It Takes a Village; One Community's Path to Net Zero

Michele Rochon-Wood
Owner and Creative Director at Workplace Culture Store
Published Nov 18, 2024

Energy is one of those things the general public takes for granted until it isn't there.

That's a sign that energy transmission and consumption have become the well-oiled, invisible machine they once aspired to be. Over the decades, our energy grids have come to facilitate modern life in a way that people have stopped noticing. Back then it was about going big or going home, but now we have a new goal: that same grid must continue uninterrupted while gradually switching over to what's become known as "net-zero," a term that describes a community that balances its total energy use with energy produced from renewable sources, effectively achieving a net zero carbon footprint. As expected, early efforts have proven "new" an easier prospect than converting "existing". The challenge has stretched the imaginations of governments, businesses, and energy utilities the world over, and as expected, the results have been a rousing mix of frustration and elation.

Despite the hurdles, net zero is achievable, and this time, *small* might be the operative word. A more precise descriptor might also be *decentralized*, one that aims to atone in practical and achievable ways for some of the mistakes of the past. In the era when utilities, generation, transmission, and distribution grew by consolidating, they also managed to contribute to our biggest present-day energy woes.

BedZED, (population 250) completed in 2002, is one of the earliest large-scale, mixed-use sustainable communities in the world, and is located in Sutton, South London. Masdar City, (population 1,700) established in 2006, is an ambitious project by the United Arab Emirates to create a sustainable, zero-carbon city in the desert. The city is powered by renewable energy, primarily from solar power, and designed with energy-efficient buildings, extensive public transportation, and reduced reliance on cars. Rainbow Community in Whistler (population decentralized group with temporary gatherings) was designed with sustainability in mind, focusing on energy efficiency and renewable energy. Glarus Süd (population 9,700) in Switzerland has committed to becoming net-zero in energy by 2030. Schönau (population 2,500) is a small town in the Black Forest area of Switzerland known for its grassroots energy revolution, led by a local citizens' initiative. The town emphasizes decentralized energy production, primarily from renewable sources like solar, wind, and small-scale hydroelectric power.

The Canadian Net-Zero Emissions Accountability Act became law in June 2021 and represents Canada's commitment to achieving net-zero emissions by 2050. The Act promotes transparency and accountability as Canada works to achieve these goals. Public participation and independent advice are key aspects of the Act's work. Part of the initiative includes the Net-Zero Challenge, which encourages businesses to transition their facilities and operations to net-zero emissions by 2050…which brings us to the story of the SPEEDIER project, a net-zero initiative in Ontario that came about because a "village" of stakeholders saw potential, invested time and resources in it, and made it happen. SPEEDIER enabled quantifiable reductions in greenhouse gas emissions and demonstrated achievability for other communities to do the same. In a world increasingly driven by data and with a rapidly changing climate, that means something.

In 2018 the Town of Parry Sound, Ontario (population 6,500) investigated adding a casino, one of the quickest routes to economic growth in a smaller community like Parry Sound. But, as it turned out, the transmission grid could not accommodate a facility of that size. For a casino and perhaps other large-scale economic development to be possible, transmission would have to be augmented in the area, and the required capital could not be applied at the time. This constraint and missed opportunity provided the motivation needed for an endeavor in Parry Sound towards Canada's net-zero future, also known as the SPEEDIER Project (Smart, Proactive, Enabled Energy Distribution, Intelligently, Efficiently and Responsive).

Growth in Ontario is something of a road runner these days - watching it is a bit like watching a spinning cloud of dust beelining for the horizon. When the town presented their dilemma to Lakeland, Lakeland set about investigating alternatives. Innovation tends to follow a dilemma like this, but rarely do you see such a fine example of cooperative innovation with an improvised solution.

