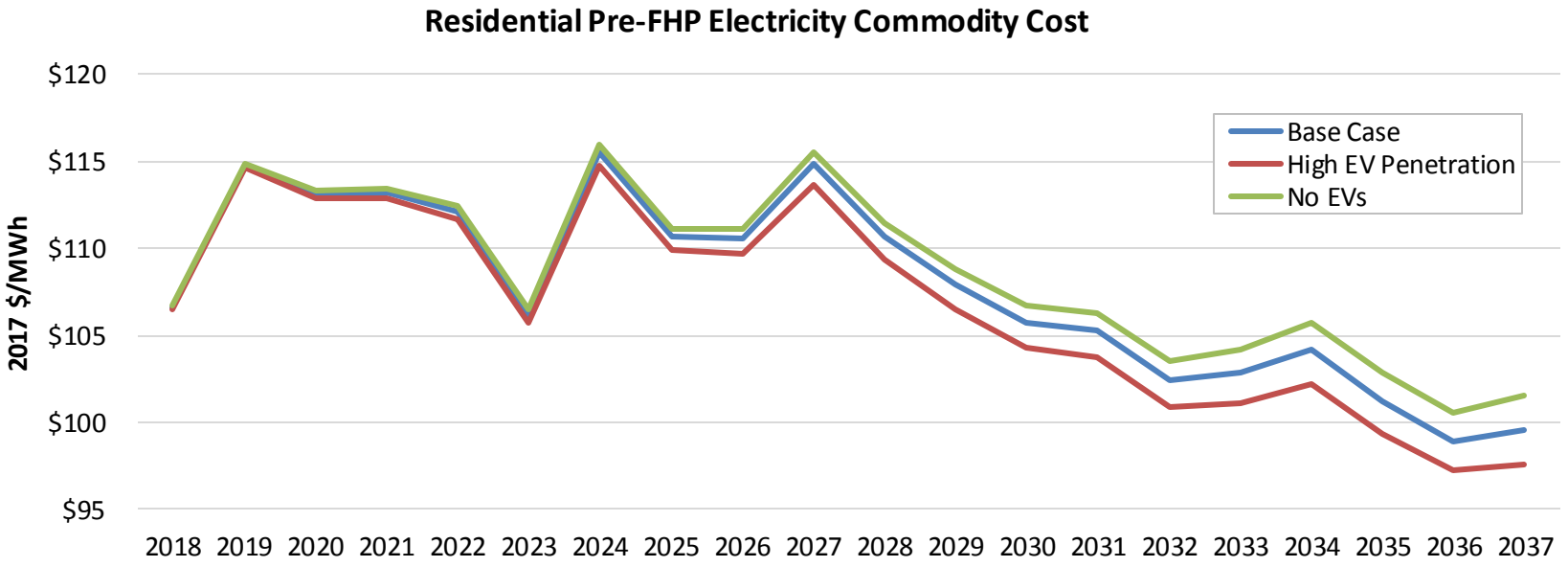
EVs Can Lower Electricity Costs

- OPG modeling shows that growth in EVs will lower electricity rates in Ontario if their demand is focused off-peak
- High EV penetration could lead to a 4% decrease in residential electricity commodity cost by 2037
- If EV owners charge when it is convenient (i.e., charging at peak when they arrive home from work), savings will be much more limited



