

Delivering Fairness and Choice LTEP 2017

Chapter 5. Innovating to Meet the Future

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Modernizing the System

The way we deliver and use electricity is changing.

New technologies allow us to capture, store, and use energy locally and deliver it in new and innovative ways. Clean, distributed energy resources are powering our economy and moving closer to home. New tools and devices are appearing on smartphones and in homes, harnessing the power of data and giving customers greater choice and control over the energy they use. Customers' expectations of their utilities are increasing. These are all pressures that are not going away.

Innovative Pricing Plans

Together with the Ontario Energy Board, the Province is working on giving consumers more choice in their electricity price plans. The OEB is using pilot programs to test innovative time-of-use price structures, as part of its review of the Regulated Price Plan (RPP). Ontario is already a world leader in this area, offering time-of-use electricity prices to most of its residential and small business electricity customers.

The pilots will test a variety of innovative price structures, including:

- different ratios between on-peak and off-peak prices;
- different times for on-peak and off-peak periods;
- prices that kick in during critical peaks – the short time periods with extremely high demand; and
- seasonal pricing plans that have a flat rate for spring and fall, and on-peak and off-peak price periods for summer and winter.

What Ontarians said in the LTEP Consultations and Engagements

- Support increased use of electric vehicles (EV)
- Support options for home storage, including EV batteries
- Microgrids can help resiliency and northern communities
- New business models can drive innovations
- Modernize regulations and rate designs
- Customers will decide which technologies work best
- Government support needed for R&D
- Distributed generation will transform conventional networks

Some of the pricing pilots will be combined with smart technologies, such as smart thermostats, energy use apps, and electric vehicles, to give customers further ability to manage their electricity use.

The pilots will help guide future OEB decisions on potential new price plans that could match a customer’s lifestyle and give them more control over their electricity costs.

In addition to these pilot programs, the OEB is also examining changes to the way the Global Adjustment (GA) is charged to mid-sized commercial and industrial consumers, otherwise known as non-RPP Class B consumers. For these consumers, the GA is a fixed charge that is the same regardless of the time that they consume electricity. A GA charge that varies with the time of use could lower prices for all Class B consumers, as well as residential and small business consumers who are on the Regulated Price Plan.

Customer of Tomorrow		
Graphic of a person looking at a Home Energy Management System that shows linkages to their home solar, battery, Ev, etc.) [Placeholder]	<u>Responding to Visibility</u> Customers have access to real –time data and applications to manage their electricity use.	<u>Participating Prosumers</u> Customers actively manage their electricity use and self-generators trade electricity with the grid.
	<u>Customer Focused Interaction</u> Distributors have the tools to meet demands for broader customer-centric services.	<u>Technology Integration</u> Home energy management systems connect customer generation, electric vehicles, energy storage and more

Commented [JM2]: I eliminated the customer of today boxes, because there is no one typical customer, we all use the grid differently, so many readers will not recognize themselves in the portrait of what a customer of today is. We can all recognize the unknown of the future though, and that is what is important, not so much where we come from, but where we are going

Net Metering

A net-metered customer can generate their own renewable electricity on-site while still being able to draw power from the local distribution network when needed. Any surplus electricity the customer has generated can be sent to the utility for a credit on their electricity bill. The credit is valid for a year.

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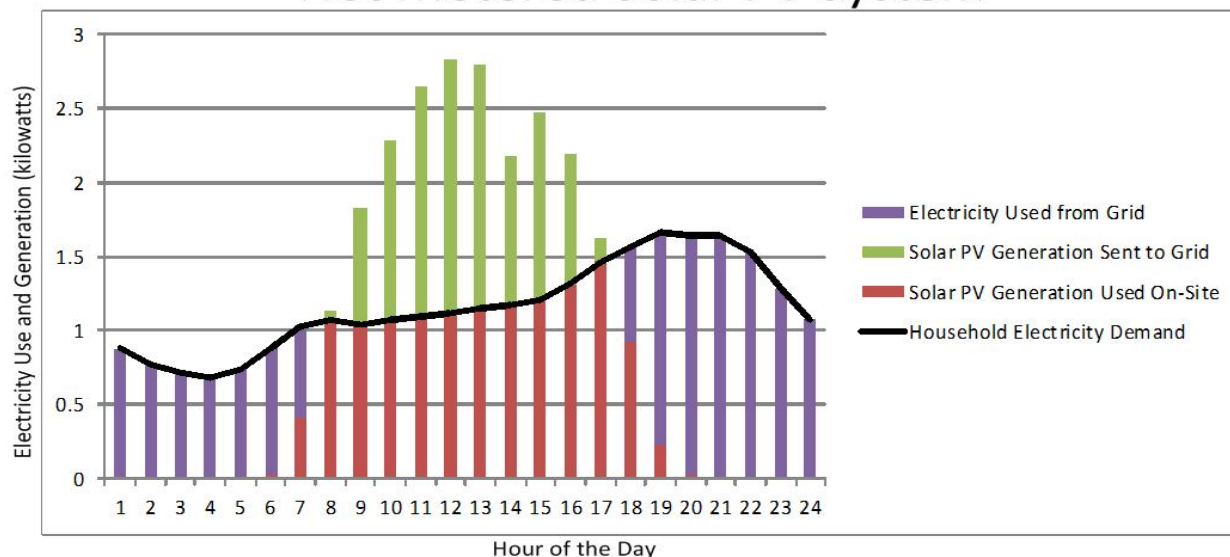
Net metering works this way for a typical customer with residential rooftop solar project:

