Renewable energy storage st john s

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Picture Saint John in the throes of autumn. Temperatures are cool but predictable, the city"s electrical grid smoothly supplies its 36,000 customers, and all is right with the world. Because 80 per cent of New Brunswick"s electricity is drawn from non-emitting sources (chiefly nuclear) and about 70 per cent of all home heating is performed electrically - by way of baseboard heaters, heat pumps and electric water heaters - the city"s residential carbon emissions remain impressively low, even in a Maritime fall. That is, until the first cold snap.

Saint John occasionally wakes up to an especially cold morning. At such times, the city"s myriad of electrical appliances all strain in unison to warm their chilly owners, drawing truly absurd sums of power all at once. The coup de gr?ce comes when tens of thousands of people shower at roughly the same time before heading to work, all of their electric water heaters firing up to condition an ocean of fresh, frigid water.

This is called peak demand, when the electrical needs of a given jurisdiction spike above and beyond its normal ebb and flow, and Saint John, which draws and distributes as much power as the entire province of Prince Edward Island, is a textbook case. So suddenly can it reach peak demand that, in order to supply it, New Brunswick Power must ignite a network of diesel generators, natural gas power plants and even the infamous Coleson Cove Generating Station, just to accommodate Saint John on the occasional cold morning.

And the consequences are visceral. Not only do spikes 15 minutes or longer cost Saint John Energy (the city-owned electric utility) $15,000 per megawatt, Natural Resources Canada calculates that power produced at these times is twice as carbon intensive as that produced off-peak.

"We are heavily incentivized to prevent [peaks] from happening, from an economic perspective but as well from an environmental perspective"

But preventing a peak is no simple task. It requires the careful coordination not only of the utility and its various lines and transformers, but also of the households being supplied, and even of the individual appliances drawing power. To put it another way, Saint John Energy would need control over the supply of power and how it was used in order to prevent peak demand, all without inconveniencing customers. In Mitchell"s line of work, such overarching infrastructure has a name - smart grid.

And "smart" is the appropriate term. This upgraded grid, conceived in 2019 and now connecting 80 per cent of the city, has been endowed with artificial intelligence and the capacity for machine learning, complimentary tools which allow Saint John Energy to predict peak demand before it happens, and to mount a defence using the coordinating capacities of the smart grid itself.

A basic example of this is "tap changing." Household electronics all operate within a certain range of voltage,

so, ahead of a peak demand event, Saint John Energy can now restrict the voltage fed into households to the lower end of this range. Appliances continue to function normally but, cumulatively, use much less power, blunting the peak without customers even noticing.

There are also more direct interventions. Saint John Energy now rents out "smart appliances" to their customers which can network with, and be controlled by, the smart grid. The 1,500 smart water heaters they are presently distributing can, for instance, be switched on or off remotely by the utility. During a peak demand event, when everyone has finished their shower and gone to work, the reheating of water in some households can be postponed for minutes or hours, staggering their demand for electricity and, once again, softening the peak.

The renting of household appliances is nothing new. Saint John Energy has been doing so for over a century, bringing the latest technology into households for a modest monthly fee, a service they have now tailored to strengthen their smart grid. Their appliance portfolio presently includes hot water heaters, LED streetlights and, of course, heat pumps. Mitchell hopes to one day incorporate electric vehicle charging stations, smart baseboard heaters, residential battery storage systems and even rooftop solar arrays.

Smart grids are a compelling solution to the problem of peak demand. They"re also a solution to an entirely different problem - the intermittency of renewable power. Wind and solar are unruly beasts, overproducing at some times and underproducing at others, a flakiness which has frustrated their incorporation into many electrical grids. But with a smart grid such as Saint John"s, renewables can be tamed.

When wind turbines and solar panels are at their most fruitful, Saint John Energy can now direct their sudden surges of power into the appliances connected to their smart grid, switching on heat pumps, hot water heaters, residential battery storage systems and electric vehicle charging stations in much the same way these appliances are switched off during times of peak demand. Extra power can also be shunted to their Tesla Megapack, a 1.25-megawatt battery pack sitting at their substation in Millidgeville since 2020.

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