

ONTARIO'S ELECTRICITY FUTURE
QUESTION 17

What impact will Ontario's electricity market redesign have on the cost and greenhouse gas emissions of our electricity system?

The market redesign (known as Market Renewal) may save money, but it does not yet provide a clear path towards a long-term low-carbon electricity future.

Today, generators earn only 16% of their revenue in Ontario's electricity markets, with the rest from long-term contracts or regulated rates (see Q2). Market Renewal is intended to reduce cost to customers by compelling generators to compete for much more of their revenue in short-term markets for different services, such as ability to meet peak demand, supply electricity in all hours, or respond quickly to changes in demand. Transforming the market is a large task and will take many years.

The most important stream of Market Renewal is a new capacity auction, specifically to procure incremental capacity to ensure Ontario has enough electricity at times of peak demand. Capacity auctions force generators and other resources to compete repeatedly for the opportunity to supply electricity capacity or reduce peak demand, without secure long-term contracts. A capacity auction should bring on some resources that have a low

marginal cost, such as continuing production from existing gas, wind, or solar generators after initial contracts expire; upgrades to existing facilities; or conservation that reduces peak electricity use. However, it may not incent significant new generation capacity that requires upfront investment, and if it does, gas-fired generation may dominate instead of low-emission generators.

This model might keep new supply costs low if electricity demand stays flat, as the Long-Term Energy Plan envisions. As currently proposed, Market Renewal seems less likely to meet Ontario's needs in a world where low-emission electricity use must grow (see Q15). Without better policies to support new low-carbon electricity resources and conservation, gas-fired generation and greenhouse gas emissions will likely increase. The Independent Electricity System Operator is working to address this concern.

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The details...

Introduction

Ontario's electricity system needs to do many things well, including: having enough electricity production capacity on hand to reliably meet Ontario's needs when electricity demand is at its highest; supplying electricity at a reasonable cost and environmental impact at all hours of the year; and continuously matching electricity supply and demand in real time. It must also help Ontario achieve other policy goals, such as complying with the Climate Change Mitigation and Low-carbon Economy Act.

As Ontario's existing electricity resources reach their end of life, or external conditions (e.g., overall electricity demand) change, new resources may be needed so that Ontario's electricity system continues to function as intended.

Ontario's 2017 Long-Term Energy Plan commits to procuring new resources through competitive, market-based mechanisms such as auctions, each designed to meet specific system needs. Some proposed market changes are already known, but others will likely be developed. This approach is known as "Market Renewal". It is a major change from the system used over the past decade, which has used centralized procurement and long-term, technology-specific contracts (often 20 years in length) to get new electricity generation resources built (XQ2).

The goal of Market Renewal is to improve and expand Ontario's electricity markets, "to meet Ontario's current and future energy needs reliably, transparently, efficiently and at lowest cost".¹ Market Renewal will address some known issues with the current market design, and increase the electricity system's responsiveness to changing conditions, by avoiding long-term contract commitments. Its key methodology is to have generators and other resources compete to provide specific services for short periods of time. In Ontario's long philosophical debate between which is best for

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energy policy, government control or free markets,² this is a swing back to free markets. In essence, it parallels many companies' shift from offering long-term, secure employment to the gig economy, where workers compete for individual pieces of work.

Like the gig economy, this approach usually saves the buyer money, at least in the short run, but this reduction in price may come at the cost of other public goods (social, economic, environmental, etc.).

How do Ontario's existing electricity markets work?

The IESO operates several markets for electricity services. The most important by far is the real-time electricity market. Electricity generators offer their potential electricity production into the market at a price of their choosing, and the IESO continuously manages this market (on a five-minute interval basis) to select the lowest-cost set of offers that can meet Ontario's immediate electricity demand. This market sets the wholesale electricity price, and determines which generators will be supplying electricity in each five-minute interval. In general, the market price settles just above the marginal operating cost of generation (near-zero for nuclear or most renewables, and around the cost of fuel for gas-fired generation).

