

Innovations in Ontario's Utility Sector

by Eli Angen & Binu Jeyakumar | Pembina Institute

For innovators and entrepreneurs, it is impossible to talk about the future of the electricity grid without a smile and a twinkle in their eye. The modern grid will be dynamic – finely balancing generation, load and storage – with more distributed components and higher responsiveness. There will be far greater access to information and data for generators, systems managers, energy managers and customers allowing all actors to be more aware of, and are better able to manage their energy use.

The modern grid will change fundamentally how consumers, producers and service providers interact – bringing more entities into the game, enhancing their capacity and blurring the lines between them. Its repercussions will extend beyond the realm of technology and into our social and economic behaviors.

This creates boundless opportunities for those willing to embrace it, but it also presents a potentially disruptive challenge for everyone involved, particularly large institutions. As Neetika Sathe of PowerStream says, "if you look forward, you can clearly see disruptive changes affecting the energy landscape. You can either ride that wave of change or put your head in the sand and let it hit you."

Some utilities are already working to seize this opportunity. They have started providing or are implementing services that both enable and carve the path to the modern grid. For example, Oakville Enterprises Corporation (OEC), through its distribution company Oakville Hydro, is piloting the integration of electric vehicle (EV) charging and EV battery storage capacity on the grid. London Hydro sees technology as a differentiator for the utility business. This is empowering London Hydro's customers to access information through mobile, "open data by design", Green Button enabled cloud solutions. EARTH Corporation, which owns Erie Thames Powerlines, has been rapidly expanding the services and scope of its unregulated business. Greater Sudbury Utilities is an active participant in Sudbury's Community Energy Plan and are using it as an opportunity to ensure they are an enabler of the future the community wants. For the first time in Canada, PowerStream is launching a utility-owned, virtual power plant using residential solar-storage technology in its service territory.

An increasingly important question that utilities need to ask themselves is what role they want to play in a more distributed and modernized grid.

Drivers of Innovation

There is a constellation of factors coming to the forefront right now that are forcing utilities to innovate and modernize. Some of the dominant factors include:

- **Technological change:** Whether it's talk of which jurisdiction now has renewables at grid parity, new storage technology, or the newest in smart grid technologies, it's abundantly clear that the way we generate, store and monitor electricity is changing. Some of these innovations present opportunities, while others, like rapid penetration of rooftop solar, present a more existential threat to the future of traditional utilities.
- **Changing customer expectations:** As opportunities increase for electricity consumers to have better access to information, they are demanding more options and flexibility. Many are taking on the role of "prosumers" by producing some of their own electricity, and want the ability to control their electricity storage and usage. Customer expectations are also expanding beyond simply wanting affordability and reliability, to include environmental responsibility and responsiveness.
- **Government and community mandate:** Some jurisdictions have their own principles, priorities and visions for energy efficiency, clean energy, greenhouse gas reductions and distributed

generation. Some of these are regulated changes that will force utilities to change, while others are simply local ambitions and aspirations that utilities have the opportunity to embrace.

- **Aging infrastructure:** Over the next few decades, many of the existing electricity network components will be reaching their end of life. At the same time, most of the capacity in the system is oversized to deal with peak demand. All of this creates an incentive for better asset management and reconsidering some of the traditional operating philosophies.
- **Risk of reduced role in future market:** If utilities don't adapt to the changing electricity system, they face the risk of their market share and role diminishing over time. There are non-utility actors that are joining markets to provide services such as installation of solar panels, applications for monitoring energy usage and energy efficiency technologies.

Innovative Services and Business Models

There are several opportunities for diversifying and modernizing the services that utilities provide. The opportunities for innovation fall into three broad categories:

1. Clean Technology and Distributed Generation

Recognizing a growing public interest in the transition to greener sources of energy and to reduce energy consumption, leading-edge utilities are offering services that include:

