

ONTARIO'S ELECTRICITY FUTURE
QUESTION 18

What impact will net metering have on the future of renewable electricity in Ontario?

The transition from fixed-price contracts (such as FIT and microFIT) to net metering will reduce near-term costs to electricity ratepayers, but will also discourage renewable electricity generation.

Net metering will allow customers to reduce their own power bills, but will not allow them to make money by selling renewable power to the grid.

Even for customers who wish to reduce their own bills, net metering, as currently proposed, does not recognize the value of distributed, renewable electricity to the electricity system, including the value of solar in meeting peak demand. It will therefore unduly discourage installation of new renewable electricity sources, at least until electricity prices rise and/or renewables cost continues to fall.

Ontario should support customer interest in generating their own renewable electricity, at a low overall cost, by paying “time-of-use” rates and by allowing virtual net metering for group or community projects.

What impact will net metering have on the future of renewable electricity in Ontario?

Q18

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The details...

For a decade, Ontario successfully encouraged Ontario citizens, communities and businesses to invest in renewable electricity.

From long-term contracts to net metering

For a decade, Ontario successfully encouraged Ontario citizens, communities and businesses to invest in renewable electricity projects – from small rooftop solar to large wind and water – by awarding fixed-price, 20-year contracts. This included some 25,000 microFIT projects all over the province, almost all of them small solar.¹ Long-term contracts were also awarded to encourage investors to build other forms of generation, such as natural gas.

After 2017, Ontario will no longer enter long-term contracts for renewable electricity. Existing contracts will continue, but no new contracts will be awarded. Instead, according to the 2017 Long-Term Energy Plan (LTEP), new renewable electricity projects will only be offered net metering (described below), i.e. the ability to reduce one's own power bill. Net metering is an enabling tool to modestly support customer self-sufficiency, not a procurement tool to increase Ontario's electricity supply. The IESO's Market Renewal Initiative will examine procurement opportunities for renewable generation (likely larger-scale renewables) as the need arises (Q17).

After 2017, Ontario will no longer enter long-term contracts for renewable electricity.

Net metering allows a household or business that produces renewable electricity for their own use to receive bill credits for some extra electricity sent into the grid. The bill credits are calculated based on the average unit price that the customer normally pays their utility to purchase electricity. However, the renewable system must be designed to primarily to meet the customer's own electricity needs. If renewable electricity production exceeds consumption (over a 12-month period), customers are not given any credit for the "excess" electricity delivered to the grid.²

All Canadian provinces already offer some form of net metering.³ Ontario has allowed net metering since 2006, but it has been little used; the various Feed-in Tariff (FIT) programs, despite their administrative hassles and interconnection issues, were more economically attractive. Other jurisdictions, such as Manitoba, Alberta, and Saskatchewan also allow net metering, sometimes in addition to capital incentives for solar.⁴

The FIT/microFIT program was a cornerstone of the 2009 Green Energy Act (Q9). FIT participants were guaranteed a fixed price for the electricity they will generate over a 20-year contract. Contract prices varied by size and energy source. They were set at the level needed to attract the capital investments required to get projects operating, i.e. to guarantee developers a reasonable rate of return (e.g., 8% over 20 years, with a 12 year break even point). FIT was intended to ensure projects were built and to help develop an Ontario-based renewable energy technical support industry to supply clean power to the grid. FIT was the international "best practices" benchmark for building a renewable energy industry at the time the Green Energy Act was passed.

Since then, with the dramatic price drop in solar technology, many jurisdictions have moved to some form of net metering for small-scale renewable electricity. However, the ECO finds that there may be

Under Ontario's net metering plan, it is not possible to make money by producing more power than one needs.

limited uptake in Ontario. Under Ontario's net metering plan, it is not possible to make money by producing more power than one needs over the course of a year.⁵ It is not even possible to entirely eliminate one's own power bill. Because there is no credit given for extra electricity produced, net metering customers will size renewable energy systems primarily to meet their own electricity need. This means that larger, lower cost renewable electricity projects are unlikely to be developed, unless they can be developed on the site of a customer with very large electricity needs. Large projects produce most of Ontario's renewable electricity, and can do so at lower overall costs due to economies of scale.

Even for those who wish to produce their own power, net metering is not a contract, but a policy and regulation that could change at any time. It offers no price certainty, and no guarantee that the net metering policy will remain in place (at any price) long enough for a new system to pay for itself. However, Ontario has had a net metering regulation since 2005 and the recent proposals build on that framework.

In the short term, if it were not for the likelihood that grid power prices will continue to rise (Q9), it may not make financial sense for most grid-connected customers to build renewable power under net metering. Over the long term, the Ministry of Energy expects increased interest in the program as a result of proposed regulatory enhancements and many people's desire to be part of a solution to climate change.

In the hope of improving the economics of net metering for some potential producers, the government is considering regulatory changes to expand the scope of eligible net metering ownership models.⁶ These proposed ownership models include third party ownership and virtual net metering demonstration projects. The purpose is to allow greater opportunities for Ontarians to participate in net metering and thereby to help them reduce their electricity bills. These ownership models will result in helping net metering participants to reduce their upfront costs for the system. Consumer protection is also part of this proposal. What will these changes accomplish, and how will they affect the future of renewable electricity in Ontario?

How net metering will work

Ontario's net metering regulation (O.Reg.541/05: Net Metering) came into force in January 2006.⁷ It was recently revised, following consultation including use of the Environmental Registry (Proposal # 012-8435), with changes coming into force in July 2017.⁸ A schematic of how net metering works is shown in Figure 18.1.

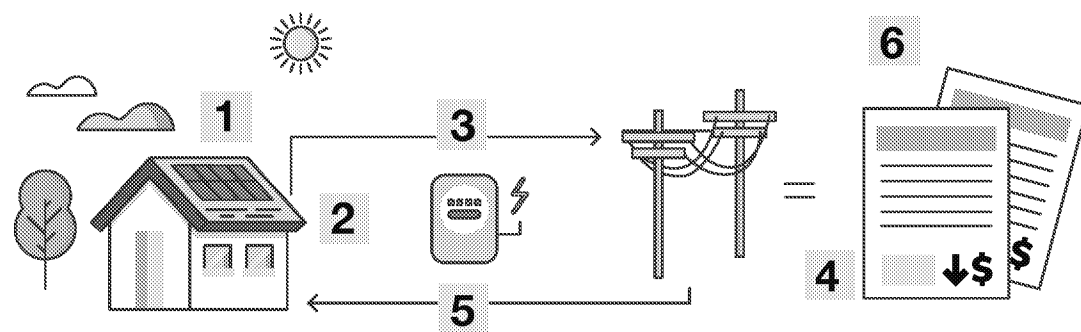


Figure 18.1. How net metering works.

