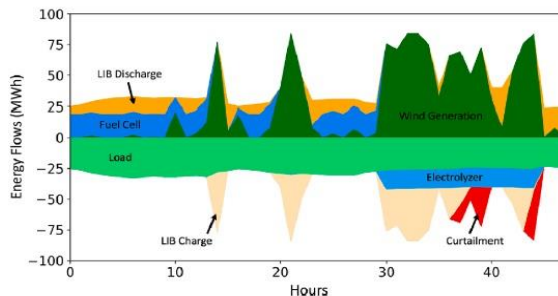




BRIDGE

Supply and Demand with
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WHY LITHIUM-ION BATTERIES AND HYDROGEN STORAGE WORK BETTER TOGETHER

Prof. Xiao-Yu Wu

The intermittent nature of wind and solar power means many microgrids still rely on highly polluting diesel generators to fill gaps in supply. But advances in lithium-ion batteries and hydrogen fuel cells — two key energy-storage technologies — could change the game.

WISE researcher Xiao-Yu Wu and his collaborator, Michael Giovanniello, set out to assess how. The investigators created a model of a hypothetical Toronto-area wind-powered microgrid with a hybrid storage system serving 10,000 customers. Real-world energy consumption data allowed them to simulate annual residential electricity demand, including both appliance and heating/cooling needs, while probabilities obtained from 25 years of historic wind data were used to model the electricity generation.

Armed with that information, the researchers determined the size requirements for wind turbines, electrolyzers, fuel cells, batteries and other components and calculated the most cost-effective configurations. They compared the costs of using hybrid storage systems to batteries or hydrogen alone. They also predicted how those costs would shift as technologies continue to improve.

Their analysis revealed that a hybrid approach would be significantly cheaper than a single technology. While hydrogen fuel cells are better at addressing seasonal supply/demand issues, lithium-ion batteries are more effective for balancing hour-to-hour and day-to-day fluctuations.

That's true today, and it would still be true in 2050, as Wu and Giovanniello predict the cost of hybrid-storage microgrids would have fallen by 55.4 per cent then. While fuel cells may play a bigger role in combined systems with improved performances and reduced costs in the future, batteries would remain important.



As microgrids play an increasingly important role in the world's supply energy, these insights will help ensure they are as green, efficient, and cost-effective as possible.

Researchers: *Xiao-Yu Wu and Michael Anthony Giovanniello*

Partners: *Natural Sciences and Engineering Research Council of Canada, Digital Research Alliance of Canada, Shared Hierarchical Academic Research Computing Network*

Source: *Giovanniello, M., & Wu, X-Y. (2023). Hybrid lithium-ion battery and hydrogen energy storage systems for a wind-supplied microgrid. Applied Energy, 345, 121311.*

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