With a new transmission station upgrade unfeasible at the time, the Town of Parry Sound would have to find ways to reduce load on the grid. The story of how the *village* of stakeholders came together for SPEEDIER is nothing short of inspiring, somewhat like a big pot of stone soup. In this version of the classic children's tale, Parry Sound is the clever passerby who sets the water to boil and drops in an ordinary stone, promising that it will produce a delicious environmental stewardship soup. Those who stepped up with ingredients are an interesting mix of government, non-profits, academic institutions, and software and technology mavens. But before we meet the

village and its cast of stars, let's look at the system they ultimately implemented together. Context first – that way each villager will have significance in the grander story.

The System

The Microgrid

For a resilient and reliable system: A 500kW PV Solar Installation; the microgrid uses a solar array and battery storage system to provide increased system resiliency.

As a step towards net zero, a microgrid, also known as a Decentralized Energy System(DES), has the small size and more importantly, nimbleness and flexibility to incorporate Renewable Energy Technologies(RES). Microgrids allow communities to deploy renewable energy and reduce peak loads and losses by locating closer to the consumer. The nearer the infrastructure is to its customers, in other words, the less energy is lost along the way. In the case of SPEEDIER, a decommissioned landfill (conveniently located next to a major user of energy, the wastewater treatment plant) provided the space needed for the solar installation, which symbolically supported the themes of improvisation and reclamation, securing SPEEDIER's place among other clever, budget-constrained environmental stewardship projects around the world. By managing demand at a community level, microgrids can also be made more reliable, something that would be less achievable in larger centers, which supported the theme of "small footprint, big impact." Finally, a microgrid can use stored energy to improve the stability of the primary grid, which can fluctuate depending on the variability of renewable energy sources.

The SPEEDIER microgrid is comprised of 160 homes and means more resilient and reliable sources of energy. It can island seamlessly, which means that it can disconnect from the main grid (island) without disrupting supply within the microgrid's boundaries. It can *blackstart*, which means that it can restart itself without relying on the main grid. After an outage, the microgrid can independently restore generation and resume operations. This functionality was tested on three occasions and passed, demonstrating reliability. It continues to perform in live situations. The solar array also opens up possibilities to participate in energy generation at the provincial level, which could be a highly advantageous project byproduct for a small center like Parry Sound and Lakeland.

Energy Storage

For storing energy: 10 Tesla Powerwalls and Tesla Megapack Storage Battery; a battery energy storage system shaved and managed peak demand, reduced constraints, provided visibility, and enabled support for future opportunities in renewable energy.

Part of the SPEEDIER project was the advent of energy storage, which would support efforts to reduce load during peak hours. Peak periods mean more expensive power and added stress on the grid, so *peak shaving*, which includes storing energy using Battery Energy Storage Systems (BESS) mitigates demand during those hours.

Demand Management

For managing demand: 50 Mello Smart HWT Controllers; managing load demand for hot water tanks at 50 participant test sites, responding to the changing load demand of the feeder, addressing

capacity constraints at the transmission station. This will assist with plans for future demand response programs in the community.

With SPEEDIER, a model-based Distributed Energy Resource Management System (DERMS) connects to digital protection relays at the substation and reclosers downstream of the feeders to create a state-estimated real-time view of the live utility feeder. The controllers use what can be thought of as an old-fashioned battery – a hot water tank, not to store electricity, but heat. Heating the water at an hour other than peak demand time reduces the load on the grid, and therefore has the potential to reduce reliance on dirty energy. Fossil fuel energy is there to provide supplements when needed, so for maximum impact, peak demand is the right hour of the day to reduce load. Because a hot water tank is full of water, it can act as its own energy storage system. You just have to install the controllers to manage the timing of charging. Ordinarily hot water tanks are a significant drain on energy and water resources in a community – the data gathered has the potential to inform future mitigative efforts in larger communities.

Data Management and Communication

For managing data and communication: data from SCADA, metering repository, operation database, GIS, distribution feeder model enabling the DERMS to make data-driven control decisions; key concerns were maintaining customer privacy, network security, and allowing the data to inform and support the goals of the project. This required visibility, control, and optimization, which depended on how the project structured and integrated the data.