Source: Ontario Ministry of Energy, Delivering Fairness and Choice, Ontario's Long-Term Energy Plan, (Toronto: Ministry of Energy, October 2017) at 57.

Notes:

1. Solar panels mounted on the roof of a house generate electricity.
2. The electricity generated is used to power the house first.
3. Any extra electricity generated is sent to the local grid.
4. Net-metered customers receive credits on their electricity bill for electricity sent to the local grid.
5. Electricity is drawn from the local grid when the home's electricity needs are higher than the amount of electricity generated by the solar panels.
6. Net-metered customers' monthly electricity charges are calculated based on the difference between the amount of electricity used from the local grid and the credits received from any electricity sent to the local grid from the solar panels.

To be eligible for net metering, electricity must be generated from a renewable energy source. It is expected that most net metered generation will be rooftop solar systems, at least for residential customers. It is a billing arrangement between the customer who generates the electricity and their electricity distributor. There is no limit on the size of the renewable electricity system,⁹ which could enable larger industrial or commercial customers to install quite large renewable energy systems, if they have suitable roof space or available land and enough demand to use the electricity produced. There is additional net metering potential if net metering facilities could also be used in structures for covering parking lots.

In essence, net metering allows customers to treat the grid as a battery where any excess electricity is stored until they need it. If they need more electricity than they are generating, then they take this additional amount from the grid, just as they would from a battery.

Net metering allows customers to treat the grid as a battery.

But when they generate more electricity than they are using, the excess is injected into the grid. Customers are credited for this, at the same rate that they are usually charged for electricity. The monetary value of the credit is based on all volumetric (kWh) charges that a customer consuming this amount of electricity would otherwise pay.¹⁰

Net metering can reduce commodity charges, and some delivery and regulatory charges (see [Q8](#) for a description of the residential bill).¹¹ But as electricity bills also include fixed charges, which net metering cannot reduce, a customer's bill will not drop in proportion to the percentage of their electricity use that is self-generated.¹²

Why do customers still need to pay an electricity bill if they generate 100% of their own electricity?

For example, a Hydro One residential customer who uses 750 kWh per month¹³ of electricity and generates 50% of this (375 kWh) will see their bill fall by 38%. A customer that generates an amount exactly equal to their consumption (750 kWh) of electricity will see their bill fall by 75%, but not to zero.¹⁴ This equates to a payment of about 11¢ for every kilowatt-hour of electricity generated (using the electricity rates in effect in early 2018), much less than the 21-31¢/kWh tariff that was available to rooftop solar projects in 2017, the last year of the FIT/microFIT programs.¹⁵ The figures for other utilities are similar.

Why do customers still need to pay an electricity bill if they generate 100% of their own electricity? The reason is that they are using the electricity grid infrastructure as back-up to compensate for the real-time imbalances between their electricity production and their electricity use (Figure 18.2). This has value to the net metered customer, as it avoids the need for the customer to buy a large amount of on-site energy storage (such as batteries). The fixed charge for grid access is currently about \$20/month for residential customers (the exact amount will vary by local distribution company (LDC)). These amounts will rise in the future, as more of the electricity bill will be recovered through a fixed charge. The move to a fixed rate is being phased in over 4 years and will be completed by 2019 for most utilities (perhaps adding another \$15/month or so in fixed charges for residential customers; again this will vary by LDC). The fixed charge is still significantly less than the cost for a customer to go completely off-grid.



Commercial rooftop solar array.

Source: Abundant Solar Energy

Some Ontario LDCs charge an additional monthly fee to process net metering statements, which creates another cost barrier for net metering.

Time-of-use pricing for net metered customers

Time-of-use pricing (electricity rates that vary with time of day) is mandatory for almost all Regulated Price Plan electricity customers in Ontario (i.e., residential and small business customers), to recognize that it is much more expensive for the grid to produce power during times of peak demand. In the summer, time-of-

use rates are highest between 11 a.m. and 5 p.m., as demand is high during these hours. This is exactly when solar systems are producing much of their electricity. In other words, the higher time-of-use price periods tend to align with the production curves for solar.

Figure 18.2 shows a schematic of electricity generation and use on a typical summer day with a residential solar photovoltaic (PV) system that is net metered. The exports to the grid (the green bars) are the amount of electricity that the customer would be credited for, offsetting their purchases from the grid (the blue bars).

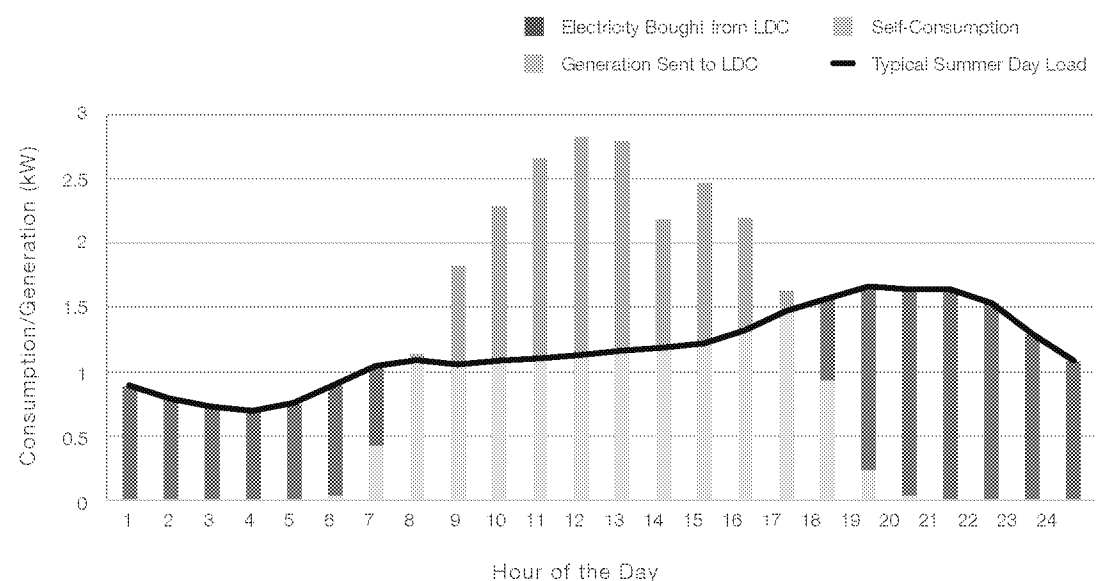


Figure 18.2. Electricity production and consumption on a summer day from a net metered 4 kW rooftop solar system.

