MODELING INCREASED PLUG-IN ELECTRIC VEHICLE CHARGING DEMAND IN QUEBEC

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month g the Tools to Support Canada's Energy Transition

IQCarbone Institut québécois du carbone





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• Goals

- To identify technical, economic and political factors shaping the potential for environmentally effective, economically efficient, and politically viable low-carbon transport and climate mitigation policy.
- Demonstrate collaboration between policy experts and modelers across jursidctions

Partner organizations

- Quebec, California, Ontario and Vermont
- Leading universities, private research institutions, businesses and non-profit organizations
- Includes jurisdictions of the WCI, RGGI and TCI

Website: www.jcctrp.org



MODEL OVERVIEW

- What is the time-specific electricity demand from electric vehicle charging given future Plug-In Electric Vehicle (PEV) penetration rates?
- How do GHG emissions change in a jurisdiction with additional PEVs?
- Model developed at University of Vermont
- Data provided by Transports Quebec

PEV Charging Demand Model: How to get from travel behavior data to realistic hourly electricity demand?

Regional Generation & Dispatch Energy Model: How will vehicle electrification impact the power generation?



PEV Charging Demand Model

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QUEBEC TRANSPORT DATA: 2013 ORIGIN-DESTINATION SURVEY OF THE GREATER MONTREAL AREA

2013 Origin-Destation Survey

- Conducted in the Greater Montreal area by the Agence Métropolitaine de Transport (AMT), the Ministry of Transport of Québec (MTQ) and other local partners
- Survey include daily, non-commercial travel by all modes, detailed characteristics, and expansion weights.
- Sampling period: September December 2013
 - 78,800 households
 - 188,700 persons
 - 410,800 trips

Greater Montreal Area



PEV CHARGING DEMAND MODEL RESULTS

Hourly Charging Demand per Day, for Different Charging Station Scenarios



Aggregate Annual Charging Demand (MWh) for Fully-Electric PEVs for Different Policy Scenarios and Charging Station Scenarios

Charging Station Scenario	Original Model (10,000 PEVs)	2020 ZEV Mandate (44,000 PEVs)	2025 ZEV Mandate (167,000 PEVs)
Home Charging Only	23,445	103,158	391,532
Home and Work Charging	23,338	102,687	389,745
Universal Charging	24,568	108,099	410,286

- Charging station availability is an important determinant of when vehicles are charged.
- Shift in daily charging between "Home Only" and "Home & Work" scenarios is much smaller for Montreal runs than the northeast US runs.
- Universal charging spreads out vehicle charging throughout the day, which might improve energy management.
- Charging demand for PEV is small compared to Hydro-Québec production (~30 TWh export) and appears feasible under a range of low-carbon transport policy scenarios.

CONCLUDING REMARKS AND NEXT STEPS

Synergies between an American Model and Canadian Data

- PEV charging demand model created by University of Vermont can be used to explore renewable energy utilization for vehicle charging as well as the cost of decarbonization.
- High-level of compatibility between Quebec/Canadian travel data and University of Vermont model.

Next steps

- Calibration and sensitivity analysis of PEV model results for Quebec
- Include the impact of PEV charging demand as estimated by the PEV model on electricity generating costs, wind utilization, and GHG emissions for Greater Montreal and expand the modeling to Quebec as a whole
- Expand the application of the PEV model to other Canadian provinces and incorporate the Electricity Generation and Dispatch Model

2020 QUEBEC SYMPOSIUM ON GLOBAL CLIMATE AND TRANSPORT POLICY



Goal

Building on the JCCTRP, the Symposium aims to bring together researchers and key stakeholders from Canada, the US, Europe and China to discuss global climate and transport policy in Montreal

Date

June 10-12, 2020

Location

 Université du Québec à Montréal (UQAM) campus in downtown Montréal

THANK YOU !! MERCI !!





QUESTIONS?



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PLUG-IN ELECTRIC VEHICLE CHARGING DEMAND MODEL (PEV-CDM) DEVELOPED AT UNIVERSITY OF VERMONT (UVM)



FULL MODEL OVERVIEW