In recent years, the wholesale market price has fallen (Figure 17.1), as (1) more generation with low marginal cost has come online, and (2) fuel costs for gas-fired generation have dropped to historically low levels (XQ4). All generators receive the market-clearing

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price when they are dispatched by the IESO to deliver electricity. This means that all generators have seen a drop in revenue from the wholesale electricity market. Because of the limited revenue opportunities in the wholesale market, long-term contracts have been used to get new generation built, by guaranteeing generators

enough revenue to recover their capital costs. An out-of-market payment known as the Global Adjustment (see XQ8) makes up the other 83% of their revenue, i.e. the difference between what generators are guaranteed in these long-term contracts, and what they make in the IESO markets.



Figure 17.1. Average annual wholesale Ontario electricity price, 2002-2017.

Source: "Average weighted hourly prices c/kWh", online: Independent Electricity System Operator <www.ieso.ca/-/media/files/ieso/power-data/data-directory/average-weighted-hourly-price-kwh.xlsx?la=en> [Accessed 15 March 2018]

Generators earned only about 17% of their revenue from markets in 2016.

The IESO runs several other markets for additional grid services, for example, operating reserve (stand-by power that can be called upon to deliver electricity on very short notice). These markets can be important for some electricity resources, but their overall size is small.

Under Market Renewal, electricity resources are to earn more of their revenue in markets, without long-term contracts or the need for the Global Adjustment. Figure 17.2 shows that generators earned only about 17% of their revenue from markets in 2016. Because most resources are currently under long-term contracts (that will not expire for decades in some cases), and much of Ontario Power Generation's revenue is guaranteed through a rate regulation process, a full transition to market mechanisms may not be possible. If it is, will take many years.

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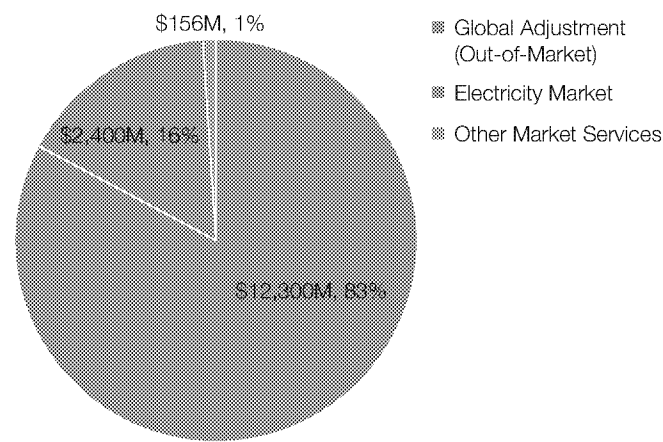


Figure 17.2. Revenue streams for Ontario electricity resources (\$ millions), 2016.

Note: "Other market services" include operating reserve (\$54 million), regulation (\$44 million), reactive support and voltage control (\$18 million), black start (\$2 million), and demand response (\$36 million).

Source: Independent Electricity System Operator, "Revenue Opportunities in the IESO Administered Market" (background information for the NEP-SC, January 2017), slide 19.

What is changing under Market Renewal?

Work under Market Renewal is proceeding under three work streams, each of which will procure specific grid services:³

- **Energy:** Improving the efficiency of the existing real-time electricity market, for example, better aligning market payments with physical limitations of the electricity system, such as transmission constraints that can prevent electricity flow from one part of the province to another.⁴
- **Operability/Flexibility:** Improving the system's ability to respond quickly to intra-hour differences between expected supply/demand levels and actual production/consumption. One example is improving the use of interties to move electricity between Ontario

and other jurisdictions (which are currently scheduled only on an hourly basis). This work stream could include changes to existing ancillary services markets, or entirely new markets.

- **Capacity:** A new market for capacity to meet peak demand.

More Market Renewal initiatives may be developed.

All three of these streams have important implications. For example, the flexibility stream should improve Ontario's ability to more efficiently integrate higher levels of intermittent renewable generation (Q6). In addition, it is likely to provide new revenue opportunities for energy storage and renewable generators that can provide services for which Ontario markets do not yet exist, such as ramping production down quickly to meet drops in demand.⁵

For the purposes of longer-term electricity supply, the capacity market is likely to be most important.