- the electricity generated from the solar panels is first used on-site to power the house;
- net-metered customers receive a charge on their electricity bill for the electricity they draw from the local utility when their electricity needs cannot be met by the on-site generation;
- net-metered customers receive credits on their electricity bill when they send any excess electricity generation to their local utility;
- The customer's monthly electricity bill will reflect the difference between the dollar value of any electricity used from their local utility, and the dollar value of electricity sent to their local utility.

The graph below shows the operation of a typical net-metered residential rooftop solar in the summer:

- the purple columns show the electricity used from the local utility;
- the red columns show the electricity generated and used on-site; and
- the green column shows the electricity that is generated and sent back to the local utility.

A Typical Summer Day With a Residential Net Metered Solar PV System



Other types of renewable energy installations are also eligible in Ontario for net metering.

Ontario has recently taken significant steps to enhance net metering by removing the limit on the size of eligible generation systems and allowing them to be paired with energy storage technologies. The Ministry will also allow third parties to own and operate net-metered generation.

Ontario will proposing additional steps allowing third party ownership and operation of net-metered generation. This will give Ontario consumers more choices for generating their own clean power and reducing their demand for electricity from the grid. The Province will also propose changes that will support pilot projects that demonstrate virtual net metering.

Virtual net metering, where renewable generation is sited away from customers but still give them a credit to offset their electricity bills, has the potential to benefit Ontarians who may not be able to host their own renewable energy systems. It also allows renewable energy to be located where the electricity is most needed on the system and where it provides the most value as a renewable source.

Taken together, these proposed enhancements would provide a platform for future innovation in clean, distributed energy and put the province at the forefront of renewable energy integration in Canada

Energy Storage

Energy storage is a game-changing technology. Sometimes, it acts like a home or business, consuming electricity from the grid. At other times, it acts like a power plant, sending electricity out when needed.

Since 2013, the Ministry has made it a priority to understand the value of energy storage for Ontarians. This includes:

- procuring 50 MW of different types of energy storage to test how they can support Ontario's electricity network;
- supporting several energy storage projects through the Smart Grid Fund to test the full range of their capabilities on distribution systems; and
- undertaking studies that look at capturing the different values of storage.

A March 2016 study by the IESO found that energy storage facilities can provide many of the services that are needed to reliably operate the power system in Ontario. The Province also commissioned Essex Energy to study the benefits of storage for distribution grids, which found that energy storage can provide many benefits for larger consumers, including cost reduction¹.

¹ Independent study commissioned by the ministry. Not yet public.

The nature of energy storage means that some of the rules governing the electricity system do not address its unique qualities. The Province will amend its own regulations and will look to the IESO and OEB to do the same to facilitate the cost-effective development of energy storage in sizes and at locations that provide value to customers and the electricity system.

Electric Vehicles

To curb climate change, Ontario will increase the use of low-emission transportation. This is critical to establishing a green economy and a carbon-free Ontario.

The continued adoption of electric vehicles (EVs) will have an impact on our distribution networks. If enough electric vehicles in a neighborhood charge at the same time, important parts of the distribution system can be damaged. As the uptake of EVs continues, pressures on our distribution networks will grow, and utilities will need the tools to manage this change in a cost-effective way.

Utilities can already work with EV owners to minimize these impacts. FleetCarma and Toronto Hydro successfully tested a project that guarantees EV owners a charged vehicle, but allows the utility to control charging to minimize grid impacts. Burlington and Oakville Hydro² are testing how to do the same thing with smart chargers by offering these chargers at a reduced cost in exchange for some control of charging activity.

