

Ontario's Long Term Energy Plan in Action

The decision to eliminate coal-fired power plants and the implementation of an aggressive feed-in tariff program puts Ontario's electricity system in the spotlight.

Introduction

In December 2013, the government of Ontario outlined a vision for the electricity market that has the potential to significantly alter the manner in which energy is procured and dispatched in Canada's most populous province. "Achieving Balance – Ontario's Long-Term Energy Plan" attempts to address the delicate equilibrium between supply surplus and demand reduction while planning for a cleaner future that includes controversial new sources of green energy. The success of this vision, or lack thereof, will have ramifications on other governments hoping to meet the dueling challenges of climate change and effective market planning.

Unlike its provincial neighbors, Ontario has a hybrid electricity market structure that mixes elements of a centrally planned system with a competitive rate-based approach. Since the 2003 dissolution of Ontario Hydro, the province's publicly owned utility, the electricity system is governed by two separate regulatory bodies: the Ontario Power Authority (OPA), which is responsible for the long-term planning of Ontario's energy needs, and the Independent Electricity System Operator (IESO), which balances the supply and demand ratio on an 18-month basis.

Ontario Power Generation is the province's largest utility, responsible for over 19,000 MW of electricity generation, while Hydro One largely controls the transmission and dispatch of energy to consumers.

There are clear signs in Ontario that point to more changes in its market structure, such as appointing a council to review the possibility of selling both Ontario Power Generation and Hydro One, with a decision expected at the end of 2014. Secondly, a merger between the OPA and IESO seems a foregone conclusion. As it stands, the IESO is already exploring the possibility of introducing a capacity market as an alternative to the resource acquisition strategy in place by the OPA.

The centralization of the two regulatory bodies responsible for energy procurement and demand forecasting is significant given that energy demand has decreased faster than the IESO's projections, leading to an oversupply of power that has to be exported to neighboring jurisdictions at a much cheaper rate than it costs to produce. The decrease in demand has, however, helped the province to remove nearly 25% of its 2003 energy capacity in the form of coal-fired power plants – the largest climate change initiative in North America.



"Ontario has made great strides in transforming its electricity system into one that is cleaner and more reliable," said Bob Chiarelli, Ontario's Minister of Energy. "From a deficit of 3,800 MW in 2003 to a comfortable surplus in 2013, the province has moved into a strong supply position and now has a reliable foundation on which to build."

Long Term Energy Plan

Minister Chiarelli and his Liberal party have the benefit of commanding a majority government with which to implement its vision, which is comprised of a supply mix where wind, hydro and solar energy account for 35% of electricity generation at the expense of nuclear energy, which has long been the backbone of Ontario's supply. While the decision not to build new nuclear facilities may not have been a huge surprise, it puts a vibrant service sector highly dependent on a domestic market at risk. Currently only Ontario and New Brunswick are generating nuclear energy in Canada.

The LTEP does, however, contain novel approaches to foster the development of renewable energy sources made attractive by the passing of the Green Energy Act in 2009, such as energy storage and demand response targets. The government directed the OPA to procure 50 MW of energy storage by the end of 2014. Already, a number of Ontario-based companies are advancing energy storage

technologies in the province; NRSor and Temporal Power are operating a 2 MW flywheel storage facility, and Hydrogenics is working with natural gas giant Enbridge on a power-to-gas system that captures surplus energy from renewables and converts it to natural gas using electrolysis.

These policy changes have been met with both applause and controversy. "We have a small window of time when we are not facing a major turnover in technology, but we know there are issues on the horizon that we will have to address," said Bruce Campbell, president CEO of the IESO.

On May 14, 2009, Ontario's provincial government ushered into law the Green Energy and Green Economy Act with one of the most innovative feed-in tariff programs of its kind. As the program reaches its fifth year in operation, Ontario's regulatory bodies are drastically revamping the procurement process and requirements for participation.

The main distinguishing feature of the Act was its scale of implementation. It outlined dual programs: the FIT program, which was suited for utility-scale renewable energy projects over 10 kW, and the smaller micro FIT program for projects generating under 10 kW, such as rooftop solar.

"The Green Energy and Green Economy Act was about reducing our carbon footprint and job stimulation during the global recession," said David Butters, president of the Association of Power Producers of Ontario. "Ontario has a lot of renewables in our system already and more coming, which will pose challenges to our operator."

