
Canadian Electricity Association
Association canadienne de l'électricité
ELECTRICITY INNOVATION
2019

INNOVATION
IS HAPPENING ACROSS CANADIAN ELECTRIC UTILITIES

Every year, the Canadian Electricity Association (CEA) celebrates electric utility innovation and cutting-edge technology. The pace of change across the electricity industry is as great as it has ever been. Our sector is looking ahead to an unparalleled era of innovation and investment.

LED lights, smart thermostats and energy efficient appliances are technologies readily visible to consumers. These have obvious benefits for the user, but also help the grid overall. However, innovation is happening in ways that consumers can't always see. New technologies are rapidly changing the way electricity is generated and distributed.

This year, CEA is proud to celebrate 27 innovative projects from electricity generation to customer usage. These projects will positively impact the lives of Canadians and help shape our collective energy future.

PROJECTS

PROJECT 01 alectra

ADVANTAGE POWER PRICING

This project offered customers the chance to voluntarily sign up for one of three electricity pricing alternatives to reduce their electricity costs.

Conducted with the support of the Ontario Energy Board (OEB) and IESO, this was a resounding success: it gave 9,000 consumers a level of choice unprecedented in Ontario's electricity system and resulted in noticeable bill savings for many participants while helping Alectra manage peak load and encouraging the adoption of new technology.

Tailored for EV owners, the "Overnight" model offered significantly reduced overnight electricity rates (when incented to charge their EV) in exchange for a higher On-Peak rate. Results show substantial decreases in consumption during On-Peak hours and substantial increases during Off-Peak hours. This model could result in the following customer, grid, and environmental benefits.

1. Cutting charging costs by approximately 80% makes it more affordable to own an EV. With the transportation sector accounting for 25% of Canada's 2016 emissions, projects like APP could help increase EV uptake, thereby reducing Canada's GHG emissions.
2. Results demonstrated that voluntary pricing can significantly reduce peaks which could defer or eliminate the need for future investments if expanded at a larger scale. An expanded APP could also address surplus base load generation.
3. APP helps utilities understand how customer choice, energy literacy, and other factors may lead to changes in customer behavior, helping them shape future energy services.

PROJECT 02 ATCO

ALBERTA POWERLINE BUILDS CANADA'S LONGEST 500-KV AC TRANSMISSION LINE

Alberta Powerline (APL), a partnership between Canadian Utilities, an ATCO Company, and Quanta Services Inc., energized the Fort McMurray West 500-kV Transmission project three months ahead of schedule, on-budget, and with three million person-hours with zero lost time events. This 508 km transmission line, running from Wabamun Alta, to Fort McMurray will provide essential electricity, greater reliability, and enhance the transmission system to meet growing demands in northern Alberta. This project is the longest 500-kV AC transmission line in Canada and was ranked among the top 50 infrastructure projects in Canada.

Innovative Engineering Design:
APL designed and is utilizing fit-for-purpose guyed V towers instead of conventional transmission towers to build many sections of the Fort McMurray West 500 kV Transmission Project. The new design decreases construction time for each structure and reduces overall material and construction costs of the project.

Strengthening the grid through partnerships:
APL held more than 3,000 face-to-face meetings, engaging with people in an open and transparent manner and incorporating the feedback into route and construction plans. APL also undertook extensive consultation with Indigenous communities and engaged them as active participants in the project through significant contracts.

Protecting the Caribou:
APL is committed to the protection of the Woodland Caribou, which is a threatened species important to Alberta's biodiversity and plays a central role in the cultures and histories of Indigenous communities near the project.

PROJECT 03 ATCO

FORT CHIPEWYAN RENEWABLE MICROGRID

ATCO and Fort Chipewyan Indigenous Partners are installing the largest ever off-grid solar-and-storage microgrid project in Canada, reducing the community's reliance on diesel generation. Athabasca Chipewyan First Nation, Mikisew Cree First Nation and Fort Chipewyan Métis Local 125 have formed Three Nations Energy (3NE) to own and operate a 2200kW PV solar farm. Coupled with an ATCO-owned (phase 1) 400 kW PV solar array, a (phase 2) 1500 kWh battery storage, and microgrid controls, the project will provide 25% of the community's electricity needs, reducing diesel consumption by 800,000 L annually and cutting 2,170 tonnes of CO_2 emissions per year.

The project demonstrates an innovative partnership model for how utilities and Indigenous communities can together create a clean energy future.

The lithium-ion battery and microgrid controls are critical to system reliability and stabilization during fluctuations of solar output. Furthermore, the battery will store excess renewable energy produced during sunny days in the spring and summer, continuing to offset diesel consumption during cloudy and evening periods.

Other project benefits include improved air quality, reduced noise, increased road safety by reducing diesel tanker trips, creation of local construction jobs, and training and growing community capacity for future renewable energy and energy efficiency projects.

PROJECT 04 Capital Power

ADVANCING CARBON CAPTURE, UTILIZATION AND STORAGE

Carbon Capture, Utilization and Storage (CCUS) is widely recognized as being a necessary part of the long-term solution for achieving national and global climate policy objectives. Capital Power has invested in C2CNT, a CCUS technology that captures carbon dioxide (CO_2) from industrial process streams and transforms it into a valuable product called carbon nanotubes. Carbon nanotubes are conductive, stronger than steel, lighter than aluminum, and have multiple applications across industries to enhance various materials.

CCUS technologies will enable zero or near-zero emission natural gas generation to help integrate more renewables into a reliable and affordable power systems and reduce emissions from the many industrial processes that will continue to rely on natural gas.

By converting carbon into a range of useful and valuable products, CCUS will also create new jobs and employment opportunities in multiple sectors.

C2CNT will be a transformative technology in the materials sector which together can make a significant step towards achieving shared climate policy objectives.

As one of five finalists in the natural-gas track of the NRG COSIA Carbon XPRIZE competition, C2CNT is building a demonstration plant at the Alberta Carbon Conversion Technology Centre (ACCTC). The ACCTC, funded with support from the governments of Canada and Alberta, is hosted at the Shepard Energy Centre (co-owned by Capital Power and ENMAX).

PROJECT 05 ENMAX

CANADA'S FIRST HYBRID ELECTRIC GAS TURBINE

What do you get when you bring natural gas turbines and batteries together? Flexibility in how electricity is produced and offered to the market, with significantly lower emissions.

With the addition of a new 10 MW, 4.3 MWh lithium-ion battery to an existing natural gas turbine at its Crossfield Energy Centre, ENMAX will install Canada's first hybrid electric gas turbine.