Ontario wants to provide utilities with more options for integrating EVs into their grids at the lowest cost. The OEB will support this goal by looking at how utilities can invest in technologies such as residential smart chargers, avoid more costly system upgrades that affect all customers, but letting EV owners choose how they can charge their vehicles. .

Ontario will also work to promote information sharing and data on EV usage, and to harmonize the province's energy, climate change, transportation, and infrastructure policies. While the focus is often on personal EVs, we will broaden that to include other types of mobility, including electrified transit.

Vehicle-Grid Integration

Vehicle-grid integration is a perfect example of what can be done to modernize the grid, providing more choice for customers while giving utilities the information and tools to optimize their systems.

A car is parked 95% of the time.³ For EVs, some of that time is dedicated to charging; other times, it sits idle, waiting for its next trip. In the future, the battery of an electric vehicle could

² <http://futuregrid.ca/>

³ <http://fortune.com/2016/03/13/cars-parked-95-percent-of-time/>

deliver electricity to the home in the event of an outage. It could also deliver electricity back to the community, or even the entire grid. Essentially, the EV becomes a distributed energy resource, one that can help avoid system upgrades and reduce costs for everyone.

The Province will engage with its partners in the energy sector to develop a roadmap for Vehicle-Grid Integration that will look closely at this technology and what it could mean for Ontario.

Grid Modernization

Electricity distribution is a critical piece of Ontario's grid. Ontario's utilities are the final step in a system that delivers electricity from large generators to our homes and businesses. Ontario was a world leader in deploying smart meters, which is the foundation for a smart grid.⁴ They continue to provide a significant amount of data to utilities, allowing them to locate and respond more quickly to power outages, monitor their systems, and plan better for the future; all to the benefit of Ontario's customers⁵

Now is the time to build on our investments in smart meters and the smart grid to establish a modern grid for Ontarians. An independent study in 2015 found that modernizing the grid over the coming decades would deliver \$6.3 billion in economic, environmental, and reliability benefits to Ontario's consumers and businesses.⁶ A modern grid can be more resilient to the effects of climate change, giving utilities the real-time visibility they need to respond to problems and even address them before they happen⁷. A modern grid can give customers more choice, ranging from dynamic pricing models to empowering home energy management systems to realizing the full value of EVs. A modern grid can ensure that distributed resources like solar power, storage, and microgrids can be integrated in the most efficient way possible. Above all, a modern grid can drive down costs for customers.

Commented [JM4]: I eliminated the proposed graphic for 3 reasons: Space; it mainly consisted of text that is elsewhere in the chapter, and it was not a graphic

⁴ Source forthcoming

⁵ Information provided to the ministry.

⁶ [Navigant Roadmap](#), p.2.

⁷ Need source.

Renewing the Smart Grid Fund

The Smart Grid Fund was launched in 2011 to support innovation in Ontario's electricity sector. Through the Fund, we are learning how technologies can be applied to distribution grids to address their problems and challenges. Utilities are gaining experience with using new technologies on their systems and a deeper understanding of their potential benefits. Ontario's businesses have found the support they need to turn a pilot into a commercial success. We've created jobs and growth for all Ontarians⁸.

The Smart Grid Fund has enabled a broad range of technologies to be developed in areas such as home energy management, grid automation, energy storage, microgrids and cyber security. Now companies in the smart grid sector are moving away from focusing on single technologies to building integrated solutions that bring greater benefits to utilities and customers.

As part of Ontario's grid modernization strategy, it is the right time to renew the Smart Grid Fund. A renewed Smart Grid Fund will focus on ways to encourage a culture of innovation within the electricity sector, look at innovative processes, explore solutions that integrate many technologies, test new business models, and generate new ideas for advancing grid modernization.

Smart Grid Fund Success Stories

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Essex/Utilismart Graphics Here	<u>Real-time Data - Essex Energy and Utilismart</u> With the support of the Smart Grid Fund, Essex Energy and Utilismart have developed and deployed SmartMAP, a software application that uses smart meters to pinpoint power outages and areas where the local system is under stress. Utilities can combine SmartMAP with other tools to analyze and optimize their current system and model the effect of any changes before the purchase of costly equipment. This promotes sound planning and asset investment and saves customers money.
Prolucid graphic here	<u>Optimizing the Entire Grid – Prolucid</u> Prolucid has developed a solution that gathers data from utility assets, distributed generation resources, and smart grid devices and provides real-time feedback on system conditions. During demonstration at Toronto Hydro, data was reported in one minute

⁸ Internal data confirms these facts.

	intervals. When linked with software that forecasted demand, the utility was able to get full value out of several distributed generators.
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Distributed Energy Resources

A distributed energy resource (DER) is a decentralized source of energy that provides electricity services to individual customers, or to the wider system close to where it is located.