The domestic content requirement was the first article of the Green Energy Act to be challenged. Although the Act was passed with the promise to create over 10,000 jobs in the province, both Japan and the European Union labeled the provision as uncompetitive. In May 2013, the World Trade Organization found Ontario's domestic content law to be protectionist, and the clause will be removed from forthcoming contracts.

Greg Duke, director of business development at H. B. White Canada Corporation, believes there will be much more importation of labor and equipment once the clause is removed. "The principle behind the domestic content was admirable but it created a market that was unfortunately not sustainable because there was no longevity," he said. H. B. White Canada Corporation has constructed more than 1000 MW of wind and 400 MW of solar projects in Canada, including Ontario's first large-scale wind farm, Erie Shores.

The changes in requirements pose a challenge to the strategy of international companies that invested in manufacturing facilities in Ontario, such as Siemens, Vestas, Servion and Enercon. According to Jacob Andersen, vice president, head of wind power at Siemens Canada, the company has always treated its Ontario headquarters as a global knowledge base. "When we established our manufacturing presence in Tillsonburg it was with the intention of making it a globally competitive factory. It is a fully operational plant that can supply blades to a global market," he said.

Siemens is currently producing 55 meter-long blades for EDP Renewable's 30 MW South Branch Wind Farm in Ontario, the first 3.0 113 turbine to be installed in the Americas. The company is also



Bruce Campbell,
president and CEO,
Independent Electricity
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working with Samsung Renewable Energy and Pattern Energy to supply 140 Siemens SWT-2.3-101 turbines to the 270 MW K2 Wind Power Project in Ontario.

Despite the removal of domestic content requirements in the next round of contracts, Siemens Canada's Greg Thrasher, manager, sales and strategy explained how it is still cheaper for the company to manufacture locally. "If you consider the landed cost of a blade produced in Ontario, it is cost competitive to manufacture in the province because transportation of wind turbine components is a huge factor in the total cost of a blade when considering an import solution," he said.

The Right FIT

Ontario's wind and solar industries have evolved dramatically over the past five years. Nearly 10,000 MW of wind and solar energy has been contracted by the OPA since 2009, with multinational IPPs such as EDF EN, NextEra, Samsung Renewable Energy and EDP Renewables developing multi-megawatts projects.

The subsidy program for large renewables is soon to end in Ontario. Colin Andersen, CEO of the OPA, explains: "We have taken the large wind and solar projects out of the FIT program and we are currently running a competitive process for them under our Large Renewable Procurement (LRP). In the meantime we have run a window on the FIT program that it is now under 500 KW. Later this year we will allocate up to 100 MW more after a price review and there will be another window in 2015."

According to Jon Kieran, director, development at EDF EN Canada, Ontario's FIT program has achieved many goals. "A feed-in-tariff creates the one condition that a nas-



Colin Andersen,
CEO, Ontario Power
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Hon. Bob Chiarelli,
Minister of Energy,
Ontario

cent industry needs, which is bankability," he said. "However, it is a different climate for the industry today than five years ago, as costs have decreased so significantly that there are parts of North America where wind and solar compete without any incentives at all. Having said that, it is important to remember that the FIT program accelerated the replacement of supply in order to remove 6,000 MW of highly polluting coal-fired generation."

EDF EN is Ontario's largest operations and

maintenance company for ground mounted solar with 70 MW in its portfolio, and recently opened Canada's largest wind farm in Alberta.

Samsung Renewable Energy's 1,369 MW portfolio represents a \$5 billion investment that includes Ontario's largest wind farm, the 270 MW South Kent Wind project developed with partners Pattern Energy. While the controversial Samsung deal with the provincial government had to be renegotiated from its initial \$9 billion, 2,500 MW commitments, the company has another 870 MW of wind and solar energy in development.

One of the reasons for the renegotiated contract put forth by Minister of Energy Bob Chiarelli is that Samsung struggled to meet its deadlines. Tim Smitheman, manager of communications, government and public relations at Samsung, admitted that the regulatory process was longer than anticipated when the deal was signed in 2010. "At the Haldimand project, it took us about four years to develop and solidify our partnership with the Six Nations council, which now has

a 10% equity stake in the project. However, the main reason behind the delay was the decreasing demand scenario in the province since 2010," he said.

By law, wind and solar projects must obtain a Renewable Energy Approval from the Ontario government, a lengthy process that has caused headaches throughout the supply chain. To date, only one large project, EDP Renewable's 30 MW South Branch Wind Farm, has not been appealed.

