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MODELLING GREENER MICROGRIDS

Bharatkumar V. Solanki,
Kankar Bhattacharya & Claudio A. Cañizares

More than half of Canada's 280 remote communities are cut off from centralized electricity grids, relying instead on high-polluting diesel generators. But as the need to reduce greenhouse gas emissions grows, more and more of these isolated communities are searching for greener microgrid options that add renewable energy to the mix.

Waterloo engineering professors **Kankar Bhattacharya** and **Claudio Cañizares** are helping guide that search. Along with PhD student Bharatkumar Solanki, the WISE researchers developed a mathematical model that can zero in on the optimal microgrid system that is affordable, sustainable and reliably meets electricity demands.

They started by creating a formula to calculate the fuel consumed and CO_2 emissions produced by fossil-fuel-based generators. They then integrated data from wind and solar systems in one Ontario First Nation microgrid to forecast the variable amounts of electricity that renewables produce over the course of a day.

Meanwhile, the trio also considered the potential impact of demand response programs that encourage customers to curtail their electricity consumption or shift their use to off-peak hours.

Using a five-generator microgrid as a case study, the researchers applied their comprehensive algorithm to a variety of microgrid operating strategies. The results show that the right approach can reduce CO_2 emissions by up to 52 per cent without dramatically increasing operating costs.

The model offers engineers an important tool for developing greener microgrids. At the same time, the research highlights the demand side of the equation — illustrating the important role consumers play in creating a sustainable energy future.

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