Source: Ontario Ministry of Energy, Delivering Fairness and Choice, Ontario's Long Term Energy Plan (Toronto: Ontario Ministry of Energy, October 2017) at 58.

However, net metered customers are not billed and credited based on time-of-use rates. They are billed on tiered rates that do not vary by time of day.¹⁶ This is due to information technology issues related to metering and billing. Using tiered rates allows each LDC to bill net-metered customers with the minimal

data management effort, but the trade-off is that it ignores the higher value of distributed solar power when provided at peak times, and also likely makes net metering less financially attractive for potential participants.

Using tiered rates allows each LDC to bill net-metered customers with minimal effort, but ignores the higher value of distributed solar power when provided at peak times.

Options for expanding net metering

The Ontario Ministry of Energy recently posted regulatory proposals and invited comment on some options, such as third party ownership, and virtual net metering demonstration projects, that could expand opportunities for net metering.¹⁷

Third party ownership: Third party ownership would enable other entities to own a net metering generation facility at a customer's site. This could help raise capital and professionalize construction and operation, enabling net metering for customers who cannot or do not want to take the financial or operational risk of owning and operating their own renewable energy system. The customer would enter into a financial agreement with the owner of the generation facility to take the electricity generated and to allow any excess to be directed into the LDC's system. The customer would then receive a credit on their bill for this excess electricity, and would presumably share that credit in some fashion with the third party operator. The Ministry is also considering consumer protection measures, similar to those that are in place for electricity retailing, when a customer enters into an agreement with a generator.¹⁸

The uptake in Third Party Ownership projects will depend in part on the creditworthiness of load customers, which will vary. This will impact the ability of

solar energy providers to secure financing and leasing options to provide this service to potential customers.¹⁹

Virtual net metering: Virtual net metering is considered an "innovation" in the LTEP (XQ3). Virtual net metering allows Ontarians who are not able to have a net metered renewable energy project at their own location to participate in renewable energy projects located elsewhere (within the same LDC territory or potentially in the territory of other LDCs). For example, customers who rent, or homeowners without sun access could invest in, and be credited for, solar electricity generated on a neighbour's property. Businesses with multiple locations could add solar at the most suitable locations, and offset some of their electricity use at other sites. The Ministry of Energy plans to allow proponents (likely in partnership with LDCs) to undertake demonstration projects, to help guide future policy.

Depending on how it is implemented, virtual net metering could also enable community solar, whereby individuals or businesses aggregate their funds (e.g., through a co-operative) to develop one or more larger-scale renewable energy projects, and use the electricity generated from the projects to reduce their electricity bills. Larger systems are more economical to install and operate than smaller systems.²⁰

Siting restrictions: To ensure that generation facilities are sited appropriately, the Ministry is proposing siting restrictions for net metered facilities, similar to what existed under the FIT/microFIT programs, so that projects will not negatively impact residential areas and the province's most productive soil will remain available for agriculture.²¹ Non-rooftop (ground-mounted) solar PV systems would have to be more than 15 metres from the property boundary and could not be sited on prime agricultural land. There would be a blanket prohibition on wind and non-rooftop solar net metered projects connected to residential dwellings. The Canadian Solar Industries Association (CanSIA) believes

Virtual net metering could enable community solar.

that these siting requirements are too restrictive.²² The ECO also believes that there are good opportunities to use solar in structures that cover vehicle parking and that these should be excluded from the siting restrictions on “non-rooftop solar”.

Integrating net metering into distribution

networks: The Ontario Energy Board has established a working group to address any issues in connecting to the distribution system that could arise if there is increased interest in net metering.²³

The most important issue and a key barrier is a provision in the distribution system code which only requires distributors to facilitate net metering until the total amount of generation capacity from net metered customers reaches the 1% threshold of the distribution system’s peak load (averaged over 3 years). It is at the utility’s discretion as to whether to permit additional net metering.²⁴ This provision will be reviewed by the Net Metering Working Group.

The 1% threshold for net metered projects is one example of the larger regulatory and technical challenges of integrating more renewables into distribution networks. It is not clear whether the 1% threshold was originally set to minimize any financial impact on LDCs from net metering, or whether it was also set in part as a (very conservative) estimate as to the amount of distributed generation an LDC should be able to accommodate without any upgrades to its distribution network. LDCs understandably must ensure that the new two-way power flow does not cause problems for their distribution system, which was originally designed for one-way power flow.

The Green Energy Act gave the Ontario Energy Board a new objective of promoting network upgrades

to facilitate renewable energy connections, and took steps to spread some of the costs of network upgrades across all provincial electricity customers, so that certain LDCs were not burdened with excessive upgrade costs.²⁵ The Board has provided guidance as to how distributors can seek funding for grid upgrades to enable renewables. At least \$800M in approved infrastructure upgrades since the passage of the Green Energy Act were done (at least in part) to support renewable energy integration.²⁶

LDCs are not required to have technical capacity to accommodate renewables.

But LDCs are not required to ensure that they have technical capacity throughout their network to accommodate renewables, and there is no clarity as to what level of upgrades (and what level of spending) is reasonable for utilities to make. Utilities therefore move at their own pace in making their network renewable-ready, and adopt their own technical criteria for whether or not projects can be connected.²⁷ For example, Hydro One and some other distributors limit renewable energy on a line to 7-10% of the line capacity; this has been a significant barrier to renewable energy development in some parts of the province.²⁸ The IESO is currently assessing the potential for rooftop solar in Ontario based on building roof space, but this analysis does not take into account whether the relevant LDC will accept the power.²⁹

Will net metering encourage renewable electricity?

Will net metering encourage Ontarians to add renewable electricity supply? It looks unlikely, at least in the short term. In 2016, after a decade of net

metering, Ontario had only 983 net metering facilities (851 of them solar), with a total capacity of only 12 megawatts.³⁰ While this was 30% higher than in 2015, it still represents a vanishingly small fraction (about 0.04%) of Ontario’s overall electricity capacity.

At the moment, net metering projects do not make financial sense for most customers.