The revised REA process promised a 6-month turnaround guarantee once applications were submitted. In reality, the process begat new obstacles such as archaeological studies and zoning issues. For companies that were present in the province prior to the introduction of the REA, it has proved a frustrating transition.

"It is a much more difficult industry to work in than it was five years ago," said Brent Bergland, general manager, Canada, at Mortenson Construction, which established a base in Ontario in 2005. "While this is likely true of other energy technologies, it is particularly hard on wind when projects become delayed through the environmental review tribunal appeals process. Nearly every project that goes through the process will be appealed. This has unfortunately had a negative impact on the industry by delaying projects from going ahead, and while ultimately these projects will be built, they are being constructed in a much tighter timeframe."

One of the major facets of the REA process is to increase consultation with local communities. In the past, Ontario developers faced backlash from communities who objected to renewable energy projects close to residential areas. "The main challenge to developers is overcoming the 'not in my backyard' perception that exists in Ontario," said Paul Miron, senior title counsel at First Canadian Title, a title insurer in Canada. "It is not a huge issue with solar installation, but is not limited to wind farms; any type of gas, biomass or nuclear plant can face community resistance as well. This challenge is not something that affects a title insurance policy, since we get involved only after the developer receives the permits. However, a number of projects have hit roadblocks that have slowed their development."

One of the key elements of the Large Renewable Procurement process is the ability for the developer to demonstrate support

An advertisement for EDF EN Canada. The background shows a large wind turbine against a blue sky, with a forest of evergreen trees in the foreground. A white rectangular box on the left contains the EDF logo (an orange stylized flower) and the text "edf énergies nouvelles". Below the logo, the text "TRUSTED LEADER IN PROJECT DEVELOPMENT AND OPERATIONS & MAINTENANCE" is written in blue. At the bottom left, contact information for EDF EN Canada is listed: Ontario: 416.363.8380, Québec: 514.397.9997, and www.edf-en.ca. At the bottom right, contact information for EDF Renewable Services is listed: 858.521.3575, O&Mbusdev@edf-re.com, and www.edf-renewable-services.com.

from the local municipality before the provincial government will approve the project. According to Mortenson's Brent Bergland, this will likely change the scale of the projects yet to be built. "Individual projects will more likely be in the 25-50 MW ranges, with the most being around 100 MW," he said.

With a crowded market and less megawatts on offer in the new Large Renewable Procurement program, it remains to be seen whether there will be enough opportunity for developers and manufacturers to sustain a vibrant wind and solar industry in Ontario. According to Mark Gilmore, director of operations, North America wind power and solar generation at GDF Suez Canada, when the competitive procurement process begins, there will still be a need for larger players to develop the industry through their expertise and technology.

The fact that there are fewer megawatts for wind energy on offer will certainly present a challenge for the province to sustain a manufacturing base for renewable energy. "We have yet to see who will be able to adapt to these changing requirements, and it might

not be enough to sustain every manufacturer in Ontario," said Helmut Harold, CEO North America at Servion Canada Inc. "My hope is that there will be projects that did not get approval or faced serious delays in previous procurement programs which get recycled, so that we will have more than 300 MW per year to work with in the future."

Closing the funding gap

Ontario's renewable energy sector has undergone an intense ramp-up period, and other facets of the province's economy are beginning to familiarize themselves with what this development could represent in terms of investment opportunities. Despite this degree of unfamiliarity, renewable energy developers have a few domestic options for financing their projects.

Sean Durfy, president and chief development officer at Northland Power, one of the province's largest IPPs, believes the key aspect is to have long-term PPAs attached to your asset. "With 17 projects and 26 years of experience, the banks are very comfortable with us as an IPP developer. There is a lot of appetite

by the banks and equity to get involved in projects with the right company," he said.

While Northland Power is a well-known IPP, the financing environment for smaller-scale developers is more restrictive. Banks and pension funds show little interest in solar and small wind farms, leaving smaller lenders to fill the investment gap.

CIT Financial have been involved with the financing of over 15 renewable energy projects and directly lent several hundred million dollars to projects that have borrowed upwards of \$1 billion. "Given the PPAs that underlie these projects from what is essentially a government agency, we see that returns are there," explained Terry Parco, managing director at CIT Financial, energy and infrastructure. "The economics of the energy market in Ontario is driving the pricing down on these contracts. As the industry develops and becomes much more efficient, the price paid in the contracts is declining so people have to become more efficient in driving their projects in order to get more financing."