This innovative solution will enable ENMAX to have the turbine at the ready without using any fuel - similar to a hybrid car which idles with zero emissions at a red light, and then uses both the battery and engine to accelerate to full speed when the light turns green.

The result is an estimated reduction of 274,00 tonnes of GHG emissions per year, the equivalent of removing 59,500 cars from the road annually.

To help make this project a reality, ENMAX participated in Emissions Reduction Alberta's Industrial Efficiency Challenge. From a field of 93 submissions, the Crossfield Hybrid Electric Gas Turbine was one of 11 projects recognized for its potential to significantly reduce greenhouse gas emissions in the province.

PROJECT 06 ENMAX

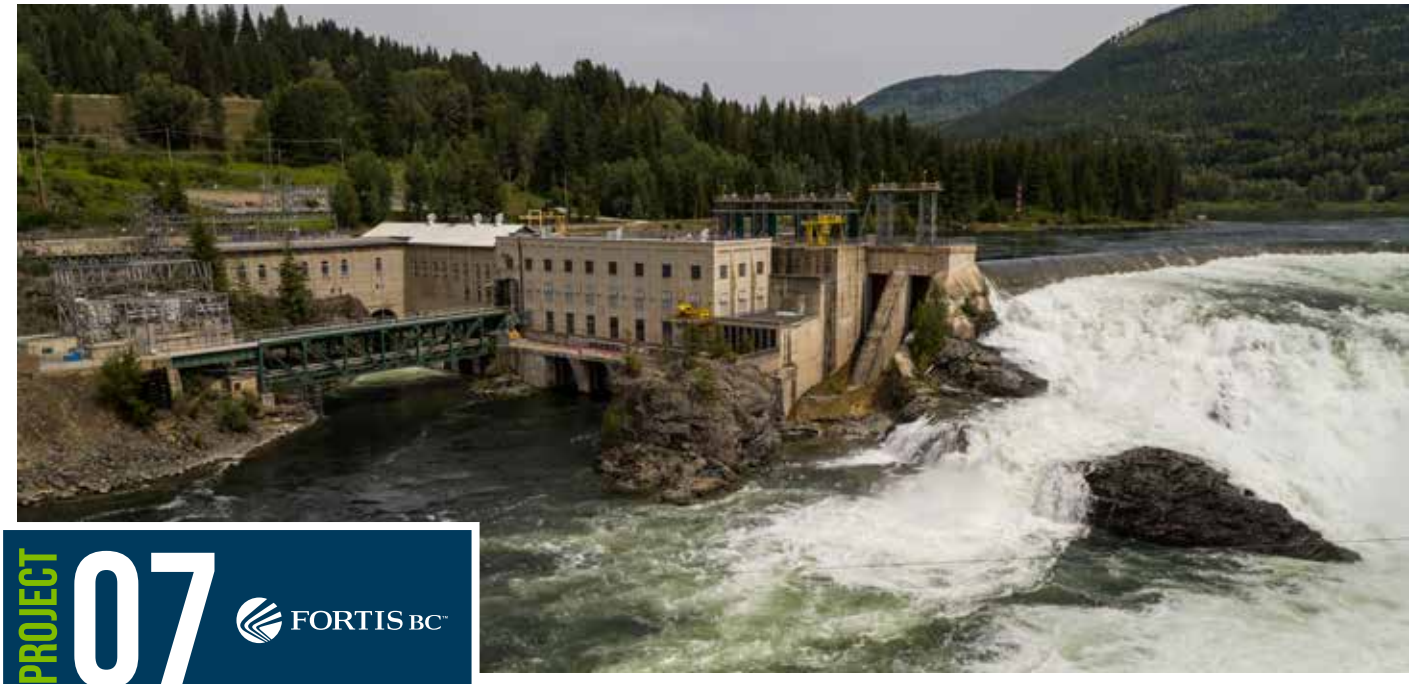
FINDING AN ANSWER TO URBAN GRID LOCK

While energy consumers on Calgary's standard distribution network have been able to generate electricity from solar and sell power back to the grid for roughly a decade, in Calgary and many urban settings across North America, there is also a highly specialized and reliable secondary network that doesn't allow for two-way power flow.

ENMAX is the first utility in Canada to propose a solution to this unique type of 'grid lock'.

With funding from Natural Resources Canada and Alberta Innovates, ENMAX is demonstrating how innovative modifications to the network's highly specialized hardware, software and communication systems could allow for two-way power flow on a segment of the grid that has not historically been able to support it.

By advancing this technology, ENMAX will give customers in urban settings more choice – unlocking the potential for further small-scale clean energy generation not only in Calgary, but in other cities that face the same challenges.



PROJECT 07

FORTIS BC™

UPPER BONNINGTON REFURBISHMENT PROJECT

Carefully maintaining existing assets is one of the ways Fortis BC works to keep rates lower for customers while providing clean energy.

An example of this is the five-year, $30 million program to refurbish the Upper Bonnington Generation Plant to ensure the facility continues to provide safe, reliable and clean energy into the future. West Kootenay Power, now FortisBC, built the plant in 1907 with two units to support the region's booming mining industry. They added two more units in 1916 and two more in 1939. All of these units continue to operate today.

This refurbishment project will extend the life of the facility for at least another 20 years. It will also provide protection measures and controls to meet modern standards.

As part of the project, Fortis BC will replace the auxiliary systems that run the units and refurbish many of the core components, so even after this refurbishment, some of the original components such as the original turbines, rotors and shafts will remain in service.

The plant was recently recognized internationally for being in continuous operation for over 110 years. It was selected from a pool of 100 plants worldwide for the 2018 Hydro Hall of Fame.

PROJECT 08 hydro one

BATTERY ENERGY STORAGE SYSTEM FOR RELIABILITY IMPROVEMENT

A First Nations community in Northern Ontario has suffered from historically poor reliability. This is the result of a very long radial supply from the upstream transmission and distribution systems. The nature of the supply to the community limits the viable options available to improve the community's reliability.

Historically, only 1% of all outages affecting the community occurred within the community itself. As a result, the community is an ideal candidate to have its reliability improved through the installation of an islanding Battery Energy Storage System (BESS).

This project will install a 1.5MW / 3MWh BESS on the feeder supplying the First Nations community, allowing it to be islanded and supplied via the BESS during an upstream supply outage.

