

Optimal Deployment of Green Hydrogen Plants into Ontario Electricity System

Hydrogen Innovation Fund Project Details

Proponent: York University

Partner: Alectra Utilities, Bruce County, Saugeen Shores, Volta Research, and Hero Energy & Engineering

Project Type: Feasibility study

Project Total Cost: \$180,000

Year Contracted: 2023

Location: North York and Bruce County

Status: Open

Project Objectives

This research study will assess the techno-economic challenges and opportunities associated with the wide adoption of green hydrogen plants in Ontario.

It will explore optimal mechanisms of integrating large-scale green hydrogen plants into Ontario's electricity system. It will investigate the optimal design / configurations and operation of both centralized and distributed green hydrogen plants, aimed at achieving one or more of the following primary objectives: 1) support renewable smoothing; 2) provide ancillary services; 3) minimize the levelized cost of hydrogen (LCOH¹) production; 4) meet hydrogen production targets; 5) meet profit target for green hydrogen plant investors.

The study will be conducted at three locations within the province to determine the potential to locate green hydrogen plants within each of these areas: York University, Bruce County, and a specified area within Alectra Utility's service territory.

¹ Levelized Cost of Hydrogen (LCOH) is a methodology used to account for all the capital and operating costs of producing hydrogen (\$/kg or hydrogen produced). It is a common metric used to benchmark the cost-competitiveness of hydrogen production projects.

Outcomes

If successful, this study will provide a research-based guideline for the optimal deployment of green hydrogen plants and their integrations into the Ontario electricity system, to support the province's decarbonisation efforts. This research will help inform planning activities for hydrogen development in different regions/zones based on defined practical scenarios for the distribution of hydrogen demand and export corridors by 2035 and 2050.

Expected learnings include:

- Detailed techno-economic analysis that calculates the Levelized Cost of Green Hydrogen in Ontario under different configurations and/or opportunities for grid service provisions with consideration of carbon taxes/credits.
- Analysis of the performance characteristics for different types of electrolyzers (alkaline and proton exchange membrane) under different operation/design options
- Comparison of prices/costs of hydrogen production for large-scale (centralized) and distributed green hydrogen plants based on the electricity prices (e.g. Class A, Class B)