The company recently underwrote the 10



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Aerial shot of the Bruce site. Photo courtesy of Bruce Power.

MW Silvercreek Solar Park in Ontario.

Corpfinance International (CFI) has been providing both financing and financial advisory services to independent power producers for more than two decades. "The appetite of Canadian lenders continues to grow in wind and solar financings as their experience increases," said Christopher Ball, executive vice president at CFI. "With respect to solar, the industry has seen some recent maturation in Canada through reduced equipment costs and increased reliability. Both factors along with more operating experience have provided lenders comfort in providing financing to this sector."

Nuclear's uncertain future

Ontario may not be building new nuclear facilities, but the Long Term Energy Plan did include plans to refurbish two of the province's three nuclear generating stations in 2016: the 6,300 MW Bruce generating station and the 3,512 MW Darlington station. The remaining station, Pickering, will likely go offline by 2020.

Both Ontario Power Generation and Bruce Power face public scrutiny during refurbishment, which has a troubled history in Ontario. Previous refurbishments at Pickering cost \$2.6 billion, or double the target cost of \$1.3 billion. The Bruce power station

also experienced cost overruns during its last refurbishment.

James Scongack, vice president, corporate affairs at Bruce Power, is confident that the company has learned lessons from past projects. "When we refurbished Units 1 and 2, they had been out of operation for 20 years with no expectation of being put back into service," he said. "The remaining units at the Bruce site are all operating units – we are very familiar with them and have invested in their maintenance."

While the specifics and time frames of the refurbishment projects are still being decided, the province's investment in the two nuclear facilities is welcome news to the domestic service and supply sector. "We would have liked to see a new build in the Long-Term Energy Plan, but we understand the province is facing high debt as well as lower demand for power because of the recession," said Dr. Ron Oberth, president of the Organization of Canadian Nuclear Industries. "We recognize that the number one priority was to invest in its existing assets."

Longer-term, nuclear supply and service companies are looking to export their expertise to countries that are investing heavily in nuclear energy. Candu Energy Inc., which manufactures a unique heavy water reactor, recently signed a \$1.5 billion deal with China Nuclear Power Engineering Company Ltd. to build two reactors in Romania. AREVA Canada Ltd.'s Ontario office is working in Romania on a filtered venting system, a niche technology from the light water market and imported to the heavy water market.

The sector is receiving support from the provincial and federal governments in the form of trade missions overseas.

Revitalizing Ontario's Hydro

Accounting for 22% of Ontario's energy supply mix, hydroelectricity has provided clean power to the province since the 1890s. According to the Long-Term Energy Plan, Ontario's hydroelectricity portfolio will comprise 9,300 MW by 2025. The bulk of this capacity will be from the 440 MW Lower Mattagami River project, a \$2.6 billion investment from OPG in Northern Ontario.

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for Ontario's hydro service sector. Voith Hydro Inc. worked with OPG to supply components to the utility's DeCew Falls 1 hydroelectric station, as it had in 1904 as the original turbine manufacturer. "Projects like DeCew Falls 1 involving older units, both Turbine and Generator, are a very large part of Voith Hydro's activity in Ontario," said John Peden, vice president, sales and marketing, Voith Hydro Inc.

At Lower Mattagami, six new units will be added; three at existing stations, with the remainder to be new units. Andritz Hydro is supplying three propeller turbines to three of Lower Mattagami's new plants, but the company is expecting to see more refurbishment activity in the future. "The hydro market is shifting more towards service and rehabilitation as there are less large-scale hydro projects being commissioned," said Yves Bourget, general manager, service and rehabilitation at Andritz Hydro. "Canada alone is generating nearly 80,000 MW of hydroelectricity with a large, aging fleet. We see huge opportunities for service and rehabilitation going forward, not only in