The LTEP shows a "capacity gap" at time of peak demand opening up around 2023.

What is a capacity market and how will it work?

Ontario needs enough electricity resources producing electricity during the few hours each year when electricity demand is at its highest, and also needs to maintain a mandatory reserve margin (Q5). This need is historically what has driven Ontario to procure new electricity generation and conservation. Based on the Ministry of Energy's forecast, and assuming that the Pickering extension is approved (Q14) the

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LTEP shows a "capacity gap" at time of peak demand opening up around 2023 (Figure 17.3).

The new capacity auction is intended to fill this gap. Resources will bid based on how much capacity (measured in megawatts, MW) they can reliably deliver

at peak times, either by supplying electricity or reducing electricity use. The Ontario capacity market would likely use annual auctions. Successful participants would only be guaranteed a revenue payment for one, or at most a few, years, unlike the 20-year guarantees in existing contracts.

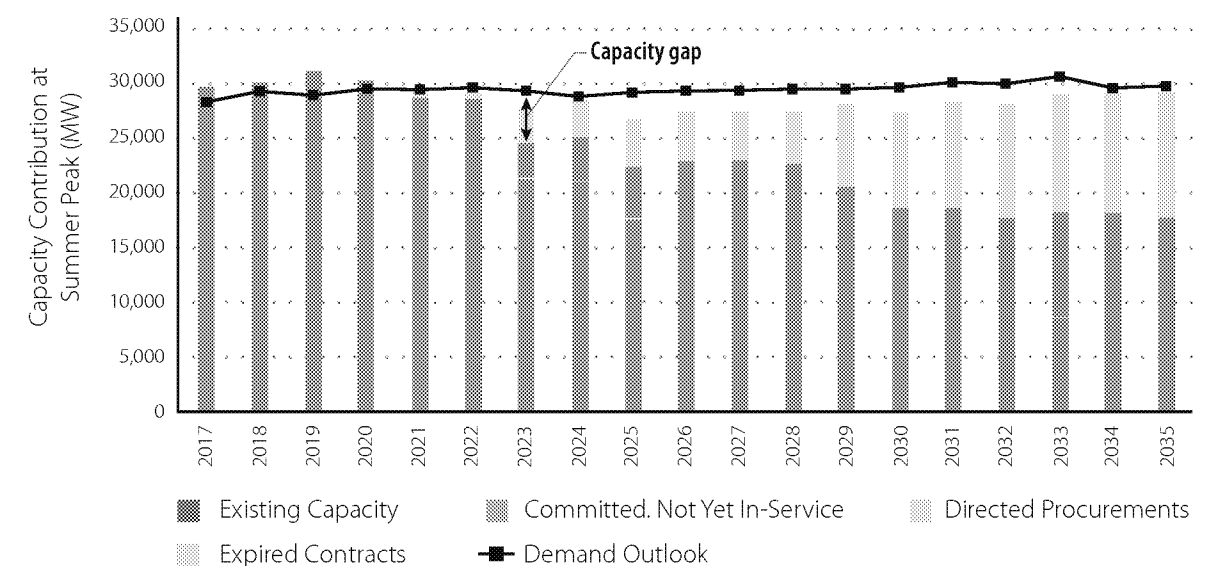


Figure 17.3. 2017 LTEP forecasted electricity demand and existing capacity, assuming that existing resources will continue to supply power after their current contracts expire (2017-2035).

Source: Ontario Ministry of Energy, Ontario's Long-Term Energy Plan 2017: Delivering Fairness and Choice (Ontario: Queen's Printer, 2017) at 37.

What resources would participate?

Ontario is proposing to use a capacity auction only for "incremental" capacity. In other words, capacity from existing resources under contract (or OPG resources rate-regulated by the Ontario Energy Board) would not participate. (These resources could participate only if they can provide additional capacity that is not currently under contract, e.g., through upgrades).⁶ The auction would be technology-neutral. Resources that might participate include generators whose contracts have expired, imports, energy storage facilities, conservation

resources (e.g., large electricity customers who could reduce their electricity use at times of peak), and potentially new generators.

