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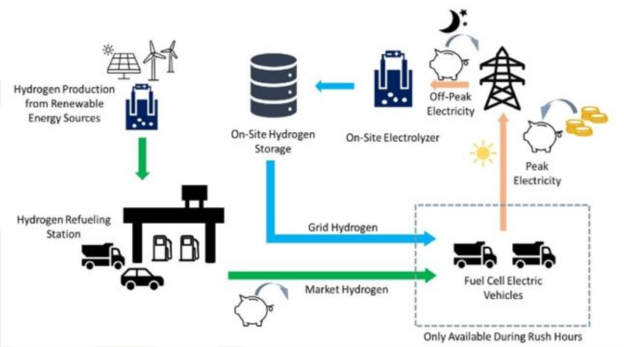

Fig. Schematic of the FCEV2G using hydrogen produced onsite (i.e., grid hydrogen) and from the market (i.e., market hydrogen)

TAPPING THE POWER OF IDLE FCEVs

Xiao-Yu Wu

Hydrogen is expected to play two important roles in the net-zero transition. One is powering fuel cell electric vehicles (FCEVs). The other is grid-scale energy storage. When wind and photovoltaic systems produce more energy than the grid needs, that electricity can be used to make hydrogen that is stored for future use.

This creates an intriguing possibility: using idle FCEVs to supply energy to the grid during peak demand times. The strategy — known as FCEV2G — works as follows.

While drivers grab a coffee at an FCEV2G station, the fuel cells in their vehicle could be used to generate electricity from hydrogen stored at the station or piped in. Selling that electricity to the grid generates revenue. At nonpeak times, when electricity is cheaper, stations could use onsite electrolyzers to produce hydrogen, replenishing the supply.

How economically viable is the idea? And how much could it reduce carbon emissions? WISE researcher Xiao-Yu Wu and master's student Daniel Ding developed a model to simulate the operation of an FCEV2G station and assess the resulting revenues and carbon reductions under different scenarios.

They concluded that in Ontario — where electricity rates are relatively low and stable and most electricity comes from zero-emission sources — this approach isn't profitable unless significant technological improvements are achieved.

It was a different picture in Alberta, where most electricity is produced using fossil fuels and electricity prices are high and volatile. Based on 2022 data, an FCEV2G station here could already potentially generate almost US$234,000 a year, even without a carbon tax, and cut 210 tonnes of carbon emissions.

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Source: *Ding, D., & Xiao-Yu Wu (2025). Evaluating the economic and carbon emission reduction potential of fuel cell electric vehicle-to-grid. DeCarbon, 7, 100096.* *https://doi.org/10.1016/j.decarb.2024.100096*

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