Of course, customers previously had the more lucrative option of applying for a long-term fixed price contract, which will no longer be a possibility. The first phase of net metering amendments only took effect in July 1, 2017, so it is too soon to be certain what impact they will have. The Ministry of Energy declined to provide an estimate of expected future participation in net metering.³¹

To ensure potential participants are aware of the possibility of net metering, the Ontario Energy Board is looking at how to improve the availability of information for customers.³² Although the Government of Ontario has a net metering web site, which explains how the system will work and who is eligible, not much explanatory information is available on the websites of many distributors.³³

The larger problem is not lack of awareness, but economics. At the moment, net metering projects do not make financial sense for most customers. The estimated cost to a homeowner of installing solar electricity is about 16–30 ¢/kWh³⁴, well above the credit for net metered electricity (roughly 11 ¢/kWh). “Grid parity” (where the unit cost of self-generated electricity matches or is lower than the cost for electricity obtained from the grid) has been reached in some European countries but not yet in Ontario.³⁵ There will likely be some customers who see a non-monetary

benefit in meeting their energy needs with self-generated renewable electricity, and would be willing to pay a small premium for this (similar to customers who buy energy from premium renewable vendors such as Bullfrog Power), but it is unclear how large this customer base is.

The economics can make more sense for larger commercial projects, (which currently cost 12–22 ¢/kWh),³⁶ especially since installing solar can fix the cost of electricity for 20 years or more (for the lifetime of the system), while grid prices are likely to go up. Commercial customers typically have larger useable roof space, can take a longer pay-back period and have higher on-site loads.³⁷ One major reason why large solar is cheaper is that soft (non-hardware) costs such as installation, permitting, customer acquisition can make up a large share (more than half) of solar costs, and economies of scale mean that these costs are not proportionally as important for larger projects.³⁸ While CanSIA has made it a priority to reduce these costs for all sizes of solar projects, virtual net metering will be required for most potentially economic (larger) systems to fit into the net metering framework. Even then, CanSIA expects future net metering uptake to be small.³⁹

The economics can make more sense for larger commercial projects.

Electricity pricing and rate design obviously affect the economics of net metering. The Fair Hydro Plan (which reduces residential electricity bills by 25%, for a few years) pushes net metering farther away from grid parity and likely makes third party models for residential and small commercial customers uneconomical.⁴⁰ Denying time-of-use pricing to net metered solar customers further erodes the financial case for installing renewable

electricity. And the move to higher fixed charges for electricity distribution service, which cannot be reduced by a net metered project, further weakens the financial case.⁴¹ On the other hand, the Green Ontario Fund might eventually offer financial incentives for installing solar panels, which could offset some of these adverse impacts.⁴²

So could the trend of dramatically falling costs. In the last seven years, the cost of utility scale solar PV has come down by an average of 85%.^{43, 44} The trend in Ontario prices for smaller systems has been less dramatic, but still impressive, as shown in Figure 18.3 by the FIT/microFIT price trends.

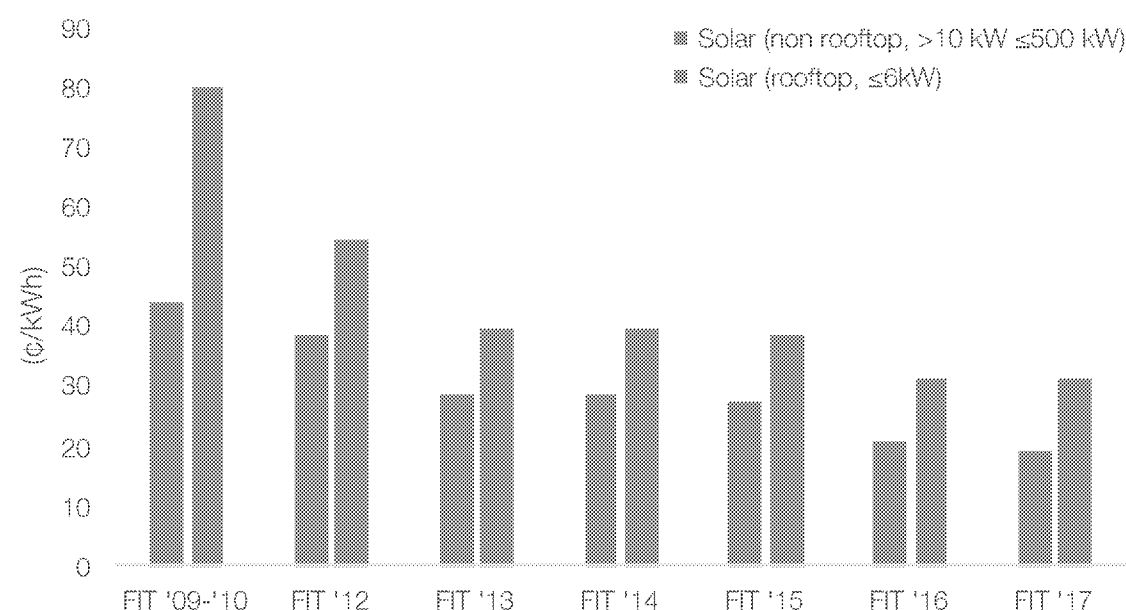


Figure 18.3. Changes in prices for selected Ontario solar procurement (2009-2017).

Note: Prices not adjusted for inflation. Only the largest and smallest category FIT projects, continuously offered from 2009-2017, are shown in this graph.

Source: Independent Electricity System Operator, "2017 FIT Price Review Background Information" (presentation, 31 August 2016) slide 22, online: <www.ieso.ca/-/media/files/ieso/document-library/microfit/updates/2017-fit-price-review-background-deck-20160831.pdf?la=en>. [Accessed 21 March 2018]

Figure 18.4 shows the IESO's projections for future cost of installed solar projects of different scales, based on dollar per watt of installed solar capacity. The IESO projects roughly a 30% decline in price over the next 15-20 years.

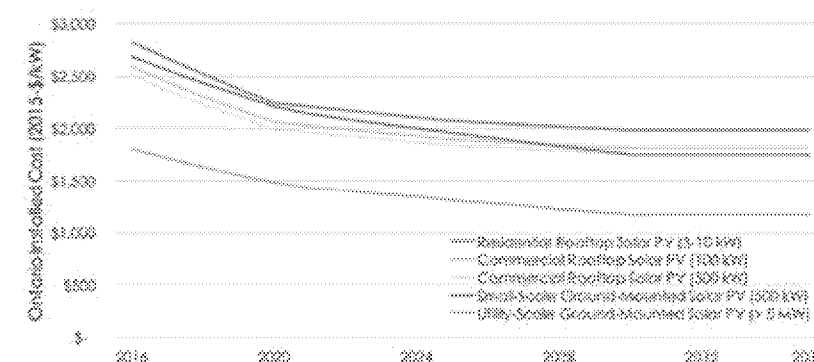


Figure 18.4. Installed solar PV cost projections in Ontario.

Source: Independent Electricity System Operator, "Appendix B, Data Tables for the Technical Report" (presentation, August 2016).

If and when the cost of solar reaches grid parity, averaged over the 20+ year working life of the panels, the number of customers interested in net metering could spike upwards.

