

Optimal Vehicle-to-Grid Charging System Considering Solar, Storage, and User Privacy

Grid Innovation Fund Project Details

Lead Proponent: Sky Clean Energy

Partners: Hero Energy & Engineering, Alectra Utilities, York University

Strategic Area(s):	Wholesale Market Integration
Project Total Cost:	\$811,121
Year Contracted:	2020
Status:	Active
Location:	Markham
Economic Development:	2 Jobs

Project Objectives

The project aims to develop a public facing, vehicle to grid (V2G)-enabled, distributed ledger technology (DLT) based charging system that aggregates multiple on-site DERs (solar & storage) to participate in demand response (DR) events.

The project concept involves developing a public-facing, 50 kW V2G charging system that can respond to DR events in tandem with on-site photo-voltaic generation (PV), battery energy storage (BES), and other unidirectional EV chargers, while also protecting the privacy of EV owner data and respecting their preferences. The system comprises of a 10 kW V2G charger, a 10 kW unidirectional EV charger, 6 kW PV, as well as a 30 kW/100 kWh BES.

The project scope includes development of control algorithm for V2G-enabled DR, as well as development of a data privacy protection algorithm using distributed ledger technology (DLT), where DLT-based smart contracts will enable EV owners to control the data flow that pertains to them.

In addition, a public demonstration of the 50 kW charging system will be available.

Based on survey feedback from EV owners and the local distribution company (LDC) partner, Alectra Utilities, a V2G incentive feasibility analysis will be conducted which could potentially translate into an extended DR pilot within the broader Ontario electricity sector.

Expected Outcomes

The outcomes of this project include the development of best practices for interoperable, scalable and secure V2G in Ontario, while delivering 17 MWh per year of energy savings and 50 kW of peak load reduction capability to the demonstration facility.

This project aims to demonstrate:

- Annual energy savings of 17 MWh, with peak reduction capability of 50 kW;
- Protection of EV owner data;
- DR response times of 60 seconds or less with 1000 DERs connected to the charging system;
- Seamless interoperability of V2G with other DERs as per International Electrotechnical Commission (IEC) 61850-90-7; and
- Feasible analysis of V2G incentive structures in Ontario, such that a potential V2G pilot can be rolled out to the broader Ontario electricity sector.



Demonstration of V2G charging at SkyClean's Markham location.