- **Micro-generation:** This can include some, or all, of the engineering, installation and maintenance of rooftop solar panels, micro-hydropower units, small-scale wind facilities and geo-exchange systems. These systems could be owned and installed by the utility or by the consumers. There are also enabling technologies that utilities can invest in, such as multi-metering for condos to allow individual condo owners to invest in solar panels and manage their own consumption.
- **Electric vehicle charging infrastructure:** The trend to electrification is growing broadly, and EVs are a good example of where this trend has the greatest overlap between utilities and customers. As EVs grow in popularity, the demand for charging facilities is also going up – both within households as well as public charging stations. In response to this demand, the Ontario government recently announced a \$20 million investment into building more public charging stations. There is room to innovate in terms of vehicle-to-grid and vehicle-to-house technologies, where EVs can be used as storage for the grid and the household.
- **Energy storage:** While energy storage is just hitting commercial viability for both customers and grid level application, it creates a host of opportunities to stabilize the grid as more variable and distributed electricity generation comes online. In addition, it can enable more efficient use of existing infrastructure by enabling load shifting and relieving bottle necks. Utilities could play a role in developing large-scale as well as small-scale (residential or sub-municipal level) storage.
- **Energy efficiency:** Whether this is municipalities broadly implementing LED street lights, or customers accelerating the adoption of energy efficient appliances, utilities have been given a mandate to focus on conservation measures.

Oakville's geo-exchange projects

Through its affiliate, Sandpiper Geo-Exchange, Oakville is now offering turnkey projects for new homes where they can install customized metering, a geo-exchange unit for heating, and solar panels for electricity. They are able to leverage their existing expertise in metering and electrical connections along with new technologies to offer customers comprehensive and sustainable home comfort packages.

2. Information and System Management

The potential of improved information and system management is slowly being realized as utilities increase their sophistication in collecting and using data from and for their customers. This capacity is critical in understanding and, and influencing change in energy consumption behaviour.

- **Data access:** The rapidly increasing availability of data from all parts of the electricity system (including smart meters) is enabling utilities to rapidly expand the amount of information they have, but also presents an opportunity for much greater engagement of their customer base. Using the Green Button standard helps set up utilities and other actors, to take advantage of this data and continue to innovate on its application and usability.
- **Fault detection and mitigation:** Faster-responding and higher-sensitivity technologies are being developed to help with fault detection and repair of grid components. With many network components reaching their end of life in the next couple of decades, these detection and mitigation technologies can help with asset management as well as improve grid reliability. In addition, as new transmission infrastructure is built for new renewable generators, there is an opportunity to equip them with sensors and other communications and data processing equipment.
- **Demand response:** Traditionally the supply of power has been dictated by the demand on the system. But now, technologies are available to allow utilities to adjust generation and demand. This can include aggregating control of loads at the customer level such as water heaters and refrigerators, or, working with and incentivizing large industrial users to curtail demand.

London Hydro's Digital Transformation

London Hydro has adopted a digital strategy for customer engagement by promoting energy management self-service. London Hydro's digital transformation includes moving to the cloud, mobile first and embracing the Green Button Standard.

ERTH Corp's Utility 2.0 journey

Two-thirds of the company's revenue is generated in its unregulated businesses, offering services such as billing and customer care, retailer settlements, traffic control and LED street lighting, high voltage construction, and installation and maintenance of renewable generation. ERTH is active across Ontario, as well as in other provinces, the U.S. and Australia.

3. Service Provision

Utilities have a wide range of customers: commercial entities, individual homeowners, municipalities, as well as other utilities. Innovation is happening in two ways: in how the utilities interact with their stakeholders, and as how they operate internally.

- **Providing enabling services:** Utilities are exploring what types of value-add services they can provide that enable other actors. For example, some are developing innovative billing services that they can provide not just to their direct customers but also to other utilities. Many of these data-related projects enable different programs such as energy efficiency initiatives.
- **Engaging customers in pilot projects:** Rather than the customer being a static actor, some utilities are engaging their customers in pilot programs that result in learnings for both the customer and the utility. This strategy also enables the utility to manage risks when considering adding a new service or program.
- **Different asset ownership and capital investment models:** There is room to further redesign the relationship between the actors in the local distribution system. For example, traditionally utilities have had complete ownership of their generating assets, but now they can also share equity or ownership with co-operatives or individual customers. At a larger scale, municipalities could attract capital investment from private service-provider companies for infrastructure projects in return for long-term service contracts.

Pre-conditions and Enablers

There are several internal characteristics and behaviours that are common across the utilities leading the way on this path to innovation.