Impact on the solar industry

Ontario has made numerous promises about building a low carbon economy. The FIT/microFIT and renewable electricity procurement programs allowed Ontario to build up substantial expertise and a large solar value chain, from professional services (e.g. financing, engineering), to photovoltaic module production, to manufacturing of supporting components, to construction and installation.⁴⁵

In a report to the International Energy Agency, CanmetENERGY (part of Natural Resources Canada) confirmed that Ontario has about 99% of the total solar installed capacity in Canada, and accounted for 90% of the Canadian market share for new installations in 2016.⁴⁶ There are still three companies producing PV modules in Ontario with a total maximum production capacity of about 250 MW/yr.⁴⁷ One of these companies (Canadian Solar) is one of the three biggest solar companies in the world by revenue at about \$2.8 billion,⁴⁸ an important Ontario success story. Heliene, located in Sault Ste. Marie is helping to transform Northern Ontario with alternative energy projects including this manufacturing facility.⁴⁹ Silfab Solar has also now partnered with Morgan Solar Inc.

Ontario's hard stop in renewable electricity procurement dramatically undercuts the future of this industry in Ontario.

of Toronto to mass produce low cost PV modules.⁵⁰ The report authors estimated that the total value of PV capacity installations in 2016 in Canada was about \$340 million, with \$300 million of this in Ontario. Ontario manufacturers are well positioned to take advantage of export markets to other jurisdictions where there is a growing demand for renewable electricity in the U.S. and elsewhere in Canada.⁵¹

Ontario's hard stop in renewable electricity procurement, including the termination of the FIT/microFIT programs as well as the cancellation of the Large Renewable Procurement (LRP II) {~ 980 MW}, dramatically undercuts the future of this industry in Ontario, other than the small niche of off-grid systems. Some of the industry is shifting to other provinces and states that do encourage solar development. Alberta, for example, now gives rebates of up to 30% off solar installations, to a maximum of \$10,000, to foster the industry and spur job creation and has committed to 30% of all electricity to come from renewables by 2030.⁵² Both Alberta and Saskatchewan are taking the lead in utility scale solar projects, which are attracting companies from Ontario.⁵³

If Ontario allows virtual net metering and third party operation, pays time-of-use rates, and works to address other regulatory barriers and soft costs, then net metering could allow Ontario to transition away from the FIT model and maintain some of the capacity for solar production and installation that it has developed over the last decade. This would keep some solar jobs and expertise in Ontario, an important consideration as one projection shows a net loss of about 5,000 jobs in Ontario's solar sector between 2017 and 2021.⁵⁴

Does net metering benefit LDCs and other electricity customers?

Net metered customers use the grid as a large battery. They use the wires and poles that move electricity around, and grid sources of power when their own system is unable to meet demand. How does net metering affect the cost of distribution and of generation for the system as a whole?

For wires and poles, net metered customers are roughly paying a fair share of the current costs to maintain the existing grid, under the current distribution rate design.⁵⁵ This means they do not impose any additional distribution costs to customers who do not participate in net metering. In the longer term, net metering could increase or decrease grid infrastructure costs. On one hand, generation is typically sited closer to load. This may reduce costs, i.e., there may be opportunities to “downsize” parts of the grid when infrastructure is replaced, or existing infrastructure may accommodate more growth.⁵⁶ There may also be savings because less energy is lost through line losses as electricity travels from generator to consumer. On the other hand, utilities may need to make additional investments to manage the two-way flow of electricity, which the distribution networks were not originally designed for.

The generation cost impact of net-metered projects on non-participating customers is equivalent to the government purchasing an open-ended amount of new renewable electricity generation, at a rate that is currently roughly 11¢/kWh. This is lower than we have historically paid for renewable electricity in Ontario (the average cost of solar PV in LRP 1 was about 15.7¢/kWh). Therefore, the transition to net metering reduces electricity supply costs to non-participating customers, at least in the near term.

During hot summer days, solar generation displaces some natural gas-fired generation, reducing cost and greenhouse gas emissions.

Solar electricity production is high during summer days, as shown in Figure 18.5, which benefits the environment and the electricity system. This output coincides with the current peak demand requirements of Ontario's system (primarily from the increased use of air conditioners). Peak electricity is by far the most expensive for the grid to provide. During hot summer days, solar generation displaces some natural gas-fired generation, reducing cost and greenhouse gas emissions.⁵⁷ Solar does not supply power at night (unless it is combined with energy storage), when Ontario's system generally needs power the least. It may also reduce the need for new generation capacity, although this might change if Ontario switches to a winter-peaking jurisdiction in the future (e.g., due to electrification of heating).⁵⁸

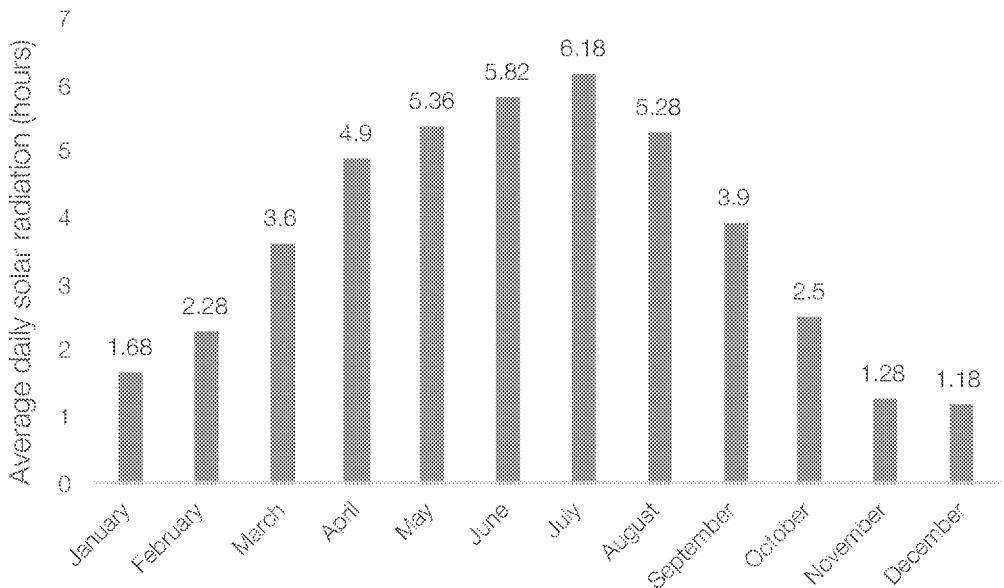


Figure 18.5. Average daily solar radiation – Toronto.