Note: Does not include cost of conservation

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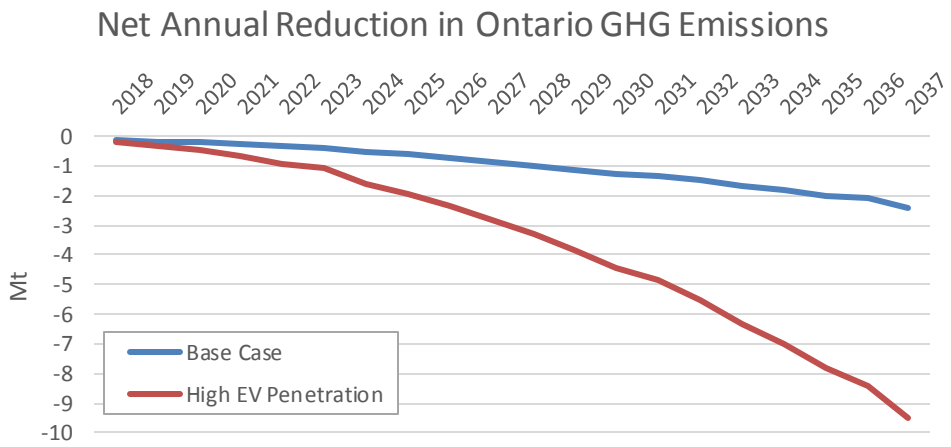
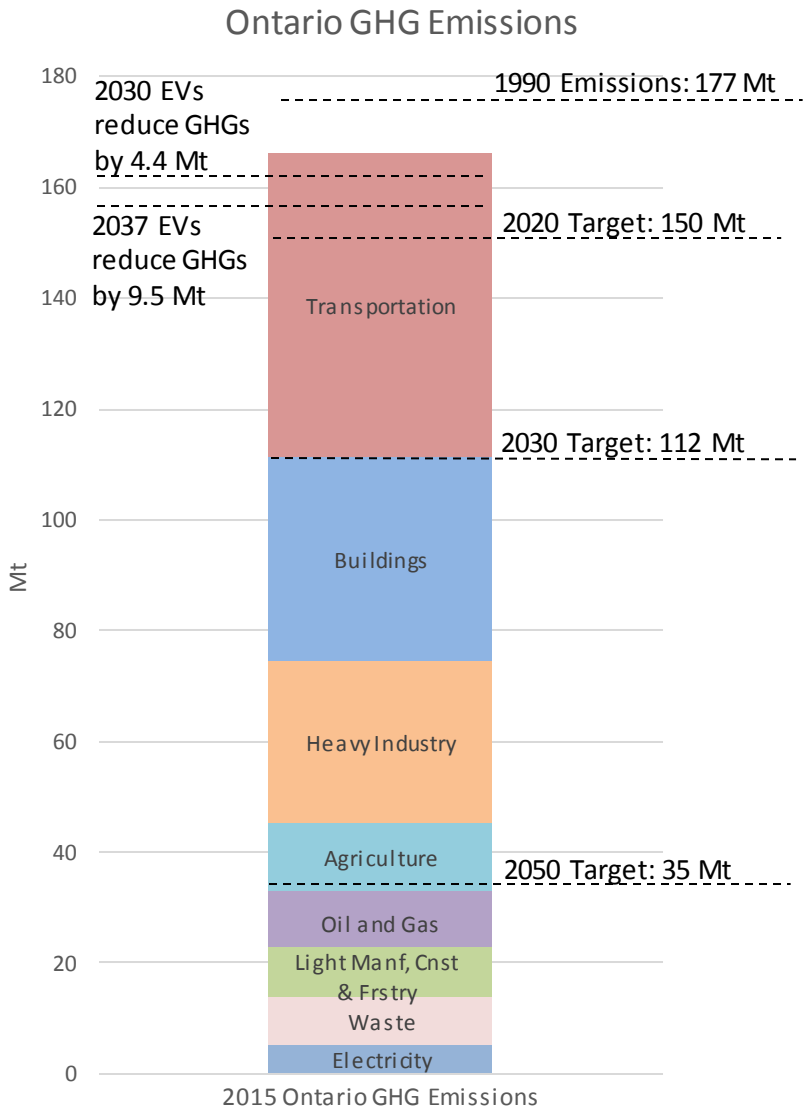
Leverage Ontario's Clean Electricity System to Reduce Transportation Emissions

- The transportation sector is the largest emitter of GHGs in Ontario
- High EV penetration could reduce annual Ontario GHG emissions by 9.5 Mt in 2037 or 6% of Ontario's total 2015 emissions
- Adding more non-emitting generation in the medium to long-term could lead to an even greater reduction in Ontario GHG emissions from EVs



Note: This graph accounts for changes in emissions from converting ICE vehicles to EVs in both the electricity and transportation sectors.