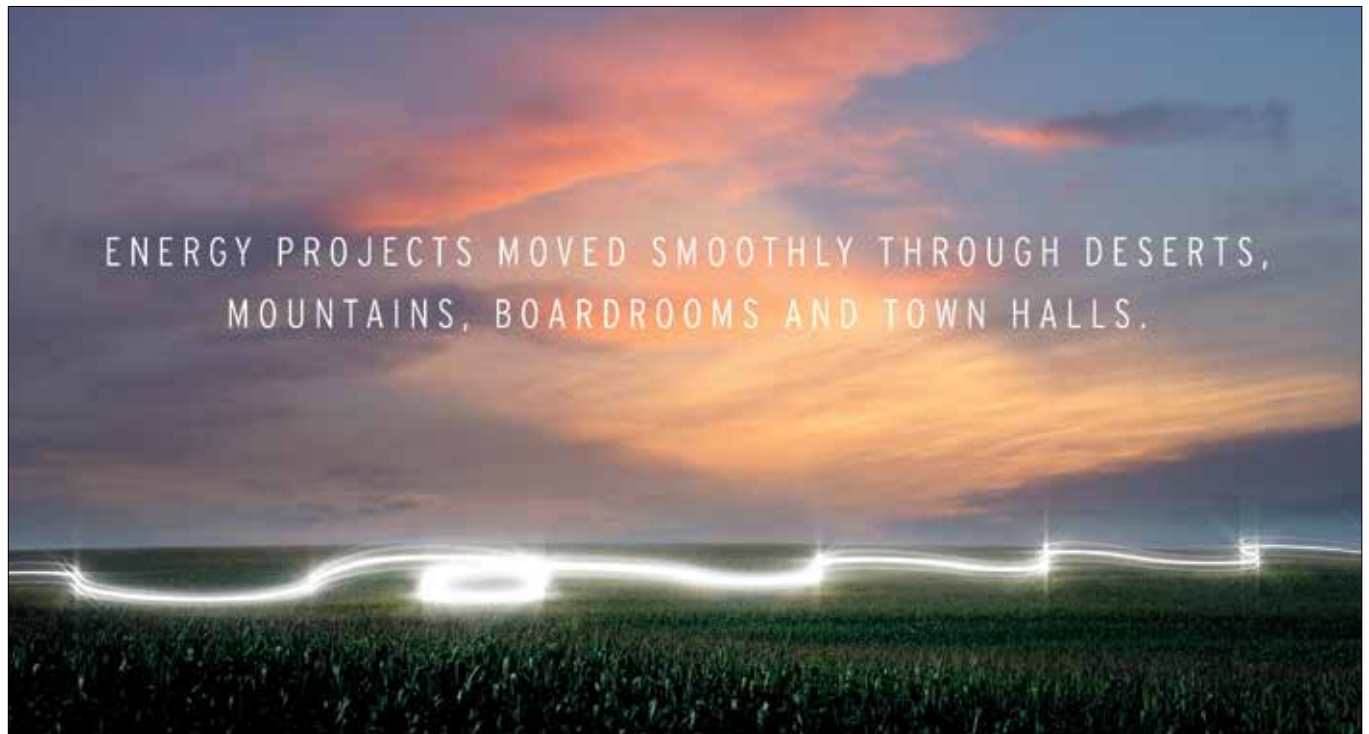
Construction work at Smoky Falls, one of four sites of the Lower Mattagami River Project. Photo courtesy of Ontario Power Generation.

Canada but also globally."

Both Voith and Andritz have opened facilities in Ontario to manufacture hydro-power coils for the domestic and international markets. "Before we established a manufacturing presence in Peterborough we had no choice but to procure our coils from our facilities in Brazil," said Andritz's Bourget. "The new coil shop is already in operation, producing two sets of coils for two different customers. In 2015, we plan on implementing our bar

manufacturing in Peterborough, making Ontario our North American centre for generators."

Another avenue being explored by Northland Power is in the form of pumped hydro storage. The Marmora Pumped Hydro Storage project, currently under development, is the first of its kind in Ontario. Pumped storage projects generate energy by moving water between two reservoirs at different elevations. "Pumped storage is a great solution for grid reliability and stability, providing



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one of the few large scale, long-term proven and affordable means of deploying electricity," said John Peden of Voith Hydro Inc. There is over 140 GW of pumped storage in operation globally.