Source: “Frequently Asked Questions”, online: Northern Lights Solar Systems <www.solarman.ca/faqtech.php>. [Accessed 21 March 2018]

In U.S. states where net metering has become popular, the argument about how it is impacting utilities and their customers has been widely debated. Most U.S. studies have concluded that net metering benefits all utility customers, once all benefits such as avoided infrastructure investments and carbon reductions are considered.⁵⁹ However, the precise impacts depend on local characteristics. An extreme example is Hawaii, where there is lots of sun and high electricity prices (due to the need to import fuel) made net metering very attractive. The Hawaii Public Utilities Commission in 2015 closed its net metering program; there was so much solar generation in the State that the utility had problems managing the low combustion levels required from its fossil-fuel generators. In the Hawaiian Electric Company territory, 16% of customers had net metered systems and accounted for more than 30% of the individual circuit peak load.⁶⁰ Nevada also rolled

Most U.S. studies have concluded that net metering benefits all utility customers.

back their net metering provisions, which resulted in the major providers of rooftop panels, such as SolarCity, leaving the State entirely.⁶¹ Some states, such as Massachusetts, have placed a cap on the amount of net metering, hoping to help protect the LDCs but also encourage the deployment of solar technology.⁶²

Time-of-use pricing could improve the value of net metered renewable electricity to the grid, by encouraging customers to integrate it with energy storage, and return stored energy to the grid during “on-peak” periods, when the electricity rate is higher,

particularly in the fall and winter, when demand peaks later in the day, after the time that solar production peaks. Time-of-use pricing was the primary concern raised in public comments submitted through the Environmental Registry on the first round of the Ministry's net metering amendments.⁶³ The Ministry of Energy has committed to undertake a cost-benefit

analysis to assess whether the required investments should be made to enable province-wide time-of-use pricing for all net metered customers. Direct utility control of energy storage and net metering might deliver additional grid benefits, as discussed in the textbox "Utility integration of net metering and on-site energy storage".

Utility integration of net metering and on-site energy storage

In the 2017 Long-Term Energy Plan (LTEP), the Ontario Government has promised to work with the Independent Electricity System Operator (IESO) to develop some renewable distributed energy demonstration projects.⁶⁴ Residential energy storage is one technology to be considered.

Customers may wish to pair solar with storage to protect against grid outages. However, in everyday operations, most customers will not notice or care how power flows between their solar system, their battery, and the grid, so long as their electricity needs are being met. However, the direction and timing of power flow will matter to utilities. If they can have some control of this operation, they can use it to extend the life of grid infrastructure, reduce peak demand, and provide additional grid services.

Ontario local distribution companies (LDCs) are exploring how various forms of distributed energy resources may support their business models and enhance grid reliability. Various projects which involve linking a number of houses who are net metered, with storage capabilities and where the LDC's control and data acquisition system directs the flow of

energy for maximum benefit, are being planned or are in operation.

For example, Oshawa PUC together with Tabuchi Electric and Panasonic Eco Solutions have launched a pilot project that provides thirty homes with solar panels, batteries and an inverter (to convert electricity between direct current and alternating current) free of charge.⁶⁵ These customers will be switched to a net metering contract. The homes' energy usage during a power outage will be pre-determined to allow the battery bank to provide this minimal power for a few days.⁶⁶ Aside from that constraint, the utility will determine when the stored energy in the battery is used. With an efficient control and data acquisition system operated by the utility, it will allow the LDC to shift demand from on-peak to off-peak.⁶⁷

Alectra has conducted a similar residential solar storage pilot (the Power.House project). To test more northerly regions where daylight periods are longer in summer but shorter in winter, the company has also partnered with Thunder Bay Hydro.⁶⁸



Sunverge's residential solar electricity battery storage system used by Alectra Utilities in their Power.House demonstration project.

Source: Sunverge

These examples (and others)⁶⁹ show the future of distributed electricity generation in Ontario may be one in which net metering is combined with solar generation and storage, potentially along with some degree of utility operational control. Residential or community sized, the issue remains one of how to deploy and manage these systems over a large number of customers. If such systems are to help manage peak loads and provide energy across the grid as and when needed with the maximum benefit to customers, an advanced control and data

acquisition system will be key to its success. The Electricity Distributors Association has released a vision paper that sees utility control of distributed energy resources, including behind-the-meter energy generation and storage, as a key to helping make sure that distributed resources are used in a manner that provides the maximum value to the energy grid and customers.⁷⁰ It is an open question as to how large a role should be played by LDCs versus other actors in advancing distributed electricity generation and other innovative energy technologies (Q16).

Conclusion

Ontario has turned dramatically away from supporting the growth of renewable energy in favour of keeping near-term electricity prices down. This is a serious blow to the low-carbon economy that Ontario has been building for the last 10 years.

Net metering will not get renewable energy projects built at the same level that occurred under the FIT program. However, it does preserve a modest option for Ontario consumers who are interested in generating their own electricity and doing their part for the environment.

If properly implemented, net metering could allow Ontario to keep some portion of its solar industry jobs and expertise, as well as procuring a small amount of distributed renewable electricity at a relatively low cost.

The government should ensure that siting restrictions and constraints connecting to the distribution system do not unduly inhibit uptake of net metering.

RECOMMENDATION: The Ministry of Energy should ensure that prohibitions on siting of non-rooftop solar projects within residential areas or near property boundaries do not apply to structures that shade vehicle parking areas, whether or not they are attached to a building.

RECOMMENDATION: The Ontario Energy Board should require utilities to accommodate a reasonable level of renewable distributed generation.

Ontario has turned dramatically away from supporting the growth of renewable energy in favour of keeping near-term electricity prices down. This is a serious blow to the low-carbon economy that Ontario has been building for the last 10 years.

Since larger projects are less expensive to build and operate, policies that encourage cooperative and community projects (such as virtual net metering and third-party operation) are likely to increase the number of net metering projects.

RECOMMENDATION: The Ministry of Energy's net metering framework should accommodate and encourage co-operative and community projects.

The amount credited for net metered electricity should better match its value to the system, including its carbon reductions and peak demand reductions. Wherever possible, this should include time of day rates.

RECOMMENDATION: The Ministry of Energy should facilitate time-of-use pricing for net metering.

Endnotes

1. Independent Electricity System Operator, A Progress Report on Contracted Electricity Supply, Second Quarter 2017 (Toronto: IESO, September 2017) at 30.

2. Production can exceed consumption within a given month – customers are given a credit for the excess that can be carried forward for up to 12 months to offset future costs. See for example, Hydro One's Net Metering Program <www.hydroone.com/business-services/generators/net-metering>. [Accessed 21 March 2018]

3. International Energy Agency, National Survey Report of PV Power Applications in Canada (Ottawa, Natural Resources Canada, 2014) at 15.