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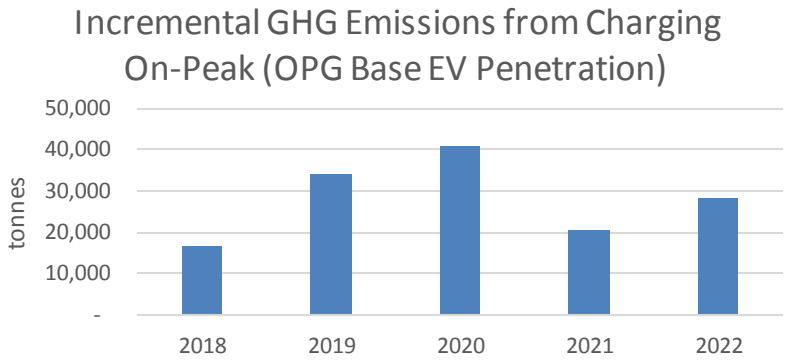
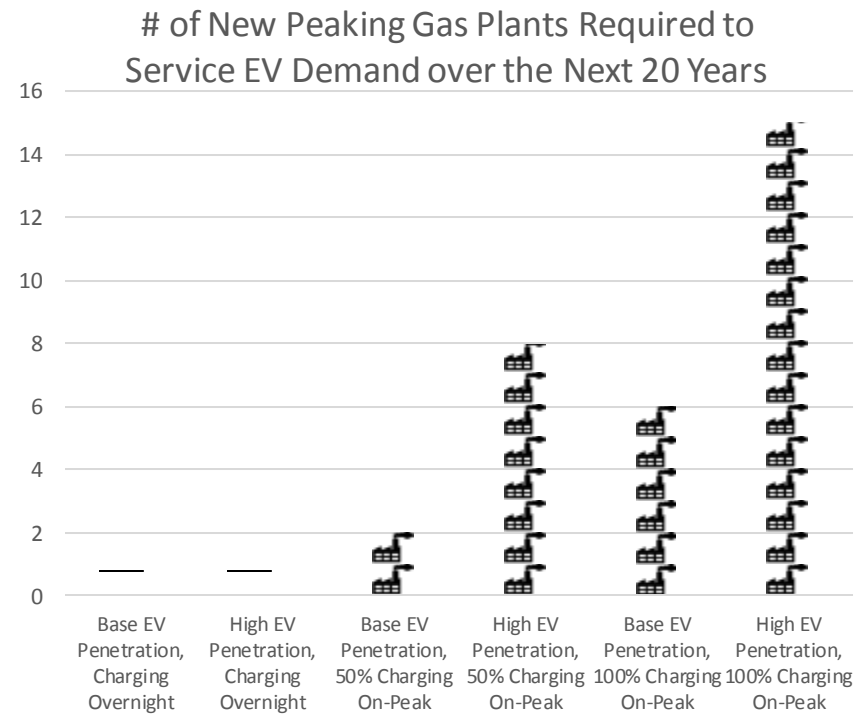
Unmanaged EV Demand Will Increase Costs and GHGs

- On-peak charging will increase electricity system GHG emissions as gas-fired generation is used to meet incremental peak demand

- As EV demand grows, up to 15 new gas-fired generators could be required to meet peak demand, increasing electricity bills for consumers above OPG's base forecast





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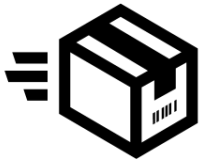
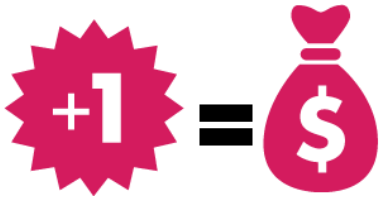
Managing EV Demand Across Ontario

- Telematics device that can simply be plugged into any EV's data port by the user to record its charging behaviour. Data transmitted to program manager via cellular network



- Device can be shipped directly to users who then plug-in the device by themselves



- EV drivers reimbursed for overnight charging with rewards points that can be redeemed online
- Optionality to provide participants with money transfers, prepaid credit cards or gift cards at major retailers

- App to provide insight and analysis into driving and charging patterns and compare to other EV drivers

- Program avoids any regulatory or infrastructure changes making it simple, cost-effective and quick to implement

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A Cost-Effective Solution

OPG can operate the program province-wide

- OPG operates throughout the province, allowing EV owners to participate regardless of where they live and which LDC they connect to
- By operating a province-wide program, OPG could leverage economies of scale to reduce program costs by about 50%

Manage EV Demand Cost-Effectively

- Estimated program cost of $425 per vehicle per year, including the cost of electricity and program operation, is an extremely cost-efficient way of delivering the program
- Total funding of about $20 million for 2018-2020 would accommodate 30,000 EVs at peak

Cost Offset by Savings for Electricity Ratepayers

- Incenting EVs to charge overnight is forecast to reduce electricity system costs by $10 million from 2018-2020, largely offsetting the cost of the EV Demand Management Program
- Cost reductions will be achieved by eliminating unnecessary incremental use of natural gas to meet EV demand at peak

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