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POWER-TO-GAS SYSTEMS: THE ECONOMICS OF GREEN ENERGY STORAGE

Michael Fowler, Ushnik Mukherjee, Sean Walker, Azadeh Maroufmashat, Abdullah Alsubaie, Daniel Van Lanen & Ali Elkamel

Power-to-gas systems may offer the energy storage solution the green energy sector has been searching for, allowing grid managers to match supply and demand. The process uses surplus electricity produced by wind and solar power to split water into oxygen and hydrogen.

That hydrogen then can be injected into existing natural gas distribution lines — providing customers with cleaner, hydrogen-enriched natural gas — or converted back to electricity when the grid needs it hours, weeks or months. The hydrogen can also be used to supply refuelling stations for fuel cell vehicles.

Chemical engineering professor Michael Fowler and his research group have been conducting studies into the potential application pathway for Power-to-gas in Ontario.

The team modeled a two-megawatt power-to-gas energy hub that links the electricity and natural gas grids. From there, they developed scenarios that factored in hourly operating costs, daily hydrogen demand for vehicles and other key factors. They also examined the impact of different prices for hydrogen fuel, hydrogen-enriched natural gas and electricity on demand.

The current study provides pricing structures that policymakers could use to make such an energy hub economically viable such including the provision of auxiliary services and carbon pricing. Most importantly the research has shown on Power-to-Gas has a number of application pathways, and could immediately make use of the surplus power in Ontario, thus reducing the Global Adjustment charges the province's consumers are paying, or increasing the renewable energy content of our current fuels.

Adopting green energy on a significant scale requires effective energy storage technology. Power-to-gas systems can help us transition to a renewable energy future.

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***Source**: Mukherjee, U., Walker, S., Maroufmashat, A., Fowler, M., & Elkamel, A. (2017). Development of a pricing mechanism for valuing ancillary, transportation and environmental services offered by a power to gas energy system. Energy, 128, 447 – 462.*

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