Thermal energy

Gas-fired generation is expected to comprise most of the province's short-term supply in the wake of Ontario's retirement of coal-fired power plants and the integration of renewables. However, the role of gas in the longer term is likely to decrease. The province's existing natural gas utilities currently provide 1,200 MW of electricity; the contracts for 75% of that capacity will expire by the end of 2018. According to the Long-Term Energy Plan, it is in Ontario's best interest not to depend too heavily on natural gas in order to hedge against price volatility. Instead, the OPA has put forth the Combined Heat and Power Standard Offer Program to facilitate the development of cogeneration facilities up to 20 MW in size. Armour Valve, an Ontario supplier of components to the power generation industry, is working with



Northland Power's Marmora Pumped Hydro Storage project would transform a former iron mine into a pumped hydro facility that time-shifts power to support renewable energy sources and grid demand patterns. Photo courtesy of Northland Power.

a number of smaller cogeneration plants. "NOVA Chemicals, one of our larger customers in Ontario, is engaged in a study for a cogeneration plant that could represent significant opportunity for us," said Bernie Mletzko, area sales manager, Ontario north at Armour Valve. "The OPA is demanding that plants have greater operating flexibility and be available on a peak-demand basis. Most plants are required to have the capac-

ity to cycle daily and this has taken a heavy toll on equipment reliability."

While there is interest in advancing cogeneration in Ontario, the market has not yet taken hold as expected. As Daniel Pearce, branch manager, power generation at Cummins Eastern Canada LP, explained: "The spark spread – the difference between the market price of electricity and its cost of production – in Ontario is so advantageous



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yet cogeneration has not taken off at an accelerated rate in the province. The OPA does provide incentives but the timelines associated with them are too short."

Thermal energy production in Ontario is not limited to combined cycle power plants. OPG recently completed a project to convert its former coal-fired plant, Atikokan Generating Station, to a 100% biomass-fueled power station, the largest in North America.

The LTEP's emphasis on renewables poses challenges for energy-intensive industries in Ontario. The intermittency of renewable energy means that sectors like mining or data centers must have sufficient backup generation.

Aggreko Canada provides backup power to the mining industry in Ontario, and though the decline in commodity prices has affected production levels, the company continues to work closely with mining clients. "We are very interested in continuing to find ways of driving down operational costs for our customers," said Asterios Satrazemis, president, Americas at Aggreko.

Ontario has also emerged as a preeminent destination for data centers, an energy-hungry industry that requires colder climates and political stability to host sensitive user information. Cogeco Data Services recently built a state-of-the-art data centre in Barrie with a secure backup power system in place. "All of our generators are N+1, and we have dual power to each rack, so we have full redundancy for both path distribution and supporting architecture if we want to take one offline," said Jeff Edward, vice president of data centers and operations at Cogeco Data Services.

The way forward: Conservation First

One of the most interesting elements of Ontario's Long-Term Energy Plan is the evolving relationship between grid operators and energy users. An aggressive conservation-based approach coupled with an expected increase in off-grid solutions could lead to a very different electricity system in the near future.

PowerStream, one of the largest electricity distributors in Ontario, is developing a microgrid project in conjunction with GE and several other partners. The microgrid will draw electricity from existing assets –

a solar array, a wind turbine, a soon-to-be installed natural-gas generator, a lead acid battery and a lithium battery – in order to provide electricity. The energy generated will also be used to power the company's electric vehicle charging stations and to maintain a steady charge in the microgrid's storage batteries.

Logic would suggest that the project might run counter to a distributor's business model, but Brian Bentz, president and CEO of PowerStream, views microgrids as the future of energy usage in Ontario. "PowerStream's philosophy is to learn about how consumers produce and use their electricity in a commercial environment and integrate these principles with the grid," he said. "The microgrid project is designed to find a suitable equilibrium between a centralized grid and off-grid solutions."

GE is providing its automated Grid IQ Microgrid Control System to validate the use case for the technology. "Microgrids give consumers the ability to achieve energy independence, and local distribution companies are examining ways to incorporate

microgrids, enabling more cost effective delivery," said Juan Macias, general manager, grid automation at GE Digital Energy.

Another factor that is changing the relationship between grid operators and end users as outlined in the LTEP is demand response. Ontario is aiming to use demand response initiatives to meet 10% of peak demand by 2025, the equivalent of nearly 2,400 MW under current forecast conditions. "Demand response has a significant future in Ontario because it provides flexibility, reliability and a very cost effective resource," said Paul Grod, president and CEO of Rodan Energy Solutions. "Ontario businesses will be able to reduce their total cost of power by providing flexibility within their own system."

With a conservation-based approach and ambitious targets for procurement, Ontario's Long-Term Energy Plan attempts to address universal challenges associated with energy planning for the future. Time will tell what impact its success or failure will have on other governments looking to model its aggressive approach. •



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