The BESS will greatly improve reliability to this First Nations community. The anticipated improvement based on outage history and forecasted community energy requirements is greater than 60%.

As this will be the first Hydro One owned BESS, this project will lay the groundwork for other such installations on Hydro One's system. There are over 80 First Nations communities and numerous others with poor reliability that could benefit from a BESS.

PROJECT 09 Hydro Ottawa

FIRST UTILITY IN CANADA TO DEVELOP A SMART SPEAKER SKILL

Hydro Ottawa has released its own Smart Speaker skill, compatible with both Amazon's Alexa and Google Assistant. Customers are now choosing how they want to interact with companies. This has resulted in more innovation from those looking to stay relevant and provide customers with the access they desire.

While many users initially invested in smart speakers primarily to listen to audio, these users have started to make use of the voice-activated digital assistants like Alexa and Google Assistant. Now, customers can access their Hydro Ottawa account with a simple command. This means customers have open access – 24 hours a day, 7 days a week – to Hydro Ottawa.

Hydro Ottawa's Skill is designed to answer some of the most common questions customers ask. After asking the voice-activated digital assistant to "Open Hydro Ottawa", customers can ask "What is the current price of electricity?" to learn current time-of-use rates, or ask "Do you have any conservation tips?" to learn how to best save energy at home. Customers can also access outage information and information about their own electricity bill by connecting to their account. Customers can also access this information anywhere they can access Alexa or Google Assistant – on their phone, tablet, in their car – and more options are becoming available every day. This will allow the company to further develop and adapt to what customers are asking for, making this endeavour one that will grow and evolve with its customer base.

PROJECT 10 Hydro Ottawa

MIGEN TRANSACTIVE GRID

For the electricity grid to grow and evolve it needs to move away from a traditional, centralized system to one that is supplemented by consumers and communities. Hydro Ottawa's MiGen Transactive Grid is a trial project that represents the future energy marketplace – one in which consumers generate more of their own power, store electricity, share with connected neighbours and send excess energy back to the grid.

MiGen is a complete end-to-end microgrid that optimizes management of energy sources and loads using Artificial Intelligence and a Transactive Energy Market. It will also include a loyalty program to encourage customers to make sound energy management decisions. MiGen promotes consumer-generated renewable energy, effective grid management, and resiliency.

The benefits are many:

- Reduction in greenhouse gas emissions and achievement of net-zero carbon communities
- Greater resiliency and flexibility of the electricity grid with the adoption of solar energy battery storage, and smart technology
- Ability to support increased demand
- Reduced investment in traditional grid infrastructure
- Fosters continued innovation

MiGen started with partial funding from the Ontario Smart Grid Fund and the LDC Tomorrow Fund, plus support of seven collaborating academia and industry partners. New partners have joined the MiGen Team to grow the platform capability. Learn more at hydroottawa.com/MiGen

PROJECT 11 Hydro Québec

ELECTRIFICATION OF TRANSPORTATION

Revolutionizing the transportation of tomorrow
By developing innovative battery and motor technologies for EVs, setting up a network of public charging stations and producing clean, renewable power, Hydro-Québec is actively involved in the electrification of transportation. In Hydro-Québec's view, promoting electric transportation supports decarbonization efforts in Québec.

Canada's first public charging network
The Electric Circuit is Canada's first public charging network for EVs. It offers both 240-volt and 400-volt charging stations throughout Québec and in Eastern Ontario.

It has rapidly expanded to many regions of Québec and continues to expand into new urban areas. There are now close to 2,000 stations.

Drivers can now travel worry-free, knowing they can top up their batteries on the road if needed.

The Act to promote the establishment of a public fast-charging service for electric vehicles was passed in June of last year. This new legislation authorizes Hydro-Québec to use revenue from the increase in electricity sales generated by charges carried out primarily at electric vehicle drivers' homes to fund the installation of more fast-charge stations. Electricity rates will therefore not be affected.

The Electric Circuit has announced that fast-charging stations will be deployed more quickly starting this year with the rollout of approximately one hundred new fast-charging stations. Over the next 10 years, 1,600 new fast-charging stations will be deployed across Québec.

In addition, Natural Resources Canada provided a first phase of financial assistance for the project.

PROJECT 12 ieso

A NEW APPROACH TO CYBERSECURITY

The IESO recently became the first system operator in North America to have accountability for providing cybersecurity-related services to the broader electricity sector under a new mandate from the Ontario Energy Board. This includes working with transmitters and local distribution companies to facilitate the sharing of centralized cybersecurity information.

To increase IESO capabilities and help fulfill this new mandate, the IESO recently launched a new security operations centre. The centre provides actionable information in a near real-time capacity, 24/7, which will help to ensure that any threats targeting data, assets and infrastructure are dealt with before widespread damage and disruption can occur across Ontario's system.

The IESO has established a relationship with the federal Communications Security Establishment (CSE) to bridge the international capabilities of the CSE to support efforts to defend electricity infrastructure. This will give the IESO global insights into trends, patterns and prior warnings.

The most exciting part of this partnership is an initiative known as Project Lighthouse. Lighthouse is a multi-phase project designed to raise the situational awareness of cyber threats to electricity companies within Ontario and enable more timely action and response to cybersecurity threats. The initiative will deliver capabilities to analyse internet-based data from generation, transmission, and distribution companies to both predict and identify cybersecurity attacks. It speaks to the value of collaboration – now, local utilities and generators are supported by IESO at a provincial level and CSE at a federal and international level.

PROJECT 13

London Hydro

SHAPING CUSTOMER EXPERIENCE USING REAL-TIME CONTROLS AND GREEN BUTTON (YOUTH PROJECT)

In partnership with the Ontario Energy Board (OEB), London Hydro was the first Local Distribution Company to implement a customer engagement program that combines quick ramp-up critical peak demand response events and 'behind the meter' energy management tools that help customers understand energy impacts in real time, powered by Green Button. The Trickl mobile app was developed to upgrade the existing customer engagement to a personalized level. It consolidates in-home device control and energy monitoring, energy efficiency advice and demand response.

This program was implemented for approximately 1,600 participants which were divided into three observation groups.

The first group focuses on impact and behavioral deviations study of digitally engaged customers in relation to real time energy consumption information availability. For the second and third group, we combined the real-time and demand response capabilities to determine whether a pricing incentive consisting of a short duration quick ramp Critical Peak Price in combination with a discounted off peak rate, provides sufficient motivation for customers to agree to short duration automated load control activities.