Specific examples of DER include:

- distributed Generation: electricity generation embedded in the distribution system for self-consumption and/or export to the distribution grid;
- energy storage: energy stored for use close to where it is needed;
- microgrid: a mini electricity grid or network that can operate independently when it is disconnected from the main electricity grid; and
- demand Response: a temporary reduction or shift in demand in response to higher prices and requests from a system operator.

Each distributed energy resource offers benefits on its own. However, their true value occurs when utilities use smart communications systems to integrate these technologies across their distribution network.

Renewable Distributed Generation

Renewable generation systems, such as solar photo voltaic (PV) panels, are becoming more widely adopted across the province. When strategically located and combined with smart communications and control systems, renewable distributed generation (DG) can provide added value to utilities and customers alike.

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The Province and the IESO, will develop a fund to support the deployment of renewable DG systems that are strategically located and paired with other DERs and smart grid technologies. The data gathered from these innovative demonstration projects will help guide the treatment of renewable DG by regulators and energy markets and the integration of these resources into Ontario's energy system.

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Barriers to Innovation

Ontario's approach to grid modernization is to create the right environment for utilities to make the best decisions for their systems and their customers. To get there, we need to address the

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barriers to innovation. Many of these barriers are a legacy of the old way of doing things, when power only flowed one way and the technologies were simple and straightforward.

However, times are quickly changing. The OEB has made significant progress in keeping up with these changes, thereby ensuring that customers are treated fairly and the grid remains efficient and reliable. To build on this effort, the Province will work with utilities and other partners and look to the OEB to explore, where cost-appropriate:

- the equitable treatment of energy storage;
- utility participation in residential smart charging;
- the deployment of renewable distributed generation and other distributed energy resources;
- the use of innovative, non-wires solutions that, among other things, enable utilities to choose lower cost alternatives to meeting network and customer needs;
- an appropriate rate-of-return for utilities on these investments;
- a cost-benefit framework that provides clarity on the treatment of investments that have may cost a utility but benefit other participants in the electricity system;
- the ability of utilities to participate in market opportunities that would ultimately reduce ratepayers' costs associated with capital or other investments; and
- opportunities for utilities to partner with their customers to address system needs.

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These efforts seek to encourage a culture of innovation throughout the sector. As part of this effort, utilities will provide the OEB with business and system modernization plans as part of the distribution system planning process.

Building on the Renewables Revolution

The tremendous growth of Ontario's clean tech and renewable energy sectors has attracted billions of dollars in investment to Ontario and led to the creation of thousands of new jobs. Ontarians have every reason to expect these economic benefits will continue. The renewables sector is forecast to contribute nearly \$5.4 billion dollars to Ontario's GDP and create 56,500 jobs between 2017 and 2021.⁹ Over \$2.5 billion of these expenditures will occur in Ontario communities, contributing directly to local economic activity.¹⁰

Exporting Ontario's Energy Expertise

⁹ Market Analysis of Ontario's Renewable Energy Sector, Compass Renewable Energy Consulting Inc., June 2017

¹⁰ Market Analysis of Ontario's Renewable Energy Sector, Compass Renewable Energy Consulting Inc., June 2017

The firms that participated in Ontario's expansion of renewable energy are now poised to export their expertise and products to foreign markets which could contribute as much as \$1 billion to Ontario's GDP and could add as many as 10,700 jobs between 2017 and 2021.¹¹

For example, Ontario based hydroelectric component manufacturers have been successfully exporting to the United States for years. Many of Ontario's solar manufacturers are also reporting increased export activity to the US, despite strong global competition. And wind component manufacturers have developed expertise that will help them access nearby American markets that have strong renewable energy targets

Ontario's energy innovators, experts in smart grid, renewables, nuclear and other technologies, are using the solid base they established in Ontario to export to other jurisdictions in North America and around the world.

A Northern Ontario Success in Manufacturing Renewable Energy

Heliene Canada has been manufacturing solar photovoltaic (PV) panels in Sault Ste. Marie since 2010. Heliene currently exports over half of its modules to US markets.

Heliene's manufacturing facility utilizes state of the art technologies from around the world, including Japanese robotics, a Spanish lamination machine, glass from the United States and solar cells from Thailand.