4. Manitoba Hydro has a net metering solar program and also pays a capital incentive of \$1 per watt installed capacity. Originally established in 2008, Alberta's Micro-Generation Regulation allows Albertans to generate their own electricity to meet their own needs. This was updated in 2016 to increase the size allowed to 5 MW and allow systems to serve adjacent sites. It is currently again being reviewed to allow community owned generation. SaskPower also has a net metering program for up to 100 kW in which they will also provide up to \$20,000 as a capital rebate.

5. Some jurisdictions like Nova Scotia do allow the sale of excess generation at the end of the year.

6. Environmental Registry Regulation Proposal #013-1913, Proposed Amendment of Ontario Regulation 541/05: Net Metering or a New Regulation (To Be Determined) to be made under the Ontario Energy Board Act, 1998 (28 November 2017).

7. Ontario Energy Board Act, 1998, O. Reg 541/05: Net Metering.

8. Environmental Registry Regulation Proposal #012-8435, Amendment of Ontario Regulation 541/05: Net Metering, made under the Ontario Energy Board Act, 1998 (22 December 2016).

9. The Environmental Registry (012-8435), posted December 22 2016, regulatory proposal removed the 500kW maximum size limit.

10. How an LDC should bill a net metered customer is explained in the net metering regulation. O.Reg. 541/05: Net Metering.

11. See the Sunfish web site for an example of a Hydro One bill for a net metered customer; online: <0.wp.com/sunfishsolar.ca/wp-content/uploads/2015/02/Hydro-generation.jpg> [Accessed 21 March 2018]

12. Larger business customers not eligible for the Regulated Price Plan pay a larger portion of their bills based on their demand (kW). As with fixed charges, demand-based charges cannot be offset based on net metering.

13. The OEB set the standard residential consumption in Ontario at 750 kWh/month on April 14, 2016.

14. The calculation is based on customers having tiered rates ("Bill calculator", online: Ontario Energy Board <www.oeb.ca/consumer-protection/energy-contracts/bill-calculator>. [Accessed 21 March 2018].

15. "FIT/microFIT Price Schedule (January 1, 2017)", online: <ieso.ca/-/media/files/ieso/document-library/fits/2017-fit-price-schedule.pdf?la=en>. [Accessed 13 March 2017].

16. As of July 1, 2017, tiered rates were: 7.7¢/kWh for less than 600 kWh used per month, and 9.0 ¢/kWh above this level of consumption. These prices do not depend on the time of day when electricity is used.

17. Environmental Registry Regulation Proposal # 013-1913, Proposed Amendment of Ontario Regulation 541/05: Net Metering, or a new Regulation (To Be Determined), to be made under the Ontario Energy Board Act 1998 (28 November 2017).

18. Environmental Registry Regulation proposal # 013-1915 Proposed Amendment of Ontario Regulation 389/10: (General), to be made under the Energy Consumer Protection Act, 2010 (28 November 2017)

19. Ontario Ministry of Energy, Market Analysis of Ontario's Renewable Energy Sector, (Toronto: Compass Renewable Energy Consulting Inc., June 2017) at 14.

20. Independent Electricity System Operator, Ontario Planning Outlook (Toronto: IESO, September 2016) at 13.

21. Environmental Registry Regulation Proposal #013-1916, Proposed New Regulation to be made under the Electricity Act, 1998 (28 November 2017).

22. "Submission re: Proposed Enhancement's to Ontario Net Metering Framework", online: CanSIA <www.cansia.ca/uploads/772/5/1/7/2513707/180118_-_cansia_submission_re_ebr_net_metering_20_final.pdf>. [Accessed 16 March 2018]

23. "Net Metering Consultation", Ontario Energy Board, online: <www.oeb.ca/industry/policy-initiatives-and-consultations/net-metering-consultation>. [Accessed 21 March 2018]

24. Ontario Energy Board, Distribution System Code, (Toronto: OEB, March 2018) at 127.

25. The exact wording of the OEB's objective is "to promote the use and generation of electricity from renewable energy sources in a manner consistent with the policies of the Government of Ontario, including the timely expansion or reinforcement of transmission systems and distribution systems to accommodate the connection of renewable energy generation facilities" (Ontario Energy Board Act, s. 1(15); Ontario Regulation 330/09: (Cost Recovery re Section 79.1 of the Act) defines the formula for recovering some network upgrade costs for renewables integration from all provincial customers.

26. Ontario Energy Board information provided to the ECO in response to ECO inquiry (22 December 2017).

27. Ontario Energy Board, Filing Requirements for Electricity Transmission and Distribution Applications, Chapter 4 (Toronto, OEB, July 2014) at 16. Applicants can use this information to seek approval from the Board for funding to upgrade their network to accommodate renewables. However, this is not mandatory- distributors determine the pace at which they upgrade their system to accommodate renewables, and can reject projects if the "technical capacity" does not exist. One exception is a 2011 directive from the Minister of Energy that specifically directed the Board to require Hydro One to upgrade certain aspects of their transmission system to enable renewables; online: <www.hydroone.com/about/hydroone/RegulatoryInformation/oebapplications/Documents/dec_order_et...HONI_20110228.pdf>. [Accessed 21 March 2018]

28. Ontario Power Authority Comments, Board Staff Discussion Paper on Issues Related to the Connection of Micro-Embedded Generation Facilities EB-2012-0246 (Toronto: Ontario Power Authority, January 2013) at 3.

29. Independent Electricity System Operator, information provided to the ECO in response to ECO inquiry (17 November 2017).

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30. Ministry of Energy, information provided to the ECO in response to ECO inquiry (17 November 2017).

31. Ibid.

32. Letter from the Ontario Energy Board to All Licensed Electricity Distributors and All Other Interested Parties (25 May 2017), online: <www.ceb.ca/sites/default/files/Letter-Net-Metering-Consultation_20170526.pdf>

33. Some general information is available at: "Save on your energy bill with net metering", online: Ontario Ministry of Energy, Renewable Energy Facilitation Office <www.ontario.ca/page/save-your-energy-bill-net-metering>.

34. Canadian Solar Industries Association, "Feedback to AWG", (presentation, 13 March 2017) slide 4 online:<www.cansia.ca/uploads/7/2/5/1/72513707/170313_-_cansia_nmf_feedback_to_awg_vf.pdf>

35. European Commission, Best practices on Renewable Energy Self-consumption (Brussels: European Commission, July 2015) at 2.