The very positive results showed that over 85% of participating customers actively participated in the automated demand response events with an average of 4 event overrides per event. The Interim report illustrates great customer engagement; 5% on-peak energy savings and 3% mid-peak energy savings were achieved by the customers in the summer period (first 6 months of the program).

PROJECT 14

Manitoba Hydro

ADVANCED PROBABILITY TOOL FOR RISK-BASED PLANNING/ PRIORITIZATION OF TRANSMISSION INVESTMENTS

Manitoba Hydro developed the System Reliability Risk Model - a new method of quantification that factors in system complexity - in order to address some industry challenges. This tool compares the impact on reliability by considering potential single and simultaneous failures on the related system network. It factors in the system topology, load data (e.g., peak, duration curves and load forecast uncertainty), equipment reliability data, and network specific conditions (e.g. tapped lines, special protection schemes, common-mode outages, etc.), to calculate expected probabilistic indices expressed in terms of MWh/year.

It includes four different modules tailored to capture the reliability risks associated with different segments of the transmission network that may be required to avoid violation of network thermal and voltage reliability criteria. In each case, the expected value is determined by weighing the probability and consequence of the potential system states resulting from the various failure events. These indices provide a means of monetizing transmission reliability risk within the corporation's value framework that's used for prioritization of investments.

This tool is currently in use at Manitoba Hydro. Other entities have requested additional details on these methodologies, including the CEA, the North American Electric Reliability Corporation (NERC), Saskatchewan Power Corporation and BC Hydro. Even further, at the request of CEATI Manitoba Hydro has developed a guideline for the risk management of substation equipment and apparatus to address various challenges and uncertainties that the power industry is facing.

PROJECT 15 Manitoba Hydro

CONTROLLED SWITCHING FOR ENERGIZING LARGE TRANSFORMERS

Residual magnetic fields found in large transformers can make energizing them a tricky business. The resulting voltage depressions and harmonics can lead to flickering lights, equipment damage and even widespread outages for customers.

Special circuit breakers with pre-insertion resistors can reduce the problem, but don't eliminate it. They are also expensive, getting hard to replace at 230 kV and below, and require frequent maintenance.

To solve this issue and to reduce costs, Manitoba Hydro investigated the application of controlled switching (also known as Point-on-Wave (POW) switching) — a relatively new technology that can safely energize large power transformers using standard circuit breakers.

Manitoba Hydro applied state of the art transformer modeling techniques and learned that the standard approach of using capacitor voltage transformers for measuring remnant flux inside the transformer was not accurate enough.

These modeling techniques and study approaches were enhanced for the case of parallel HVDC converter transformers. This allowed two HVDC converter transformers connected in parallel to be safely energized using controlled switching — a world first!

Other utilities can now save potentially millions of dollars by using transformer controlled switching with confidence, knowing that Manitoba Hydro has thoroughly investigated, tested, and successfully implemented this technology.

PROJECT 16

Énergie NB Power

DISPATCH-ABLE WATER HEATERS V1.0

Servicing a winter peak requires a substantial amount of energy from power plants. If not managed properly, the high load issue would require NB Power to spend large sums of money on building new plants in the future. To avoid that outcome, this project is aimed at deploying controllable water heaters to respond to high load situations. Most water heaters use approximately 3 kW power when heating and NB Power rents most of those across the province. Having the ability to control that load during a peak would help lower operating costs and improve grid flexibility.

Winter peaks only occur roughly twelve times a year so customers do not need to worry about frequent utility intervention. In addition, NB Power water tanks are resilient and have short recovery periods. A load reduction event would only last 2 hours. The goal would be to ensure customers have hot water before, during, and after a peak event.

NB Power is working to develop a low cost control solution for the utility. The team was deeply involved in shaping business requirements that went into an RFI. In addition, the team worked on installing controllers in the Energy Smart Innovation Lab for testing, and documenting installation and commissioning challenges.

The team plays an important role in evaluating the technologies selected from the RFI process. The technologies will be tested for safety, performance, and the ability to respond to peak load demand in the Lab.

PROJECT 17

Énergie NB Power

RF METER READER EVALUATION (YOUTH PROJECT)

The goal of this project was to analyze the accuracy of an RF meter reader and to document installation and commissioning challenges with the product. It is a plug-in 120V device that reports energy using a utility meter. By receiving the RF broadcasts the meter sends out, the device can capture usage which is used to produce a graph of the daily power demand. All this information is stored in a cloud environment and can be displayed using the vendor's android/iOS App.

The device could potentially be used as a low cost measuring device for lab testing or perhaps to report customer electricity consumption. The test consisted of attaching three electric loads to a test bed where they can be measured by a utility meter and a PLC system.

A load profile was created for the loads to turn them on and off automatically based on a daily schedule. In addition to the PLC, a high resolution data acquisition system received the meter's broadcasts.

Two main comparisons were made, one between RF meter reader's data and the data acquisition system readings and the other between the PLC's measurements and the data on the App.

Initial testing was completed in April 2019 and reflected positively on the device. Testing a product in the Energy Smart Innovation Lab is a significant step for NB Power in launching a new technology or a customer facing program.

PROJECT 18

Énergie NB Power

Nova Scotia POWER
An Emera Company

COLLABORATIVE SMART GRID INNOVATION

Nova Scotia Power and NB Power are joining forces on a potential Collaborative Smart Grid Innovation Project that will deploy and test new digital energy technologies in the residential, commercial, industrial sectors on the two provincial grids.

It's a unique partnership between two Canadians provincial electrical utilities. They will deploy and test numerous solar, battery, EV smart-charging and smart thermostat technologies, looking to optimize each technology's benefit to customers and the grid. Both utilities will deploy the same full-spectrum control software, tailored to their individual priorities.

To maximize learnings from the project, each will focus on different aspects of testing, then share the results.

Nova Scotia Power will explore how customers and the utility can benefit from EV smart-charging, and combined distributed solar and battery resources. The solar/battery initiative will focus on commercial and industrial customers. NB Power will examine how different combinations of roof-top solar, battery, time-varying rates and smart thermostats can benefit residential customers and the utility. Both utilities will use slightly different approaches and offerings to test customer engagement with, and benefit from, community solar gardens.

