

Role of Hydrogen Economy in the de-carbonization of Energy Systems

Abstract

Hydrogen and its potential are increasingly the focus of both academic and industry researchers, who believe it can overcome many of the problems affecting today's energy systems. Within the portfolio of storage technologies, hydrogen provides energy when it is needed, where it is needed, and in the space and form that it is needed. For that reason, an energy future where renewable energy sources are a significant part of the energy-generation mix requires opportunities for Power-to-gas (P2G) systems via multiple application pathways. Power-to-gas is a promising option for sustainable low-carbon future energy systems that interconnect power, transportation, residential, and industrial sectors.

In this seminar, I first talk about the importance of a Hydrogen Economy by introducing different business cases through modeling and optimization and by sketching out some opportunities for using hydrogen in key economic sectors. I will then outline my vision for the CRC in *Healthy and Sustainable Communities and Environments* over five years, focusing on the conflicts that slow down energy transition. Whether it's the expansion of utility infrastructure to integrate renewable energy, barriers to establishing power-to-gas pathways within the hydrogen supply chain, or the decarbonization of industry, conflicts always arise between economic, environmental, and social aspects. The research goal is to find compromises that allow fast implementation of decarbonization strategies that are both socially and economically acceptable.

Bio-sketch: Dr. Azadeh Maroufmashat obtained her B.Sc. degree in Mechanical Engineering and her M.Sc. and Ph.D. in Energy Engineering all from Sharif University of Technology, Tehran, Iran. She was a Postdoctoral fellow in the Department of Chemical Engineering at the University of Waterloo for four years thanks to her knowledge of Renewable energy systems and integrated modeling. She is currently a Research fellow in the Group for Research in Decision Analysis (GERAD) at the Business School of Montreal (HEC Montreal) and a sessional Lecturer at McGill University.

Her research interests lie at the intersection of integrated modeling, optimization, and energy policy. Her main research contributions have been on the optimal integration of sustainable energy generation and storage technologies with existing energy systems. She has investigated the technical, environmental, and economic aspects of urban energy system modeling (micro-grid applications), and power-to-gas as a feasible energy storage technology and low-carbon sustainable energy alternative for transportation and for the hydrogen economy. She has obtained several national and institutional grants/awards, including U.S. Department of Energy awards, a MITACS Accelerate Grant, and GERAD award. She is also a recipient of a Canadian Science Policy fellowship for Environment and Climate Change Canada in 2021-2022.

As examples of her successful mentorship, teams that she co-advised won the Grand prize (2016) and honorable mention (2018) in the Hydrogen Student Design Contest, held by the U.S. Department of Energy (DOE). Her Capstone project student team also achieved Honorable mention (2019) in the Minerva Canada James Ham Safe Design Competition.