Net-Zero Atlantic Student Poster Competition 2024

Category: Clean Tech Innovation

Title: A Bi-level Model for the Urban Hydrogen Refueling Stations Problem

By: Mina Valaei

Master of Applied Science Student in Industrial Engineering at Dalhousie University, Halifax, Nova Scotia.

Contact Information: mina.valaei@dal.ca, +1 (782) 882 2093

Research Advisors:

- Dr. Hamid Afshari, Assistant Professor, Department of Industrial Engineering, Dalhousie University, Halifax, Nova Scotia. Hamid.Afshari@dal.ca
- Dr. Hassan Sarhadi, Associate Professor, F.C. Manning School of Business, Acadia University, Wolfville, Nova Scotia. Hassan.Sarhadi@acadiau.ca

Abstract:

The increasing adoption of Hydrogen vehicles holds immense value for a sustainable and net-zero emission future, offering a clean and efficient alternative to traditional fossil fuel-based transportation. Hydrogen vehicles contribute significantly to reducing greenhouse gas emissions and addressing climate change concerns. However, the infrastructure of most cities across the world are not ready to accommodate the demand for hydrogen vehicles.

Traditional location-allocation models lack involving stakeholders' perspectives at multiple levels; therefore, a solution for a given stakeholder might not necessarily satisfy the others. This study presents a bi-level mathematical programming model for locating urban hydrogen refueling stations. The objective function of the leader (i.e., government) minimizes costs, while the followers' objective minimizes the deviation from their shortest path for drivers simultaneously.

The study also considers strategic factors like demographics to predict future demand for hydrogen vehicles to generate travel demand for drivers. The proposed model is validated using a real traffic dataset in Halifax, Nova Scotia. The model's findings cater for multi-level stakeholders and offer insights for urban planners and policymakers to foster the growth of hydrogen vehicles. The model gives an estimation of minimized costs for the government and minimized travel deviation for the drivers which can lead to a lower level of congestion in the city.