PROJECT 19

OAKVILLE HYDRO

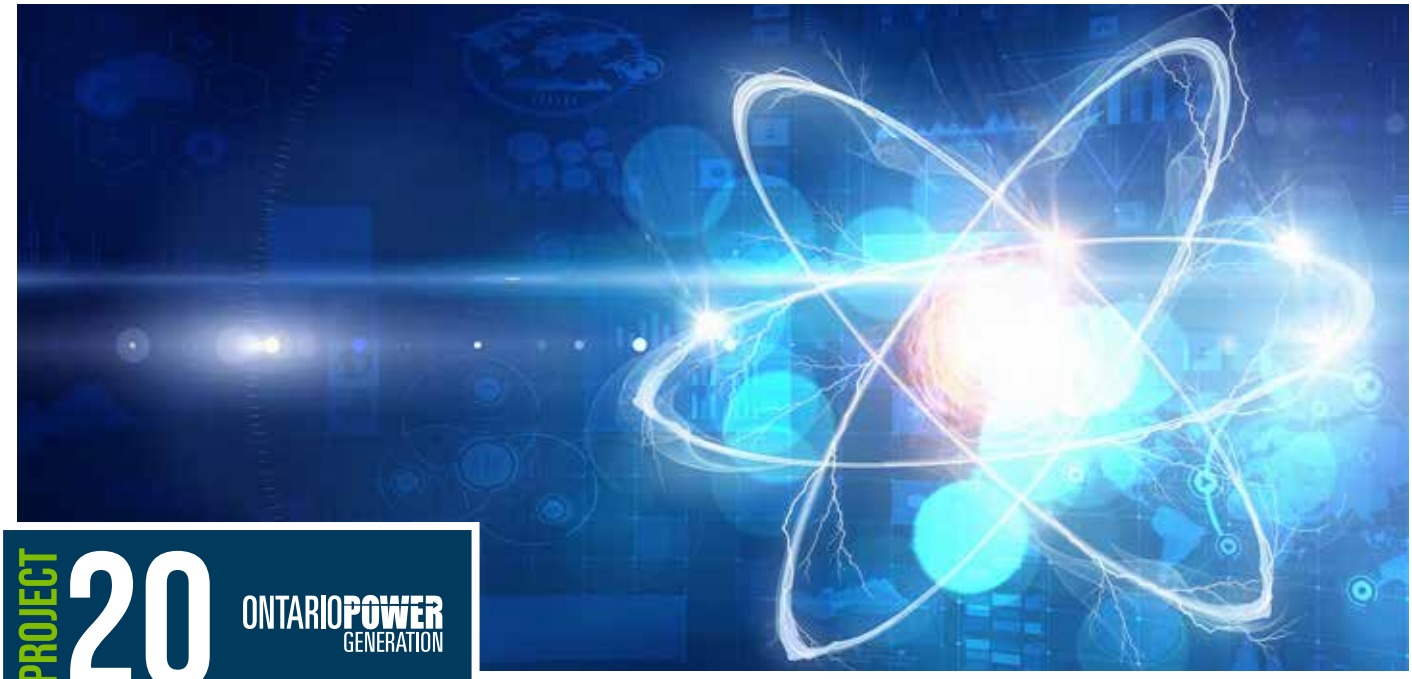
GRID INTELLIGENCE

In today's society, homes, businesses and institutions rely on electricity for the most basic of functions. Unscheduled outages can cause major inconvenience for some, lost revenue for others. From home heating, cooling and appliances, to computer systems, Wi-Fi and even most landline-connected telephones, electricity is essential for residential and business customers. It is no surprise, then, that public frustration with outages can be high, resulting in a barrage of angry tweets, comments and social media posts. Today's utilities need innovative solutions for faster, more effective outage response. Distributed grid intelligence can be part of the solution for meeting stakeholders' expectations.

Oakville Hydro's key innovative solution involved the implementation and application of a highly complex distributed grid intelligence for the electrical network.

Through advanced sensors, this network automatically responds to changing electrical grid conditions without manual intervention, restoring electricity to customers in seconds. Building this network allowed for replacement of near end of life equipment, with automated switching devices. It was an opportunity to deploy smart grid intelligence at the local municipal level to deliver maximum customer impact.

Now, when an outage occurs, the switching devices are able to detect a loss of power and automatically reconfigure the grid to an alternate supply point, allowing for almost immediate power restoration and no human intervention.



PROJECT 20 ONTARIOPOWER GENERATION

LEADING THE EFFORT TO BRING SMALL MODULAR REACTORS TO CANADA

Small modular reactors are the next evolution of the nuclear industry. Designed to provide reliable, carbon-free energy, they are smaller in size than traditional reactors but based on the same science.

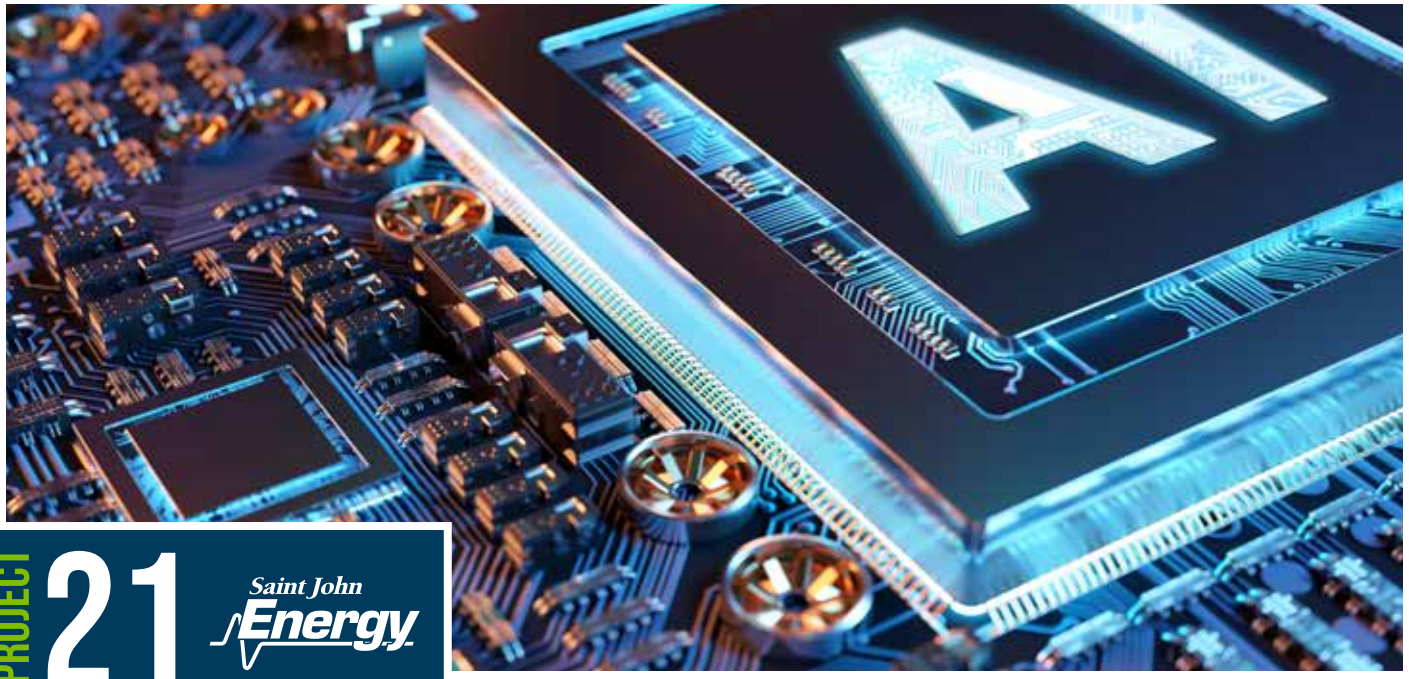
SMRs are a reliable alternate energy source to fossil fuels, and a source of energy that does not emit GHGs. SMRs could enable renewables and help achieve Canada's climate change goals.