EV Integration

For integrating EVs (electric vehicles): 1 Level III Charging Station, 3 Level II Charging Stations; EV assets promote the adoption of electric vehicles in the Parry Sound community and beyond as the project moves towards the net-zero objective. The charging stations were to be made available at three locations, which would encourage the use of electric vehicles in the community. EV's are a big topic these days, and the introduction of charging stations got people in the area thinking and talking, the first step towards transitioning away from fossil fuel-powered vehicles. EV chargers were also used for demand management, as the system could throttle back the output during peak events.

The Journey

The above list represents the technology in place at the close of the development phase, but it doesn't tell the whole story of SPEEDIER. One key ingredient of environmental stewardship and funding through Natural Resources Canada, was still needed, and that was a connection to reducing greenhouse gas emissions (GHG). The technology above had some ambiguous correlations to GHG's, but nothing that could be described as intentional and measurable. In other words, to qualify for funding, the project needed to demonstrate that fewer GHG's were emitted to the atmosphere as a result of the project, and that demonstration would have to be quantified.

This was when the academic contingent of the SPEEDIER *village* became involved. Scott McCrindle and the Research and Innovation Department of Georgian College had relevant research in the works, and were focusing on greenhouse gas emissions accounting, which turned out to be ideally suited for the SPEEDIER project.

“Georgian College Research and Innovation, along with Scott, kept us focused on our core objectives,” said Marjorie MacDonald, Project Process Lead at Lakeland Solutions., “We were working with lots of different information, and Georgian was helpful in narrowing the focus, staying on a tangible, achievable GHG reporting goal. Of course, we had to be flexible because a project like this inevitably encounters forks in the road. But the end goal doesn’t change, only the path we take. We first concentrated on reducing *load*. Once we had something quantifiable to work towards with GHG, it was a lightbulb moment. Parry Sound has a net zero goal. At first, we were thinking about it from a transmission station angle, but Georgian helped us to incorporate the idea of reducing greenhouse gas emissions in the process, and the GHG reporting part of the project came together.”

The second software component was the Distributed Energy Resource Management System (DERMS) which was the control software for all demand response and market signal interaction. This was new technology that evolved through the project based on learnings during planning and commissioning.

While the SPEEDIER project used established technology, there was innovation in the design and software and integration between independent DER’s. The key to the success of this integration was more an innovation of human and organizational cooperation, integrating existing technology and putting the right software behind it, then developing a cohesive, goal-oriented plan. Many microgrid management systems are available, but GridOS® was the one eventually deemed suitable. MEMS (Microgrid Energy Management System) communicate with the DERs through direct connections or IoT and gather telemetered data from the microgrid and protection devices. This allows the microgrid to kick in when needed, identifies faults, provides protections and controls, then allows it to start back up again.

“Climate change was always on the radar,” said project process lead, MacDonald, “But this project managed to make climate change, Lakeland, and Parry Sound together, into a conversation starter” SPEEDIER had now become part of a global objective. Meaning sprang from the coming together of the many stakeholders.

This was perhaps one of the most pleasant surprises of the project, reports MacDonald. Parry Sound residents were enthusiastic about getting involved. The 50 participants in the HWTs and controllers test initiative were only part of the overall community participation. Many came forward to express support, which was part of what made the project successful. As members of the community got involved, many organizations also stepped up.

Georgian Bay Biosphere (GBB) joined the project through their environmental and climate change expertise. GBB are a charity that supports biodiversity and creates vibrant communities through conservation, education, culture, and sustainable development programming. GBB has long been concerned about GHG emissions and were already helping their member communities in Georgian Bay area. This was instrumental in involving more of the Parry Sound and surrounding community in the effort.