- **Compelling vision and long term planning:** Given the long-term operation of their assets, utilities have both the need and opportunity to engage in long-term planning. This can build the foundation for a clear and compelling vision for the organization, or the region it is operating in, to help focus on strategies for change.
- **Entrepreneurial leadership:** Innovation requires an increased tolerance for risk and the ability to identify opportunities that others might not see. This requires a shift away from the traditional mode of operation for utilities, which is more risk-averse and primarily concerned with ensuring reliable service provision. Organizations that are able to attract competent, creative and entrepreneurial people to their workforce, better position their leadership to innovate and address emerging opportunities.
- **Holistic functions for departments:** For organizations to be nimble they should ensure that all departments are connected to the core mission as well as being committed to innovation. For example, the IT department should be expanding its function beyond maintaining the company's hardware and software to include managing information for the company and the customers, and to strategize on the best ways to improve the access, currency, security, reliability, flow, and utilization of information.
- **Developing strategic partnerships:** Another way to attract the new knowledge, skills and attitudes needed for a transition is to partner with the right external organizations that can bring the expertise to the organization.
- **Leveraging reputation:** Most utilities have a long history with their customers. This can provide a loyal customer base, and reputation for reliability. This better enables them to recruit customers for new programs, while a new entrant to the market might find this more difficult.

Greater Sudbury Utilities 10-year plan

GSU is working with a business transformation consultant to develop and implement a 10-year plan that has identified several programs and activities. The long-term horizon allows them to consider aspirational ideas such as self-healing grids. They are also trying to match their plans with Sudbury's Community Energy Plan.

PowerStream's Micro Grid Demonstration Project

In partnership with the Korea Electric Power Corporation, PowerStream is implementing a microgrid initiative covering 400 customers. PowerStream also has a microgrid demonstration project at its Vaughan office that integrates EV-to-home technology - where an EV acts as battery storage and supplies power to the building when needed.

Challenges

There are a few challenges and barriers that make innovation harder and at times prevent utilities from modernizing their services:

- **Misaligned incentives:** Even when a utility is interested in pursuing innovations, the incentives that are built into the regulatory framework can be a barrier. Generating assets result in direct returns that are easy to quantify. Improvements and new initiatives in customer service, for example, may be harder to quantify, and potentially more difficult for the OEB to approve.
- **Lack of clarity on what is permissible:** As a regulated utility there are limits on what kinds of activities can be undertaken, but there is currently a lack of clarity on precisely what those limits are. Some utilities have focused on their unregulated groups to push forward with innovative ideas, while others have done that from within their regulated business. This lack of clarity holds

many utilities back from taking on new initiatives. There is also uncertainty on whether some of the new programs utilities are trying will continue to be permissible in the future.

- **Integrating different types of businesses:** Utilities typically encompass a wide range of business units and cultures: Regulated and unregulated divisions, unionized and non-unionized workforce, local and international/national services etc. This inevitably leads to challenges in communication, isolation of departments and groups from each other, and conflicts in mandate. These can all hinder the ability to change and adapt the organization.
- **Cost to customers:** Many of the innovations outlined previously require an initial capital investment – sometimes by the utility, and sometimes by the customer. This can be in conflict with the customer expectation of cheap power, and it can be complicated for a utility to articulate the benefits that accrue throughout the system from these innovations.
- **Changing risk tolerance:** Utilities are traditionally risk-averse. Many of the investments in grid modernization involve higher levels of risks and uncertainties in their initial adoption. They need the board and leadership to be willing to embrace higher risks coupled with the work of sound risk analysis and decision-making.
- **Extended timelines to create sustainable change:** Developing the right knowledge base, competencies and attitudes as an organization and as individuals takes time. Particularly, the mindset shift and new organizational structures and functions need to have complete buy-in of the employees.

The path ahead

While there is a long transitional journey ahead, with unforeseen challenges, there is a world of opportunity waiting. The time is ripe for utilities to make the transition in their external services as well as their internal structures. They are located at the nexus of generation, consumption, and information – and are therefore in the best position to drive the modernization of the electricity grid.

Acknowledgements

This summary was developed based on information gathered from some leading-edge utilities in Ontario: London Hydro, PowerStream Inc., Greater Sudbury Utilities Inc., Oakville Enterprises Corporation and EARTH Corporation. Credit is also due to the Advanced Energy Centre at MaRS for their guidance.