OPG has been leading the effort to bring SMRs to Canada. In collaboration with industry representatives, OPG staff were key contributors to the development of the "Canadian SMR Roadmap" which set the vision and framework for the potential deployment of SMRs.

With a history of 50 years of safe nuclear operations, proven operations and project management success, SMR vendors are seeking the advice of OPG's skilled and experienced employees.

OPG is collaborating with leading SMR vendors like NuScale and Global First Power (GFP), both of which are working to deploy ground-breaking SMR technologies. Recently, OPG's work with GFP led to the achievement of a significant milestone: submission of the first-ever regulatory licence application in Canada for an SMR.

OPG has the experience and versatility to lead the advancement of SMRs. OPG is already a leader in clean energy generation, with a portfolio that is more than 90% free of smog and carbon emissions. Adding SMRs is another positive step in OPG's multi-technology approach to a cleaner future.



PROJECT 21

Saint John Energy

SMART ENERGY - NRCAN SMART GRID DEMONSTRATION PROJECT

Natural Resources Canada (NRCan) Smart Grid Pilot is an advanced demand response project looking to leverage Artificial Intelligence to reduce the peak.

The NRCan Smart Grid initiative is aiming to demonstrate that weather forecasting and other relevant data can be correlated with the utility load shape such that system peaks and valleys can be accurately predicted in advance. The project also utilizes several Distributed Energy Resources (DERS) that will help reduce system peak and greenhouse gas emissions.

Benefits:

- Develop monthly system peak prediction and resource scheduling via artificial intelligence and machine learning
- Reduce the provincial system peak load and associated demand charges for Saint John Energy
- Leverage both residential, commercial, and utility assets - share benefits with end consumers
- Reduce GHGs - benefits the provincial grid
- Develop export potential - Integrated System Manager (AI) could be leveraged by other utilities
- Establish the foundation for an innovation centre in Saint John with post secondary institutions

PROJECT 22 SaskPower Powering the future®

THE PROVINCIAL PUBLIC SAFETY TELECOMMUNICATION NETWORK

After extensive study, SaskPower reached an agreement with the former Ministry of Corrections and Public Safety and the RCMP, that is "The Provincial Public Safety Telecommunications Network (PPSTN)" – a public safety radio network managed through the partnership between the three entities. PPTSN provides public safety organizations, such as fire departments, police services, emergency medical services, emergency preparedness and rescue groups with interoperable radio communications that facilitates effective communication between these organizations during times of emergency.

The growing network of nearly 8,000 radios includes 260 'repeater sites', which enable signals to be transmitted and received over a wide area.

PPSTN is unique since it was the first province-wide, fully-operational and interoperable network in the country.

SaskPower's fibre optic network serves as the backbone of the system. Originally developed to improve communications reliability between SaskPower power plants and centralized control facilities in Regina, this 2,700 kilometre network, along with electrical power provided by SaskPower to the repeater sites, allows network to remain reliable.

A partnership between three large organizations that includes new, shared responsibilities is a significant undertaking. SaskPower is proud to say that the province is a safer place because of the PPSTN and this partnership.

PROJECT 23 TORONTO HYDRO

FAULT IDENTIFICATION USING MACHINE LEARNING TECHNIQUES PROJECT

In a typical overhead distribution system, a significant number of outages (specifically successful auto-reclosures with outage duration < 1 minute) will usually have its cause classified as 'unknown'. With this in mind, Toronto Hydro has explored new technology advancements, such as a Fault Identification tool. This tool leverages data already collected by the utility (e.g. power quality data) and applies machine learning algorithms that 'learn' from and make decisions on outage data with 'known' causes to determine the likely cause of 'unknown' outage events.

This tool will ultimately assist in investigating and diagnosing issues on the grid such as intermittent feeder outages.

The tool's accuracy is currently being assessed by withholding outage events with 'known' causes from training the machine learning model to see if it can correctly classify them. Based on 2018 data, it is showing promising results.

The Fault Identification tool is one of the first applications of Machine Learning in the Electric Utility space.

PROJECT 24

TORONTO HYDRO

NETWORK SYSTEM MONITORING & CONTROL

Toronto Hydro is constantly looking for ways to better monitor its equipment in an effort to improve reliability, asset management, and customer service. Most recently, it is implementing a Network System Condition Monitoring and Control program throughout the secondary network system in Toronto.

This program will allow for the remote monitoring and control of secondary network equipment assets in real time. At the same time, Distribution Grid Operations will be able to live monitor assets and receive instant alarms if issues arise at the network vaults. In addition, the Asset Management group will be able to trend asset conditions over the life of the asset (e.g. load, oil temperature and level) to anticipate any issues, that would not otherwise be apparent.

This program includes equipping existing assets with sensors as well as installing a fibre optic communication infrastructure to allow for communication with these distribution assets. The installation is occurring in phases with the communication system being installed first, followed by the equipment sensors and vault monitoring hardware.

This equipment will deliver expected benefits such as remote monitoring of vaults, accurate recorded data, and reduced exposure to vault entry by field workers. This program is in the implementation phase and some stations have had equipment installed and are in the testing phase, with expected commissioning next year at these facilities. Toronto Hydro plans to finish the commissioning of all core network vaults by 2025.