“If you can band together,” MacDonald reminds us, “Community climate plans can be that much more robust. The Mayor of Parry Sound was a champion who led by example, and others followed with a sense of curiosity and openness. Lakeland has also been working with some First Nations in

the area." Parry Sound is the ancestral home of the Anishinaabeg/Anishinaabek, Ojibway, Odawa and Potawatomi peoples, and the territory of the Wasauksing, Shawanaga, Magnetawan, Dokis and Henvey Inlet First Nations and is under the Robinson-Huron Treaty.

Opus One Solutions, a Canadian energy distribution and storage software company serving utilities and new business models in a decentralized energy economy. Opus's GridOS® platform supports utilities in coordinating distributed energy resources (storage, renewable generation, micro grids, EVs, and demand response) across working energy generation and transmission systems.

Georgian College is a College of Applied Arts and Technology with 13,000 full-time students, including 4,500 international students from 85 countries, across seven campuses in Georgian Bay, the largest being in Barrie. The department of Research and Innovation at Georgian is the hub for research, development and innovation, focusing on product design, prototyping, market research, analysis, testing, and e-business solution development.

Savage Data Systems (SDS) assist utility customers in their efforts to produce accurate data. SDS specializes in metering tools, meter removals, meter communication errors, and specifically data-related problems in smart grid systems.

MaRS is North America's largest urban innovation hub and a registered charity providing direct support for startups in the form of meeting spaces.

The LDC Tomorrow Fund was dedicated to financing energy research and innovation for the benefit of Local Distribution Companies (LDCs) in Ontario. The EDA is now closed but contributed to the success of SPEEDIER.

Lakeland Generation under Lakeland Holdings, along with Lakeland Solutions combined forces with Natural Resources Canada to complete remaining cast the SPEEDIER project *village*.

The Hurdles

Similar communities drawing inspiration from SPEEDIER might consider some of the hurdles the teams encountered. The first, of course, was the global event that threw a wrench into more than its share of plans in 2019, 2020, and 2021, and that was the COVID-19 pandemic.

"Don't build during a pandemic," advises MacDonald, "And don't be surprised if something changes with a vendor."

Some vendors involved changed ownership mid-project, which required a change with the HWT controllers, specifically. The change inconvenienced the project and the 50 homeowners who volunteered.

Bench testing was also more necessary, as the project team learned over time. Unexpected snags required the *villagers* to adapt on the fly.

McCrindle also cautions aspiring net zero communities: "In a project like this, you're working with existing technology, trying to make it do things it isn't designed for. You've got to be able to adapt. Someday there will be design criteria established for all technology – by design, hot water tanks, transmission and distribution networks, and electric vehicle accommodations will be more agreeable to adapting to and communicating with the newer, renewable and more sustainable

systems, but at the moment, as a rule, technology can't easily cooperate with other technology. In any project like this, be ready for those frustrations, those barriers to progress."

"Keep in mind that you're also fighting against a power structure that's been in place for more than a century," adds McCrindle, "Fossil fuel systems are an entrenched economic model more deeply rooted than any in history, so you might be fighting an uphill battle for credibility, support, and buy-in from a great variety of stakeholders."

"We learned so much," reports MacDonald of Lakeland Solutions, "We came in with limited knowledge of some of the technologies and a huge learning curve. I was continually astonished at the different ways we discovered to use technology, and pleasantly surprised at what a bunch of smart people can come up with if they agree to work together."

The Outcomes

Overall findings for the experience of the project suggest that, in any drive towards embracing and deploying renewable energy sources and sustainable practices, we do what can with what we have. We try not to double effort. We learn to shift the timeline and respond to delays. The core team is four and Lakeland has 100 or so employees who continue to support SPEEDIER's goals.

The end result of SPEEDIER was most notably a series of formulas that could be applied to each asset's activities, resulting in GHG emission reductions representing the difference between the baseline GHG profile and the emissions generated by the operation of the asset itself as an alternative. The individual data is collected, run through formatting, applied to the formulas, and used to create the outputs, which include tables, graphs and pictographs.

With permission from the author, original post available at *It Takes a Village; One Community's Path to Net Zero*