36. In addition to the capital cost of the system, in some cases there are other charges incurred for net metering, which could include an account set up charge and a monthly service charge. For example, see Hydro Ottawa, who charge \$30 to set up the account and \$19/month as a service charge. ("Generator Charges", online: HydroOttawa <hydroottawa.com/accounts-and-billing/generation/generator-charges>. [Accessed 21 March 2018]

37. Canadian Solar Industries Association, "Feedback to AWG" (presentation, 13 March 2017) slide 5 online: <www.cansia.ca/uploads/7/2/5/1/72513707/170313_-_cansia_nmf_feedback_to_awg_vf.pdf>

38. Canadian Solar Industries Association, Roadmap 2020 Powering Canada's Future With Solar Electricity (Ottawa: CanSIA, 2017) at 16.

39. Ibid.

40. Ibid at 4.

41. No LDC has completed the transition to fully fixed distribution rates, which is being phased in over a four-year period, but most distributors will be on fully fixed pricing by 2019 or 2020 (Ontario Energy Board information provided to the ECO in response to ECO inquiry (17 November 2017)).

42. One exception is the Smart Green program, managed by the Canadian Manufacturers and Exporters, which is only available to smaller manufacturing businesses, where solar is one of the project categories eligible for incentives ("Project Funding Guidelines", online: Smart Green Program <cmeweb.cmeperformance.ca/smartgreen/smartgreenproject/> [Accessed 21 March 2018]).

43. "Expect the Unexpected: The Disruptive Power of Low-carbon Technology", online: Carbon Tracker <www.carbontracker.org/reports/expect-the-unexpected-the-disruptive-power-of-low-carbon-technology/>.[Accessed 16 March 2018]

44. "Lazard's Levelized Cost of Energy Analysis – Version 10.0", online: Lazard <www.lazard.com/media/438036/levelized-cost-of-energy-v100.pdf>. [Accessed 16 March 2018]

45. CanmetENERGY, Sector Profile for Solar Photovoltaics in Canada by Navigant Consulting (Toronto: Navigant Consulting, March 2012) at 59.

46. CanmetENERGY, National Survey Report of PV Power Applications in CANADA – 2016, (Ottawa, CanmetENERGY, 2017) at 6

47. The three companies are: Silfab (Mississauga), Heliene (Saulte Ste. Marie), and Canadian Solar (Guelph).

48. "Canadian Solar - Company Profile North America", online: Canadian Solar <www.canadiansolar.com/media/canadian_solar-web_brochure-north_america.pdf>. [Accessed 16 March 2018]

49. Peter Kuitenbrouwer, "Renewing the Soo: How alternative energy investments are transforming Saulte Ste. Marie", Financial Post, (12 August 2016) online: <business.financialpost.com/executive/smart-shift/renewing-the-soo-how-alternative-energy-investments-are-transforming-sault-ste-marie?_ga=103d-c154>

50. Silfab Solar, News Release, "Silfab Partners with Morgan Solar To Disrupt The Cost of PV", (5 December 2017).

51. Ontario Ministry of Energy, Market Analysis of Ontario's Renewable Energy Sector, (Toronto, Compass Renewable Energy Consulting Inc., June 2017) at 7.

52. Slav Kornik, "Alberta offering up to 30% off solar panel installation with \$36M program" (21 June 2017) online: <globalnews.ca/news/3544679/alberta-government-revealing-details-about-solar-program/>

53. CanSIA "Solar Year-In-Review", Solar Canada 2017, (presentation 3 December 2017) slide 11, online: <solarcanadainitiative.ca/wp-content/uploads/2017/12/Day1-2-Solar-Year-In-Review-Outlook-2018.pdf>.

54. Ontario Ministry of Energy, Market Analysis of Ontario's Renewable Energy Sector, (Toronto, Compass Renewable Energy Consulting Inc. June 2017) at 25.

55. This is because of the transition to a fixed customer charge for distribution costs, at least for residential customers. This fixed cost serves to cover grid maintenance, and is not tied to the amount of electricity a customer uses.

56. Stakeholder meeting with the Electricity Distributors Association, November 2017.

57. Independent Electricity System Operator, information provided to ECO inquiry (17 November 2017).

58. Independent Electricity System Operator, "Module 7: Electricity System Cost Outlook", (presentation, August 2016).

59. "Rooftop solar: Net metering is a net benefit", online: Brookings <www.brookings.edu/research/rooftop-solar-net-metering-is-a-net-benefit/>. [Accessed 21 March 2018]

60. Julia Pyper, "Hawaii Regulators Shut Down HECO's Net Metering Program" Greentech Media (14 October 2015) online: <www.greentechmedia.com/articles/read/hawaii-regulators-shutdown-hecos-net-metering-program#gs.MrsOkHo>

61. Ivan Penn, "SolarCity to leave Nevada after PUC cuts rooftop solar benefits", (23 December 2015) online: <www.latimes.com/business/la-fi-solarcity-nevada-rooftop-20151223-story.html>

62. Electricity Distributors Association, The Power To Connect, Advancing Customer-Driven Electricity Solutions for Ontario (Vaughan: Electricity Distributors Association, February 2017) at 73.

63. Environmental Registry Regulation Proposal # 012-8435, Amendment of Ontario Regulation 541/05: Net Metering, made under the Ontario Energy Board Act, 1998 (22 December 2016).

64. Ontario Ministry of Energy, Delivering Fairness and Choice, Ontario's Long-Term Energy Plan 2017 (Toronto: Ontario Ministry of Energy, October 2017) at 68.

65. Electricity Distributors Association, The Power To Connect, Advancing Customer-Driven Electricity Solutions for Ontario (Vaughan: Electricity Distributors Association, February 2017) at 57.

66. "Solar Storage Pilot Program", online: Oshawa PUC Networks Inc., <www.opuc.on.ca/frequently-asked-questions-faqs/>. [Accessed 16 March 2018]

67. Electricity Distributors Association, The Power To Connect, Advancing Customer-Driven Electricity Solutions for Ontario (Vaughan, Electricity Distributors Association, February 2017) at 57.

68. PowerStream Inc., News Release, "PowerStream Expanding Residential Solar-Storage Through Other Utilities" (7 October 2016).

69. Examples of future energy management are: a) "Community Energy Storage", online: Ecamion <www.ecamion.com/portfolio/ces/> [Accessed 21 March 2018]; b) CBC News, "Construction begins on North Bay's new community energy park microgrid" CBC News online: <www.cbc.ca/news/canada/sudbury/north-bay-hydro-microgrid-1.4419161>

70. Electricity Distributors Association, The Power To Connect, Advancing Customer-Driven Electricity Solutions for Ontario (Vaughan: Electricity Distributors Association, February 2017) at 9.