PROJECT 25 TransAlta

WINDCHARGER BATTERY STORAGE PROJECT

TransAlta is developing the WindCharger Battery Storage Project, an innovative 10 MW / 20 MWh energy storage project. The Project will be located in southern Alberta in the MD of Pincher Creek next to TransAlta's existing Summerview Wind Farm Substation.

The project will store energy produced by the nearby Summerview II Wind Farm and discharge into the Alberta Electricity Grid at times of high-peak demand.

This is expected to be the first utility-scale battery storage facility in Alberta and will utilize a newly developed and highly efficient lithium-ion battery technology.

Construction of the Project is anticipated to begin in March 2020 with a commercial operations date of June 2020. TransAlta will be receiving co-funding support for the project from Emissions Reduction Alberta.

PROJECT 26

TC Energy

SUPERCRITICAL CO_2 WASTE HEAT RECOVERY AND UTILIZATION TECHNOLOGY

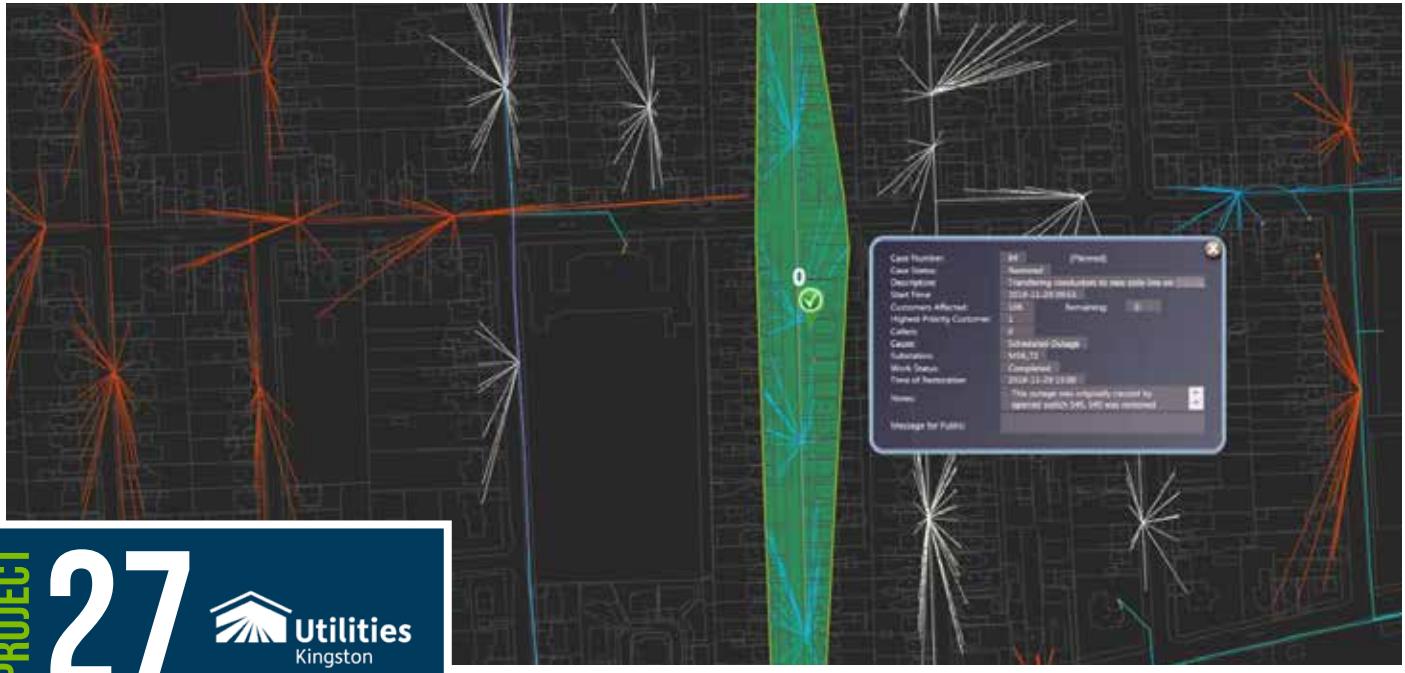
Originally a part of the Emissions Reduction Alberta (ERA) Industrial Efficiency Challenge, the TC Energy Waste Heat Recovery Project involves the installation of a demonstration waste heat recovery (WHR) generation system at one of TC Energy's compressor station sites in Alberta designed to dramatically reduce greenhouse gas emissions.

The simplified "sCO_2 system technology" is a first-of-a-kind approach in WHR and uses Supercritical Carbon Dioxide (sCO_2) as the working fluid to recover waste heat from a gas turbine and, using a generator, convert it to emissions-free electricity.

This new technology has the potential to achieve the elimination of water use, operational simplicity for future projects, minimal environmental impact and an increased heat recovery cycle efficiency that plugs right into the grid.

It also creates an additional value stream from what is usually a wasted source of energy.

The demonstration project is estimated to have GHG reductions up to 44,000 tCO_2e/year once fully implemented. By creating carbon offsets from the displacement of grid electricity, this project has the potential to reduce the facility's Carbon Competitiveness Incentive Regulation (CCIR) compliance costs by up to $1.3M/yr.



PROJECT 27

Utilities Kingston

OUTAGE MANAGEMENT SYSTEM FOR SERVICE EXCELLENCE

Utilities Kingston has implemented a new outage management system to help further improve communicating power outages. The SurvalentONE OMS pinpoints both planned and unplanned power outages, providing accurate and timely information, both for the public and for crews as they work to restore power.

This helps the utility get more accurate power outage information out faster to its customers and enables crews to restore power more quickly in order to reduce the length and disruption of outages. Customers now have an additional tool to use, to determine whether a power problem is located on utility or private property.

The OMS is the result of a two-year project that involved integration with Utilities Kingston's monitoring and control system, geographic information system, customer information system and metering infrastructure.