Heliene Canada collaborates with other industry players and universities, such as the Rotman School of Business at the University of Toronto, to create a link between academic research and industrial applications.

Ontario continues to be committed to the dynamic and innovative business climate that made this possible. The Ministry will expand its role in supporting Ontario energy companies that want to export their goods, services and expertise, by:

- working with other provincial and federal government partners, industry associations and companies to develop and support trade initiatives that strengthen international relationships and create new business opportunities;
- developing market intelligence that determines which foreign markets hold the most promise for Ontario's energy goods and services;
- participating in energy-related trade missions abroad; and
- promoting Ontario's technical expertise at appropriate international forums

Ontario will develop a pilot program that supports the demonstration of locally developed technologies abroad. Through \$10 million in pilot funding, the program will help Ontario energy companies get a foothold with utilities and buyers in global markets. In designing this program,

¹¹ Market Analysis of Ontario's Renewable Energy Sector, Compass Renewable Energy Consulting Inc., June 2017

the Province will seek to collaborate with the federal government, which announced several investments in the cleantech sector in the 2017 budget.

“Ontario can lead globally on development of clean and low-cost remote energy systems ... Emerging global economies, including India, are demanding these solutions and Canadian entrepreneurs are poised to seize that opportunity.” – MaRS Cleantech

Callout Box: *Laker Energy Products is a leading supplier of nuclear-class pipes and fittings for the CANDU nuclear power industry. The Ontario company is building on this success to export its precision-tooled products around the world.*

Laker recently purchased a new 65,000 sq. ft. facility to handle the more than \$85 million in contracts it has helping refurbish the Bruce and Darlington nuclear reactors. The facility will also support Laker’s sales to international markets, including existing and new-build projects in Argentina, Romania, China and the UK

From our own backyard, Laker has become a world leader in the provision of fully integrated, high-precision machining, assembly and testing of CANDU-related products.

Nuclear Innovation

Nuclear energy doesn’t only power our homes. It has enabled Canada to be a world leader in nuclear research and nuclear medicine, saving lives and bringing peace of mind to countless numbers of cancer and heart patients around the world.

Ontario is keenly interested in collaborating with the federal government, universities and industry partners to continue its support of the nuclear industry for both energy and non-energy applications. Ontario can help create new export opportunities for our “home-grown” nuclear innovations, such as;

- **Small Modular Reactor (SMR) Technology:** SMRs are a new generation of nuclear power reactors that have smaller footprints than conventional reactors and promise economies of scale through mass production.
- **Nuclear Fuel Research:** Technological innovations could lead to the reprocessing or recycling of used nuclear fuel or the use of thorium to power nuclear reactors.
- **Hydrogen:** Ontario’s nuclear technology could be used for the large- scale production of hydrogen. Hydrogen is a low-carbon energy source that could in the future replace gasoline for transportation or natural gas for heating.

Medical Isotopes

Isotopes from Ontario's power reactors are used in both the diagnosis and treatment of life-threatening diseases and the sterilization of medical equipment and food products.

Currently, 70% of the world's supply of the medical-grade Cobalt-60 isotope is produced in nuclear reactors at Chalk River, Pickering and Bruce¹². The isotope is used for 10 million cancer therapy treatments annually around the world and for medical imaging, equipment sterilization and non-invasive brain surgery.¹³

Recently, Cobalt-60 harvested from the Bruce reactor was used in the Sterile Insect Technique or SIT, to combat the spread of Zika, West Nile and Dengue viruses.¹⁴

The medical health-sciences company, Nordion is exploring opportunities to expand the production of Cobalt-60 to the Bruce A and Darlington reactors in the future.¹⁵

¹² Canadian companies collaborate to secure isotope supplies, 8 November 2016, World Nuclear News, <http://www.world-nuclear-news.org/RS-Canadian-companies-collaborate-to-secure-isotope-supplies-0811168.html>

¹³ Medical Isotopes, Canadian Nuclear Laboratories Website, <http://www.cnl.ca/en/home/facilities-and-expertise/nru/isotopes.aspx>

¹⁴ The nuclear connection to combat the Zika virus, May 2016, Canadian Nuclear Association, <https://cna.ca/news/nuclear-connection-combating-zika-virus-2/>

¹⁵ Nordion and Bruce Power ensure global Cobalt-60 supply up to 2064, 8 November 2016, Bruce Power website, <http://www.brucepower.com/bruce-power-ontario-power-generation-collaborate-to-ensure-steady-supply-of-cobalt-60/>