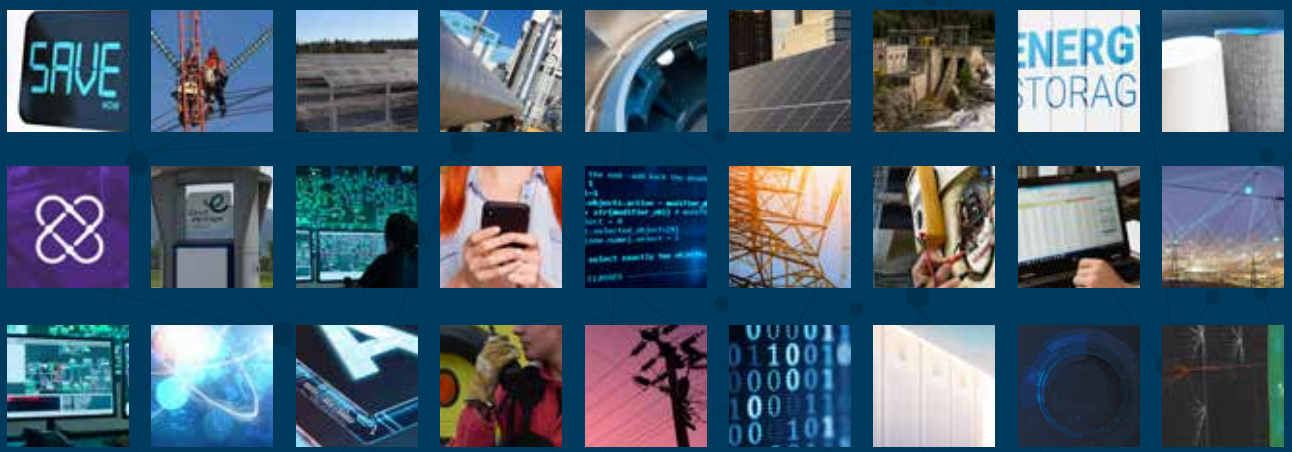
Using data from all four sources provides better information for improved diagnosis in the field. The system advises operators of an outage, based on the status of smart meters or other monitored devices. Verified outages are posted to the map at https://Power.UtilitiesKingston.com/Outages, with the intent that this improved information will reduce phone calls to operations centre staff, allowing them to focus their efforts on safe and effective power restoration.

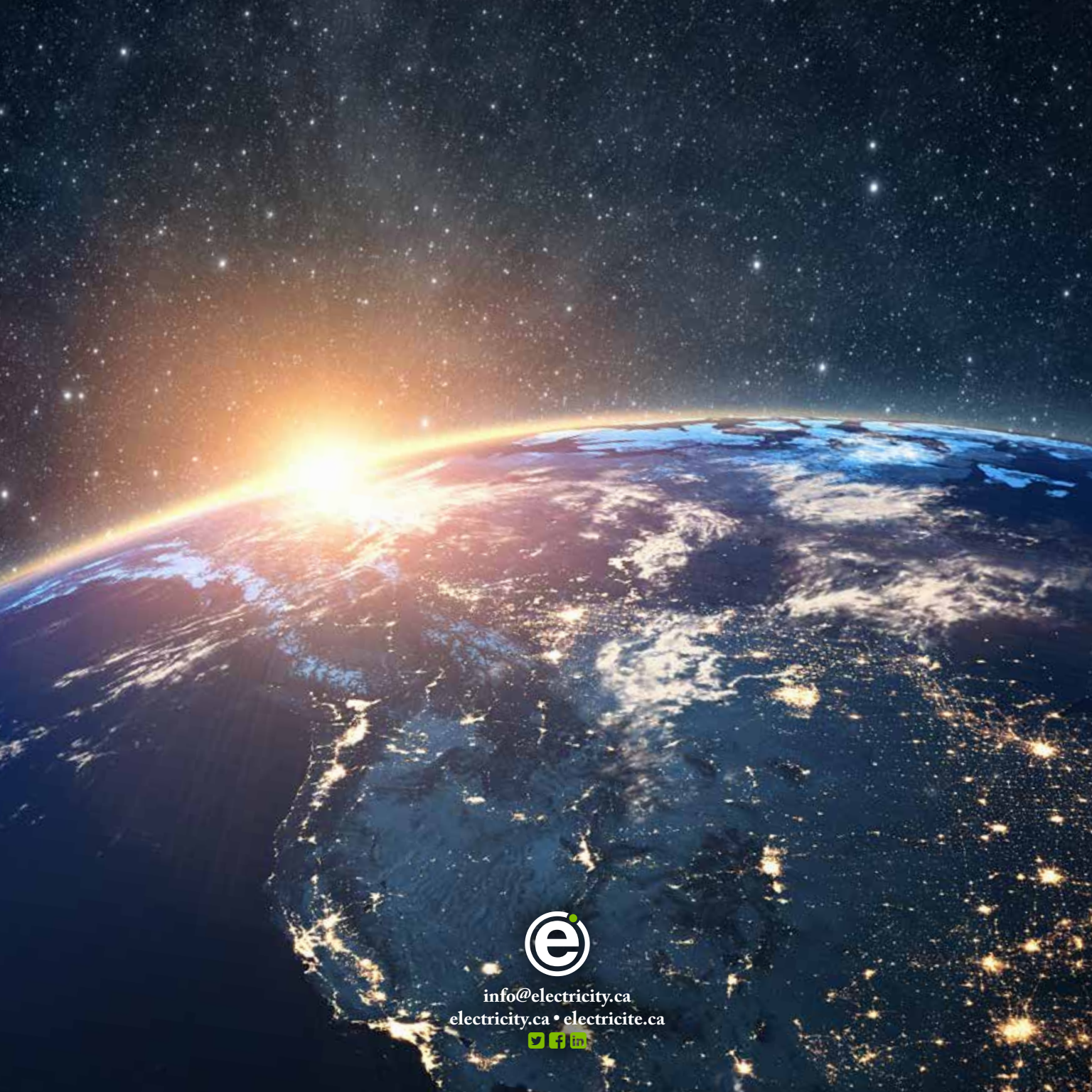
Utilities Kingston also intends to evaluate the use of this technology for water and natural gas service interruptions – one of the advantages of its multi-utility model. This utility is working to improve the delivery of utility services, for now and in the future!

The Canadian Electricity Association (CEA) would like to thank all electric utilities for submitting and presenting their innovative projects at this year's Centre of Excellence.

We have the privilege to welcome 27 projects in 2019, including two youth projects, from a total of 19 utilities across Canada. The Centre of Excellence showcases Canadian cutting-edge development in how electricity is produced, delivered and consumed, and highlights transformational progress in how electricity yields economic, social and environmental benefits for Canadians.

Innovation sits at the forefront of our industry. Creating an opportunity for our members to be recognized for their ingenuity, inspiration and dedication to our collective energy future is important to our organization. Together, we continue to move towards a brighter future. Thank you for demonstrating innovation excellence in our industry.





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