In Ontario, existing electricity generators with expiring contracts, but remaining useful life, are likely to play a large role in the capacity auction. By the mid-2020s, many gas plants will be in this position, followed several years later by a large number of wind, solar, and hydro plants.⁷ As Figure 17.3 shows, if all expired resources participate in the capacity auction, this would fill most,

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but not all, of the future capacity gap anticipated by the LTEP.

In some other jurisdictions, capacity auctions have been successful in procuring low-cost resources other than new generation. Examples from PJM (the Pennsylvania-New Jersey-Maryland electricity system) include upgrades to improve the electricity production capacity of existing generators, demand-side resources, and imports.⁸ Some of these resources might not have been identified through centralized system planning.

The potential role of conservation in Market Renewal is explored more in the textbox “Can electricity conservation fit into Market Renewal?”

Can electricity conservation fit into Market Renewal?

Conservation can contribute capacity to meet peak demand, by reducing electricity use instead of generating electricity. One form of conservation – demand response, which involves electricity customers reducing electricity use in real-time or near real-time in response to instructions from the system operator – has already proven to be a good fit for the capacity auction that will be at the centre of Market Renewal. In fact, in the past several years, Ontario has run an auction specifically for demand response providers that has served as a test bed for a more comprehensive future capacity auction.⁹ This demand response auction has been successful in securing capacity from a wider variety of participants, at a lower cost than the previous demand response model, which involved longer-term contracts at a set price. For 2018, the IESO has 571 MW of demand response capacity available for the summer

peak and 712 MW for the winter peak, procured through the auction.¹⁰

The use of these demand response resources is integrated into the wholesale electricity market. When market prices are projected to be very high (or there is an emergency operating state), demand response providers are placed on standby, and must be ready to reduce their electricity use during that day if the market price reaches anticipated levels.¹¹ The current structure is not perfect, as the trigger conditions have made it very unlikely that demand response providers will actually be called on to reduce their electricity use. The IESO is working on changes that will lead to demand response being utilized more, and also intends to replace the demand-response specific auction, by including demand response in the capacity auction, where it will compete against other resources such as generation.¹²

What about traditional conservation and energy efficiency measures, which save electricity, including at peak times, but cannot respond to instructions from the grid operator in the way that demand response and generation can? The New England Independent System Operator (ISO) shows that conservation of this type can also participate in a capacity auction.¹³ Demand resources under the New England ISO are categorized as active demand resources (demand response) which are activated when needed; or as passive demand resources (conservation initiatives) that save electricity across many hours.

Both active and passive demand resources have been incorporated into the New England capacity market since 2010. Passive demand resources offer into the capacity auction based on their

ability to reduce electricity consumption during peak summer and winter hours (e.g., 1 p.m. to 5 p.m. on June, July, and August weekdays for the summer peak). Passive demand resources do not participate in the real-time energy market. In January 2018, New England had approximately 2,700 MW of demand resources providing capacity; 2,000 MW of these were passive demand resources.¹⁴

In some other jurisdictions, customers and private-sector providers can compete in a conservation-specific auction, by bidding in the amount of incentive that they will require in order to deliver a specified amount of electricity savings. In theory, this might acquire conservation at a lower cost than we pay today. One example is the American Electric Power Ohio's Bid4Efficiency Program.¹⁵ However, higher-cost conservation programs, such as those focussed on low-income or aboriginal communities, might not be funded in such a system.

These examples suggest that some conservation programs, other than Demand Response, could potentially be integrated into Market Renewal in some fashion.¹⁶ This would be a large change from Ontario's current conservation model, where LDCs and the IESO have budgets to deliver conservation programs (see Q19), completely outside the electricity market framework.

More analysis is needed to determine whether a market-based approach to conservation makes sense. With the exception of Demand Response, integration of conservation into Market Renewal is not an immediate priority for the IESO.

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Markets can produce lower prices when supply is ample; markets can also produce rapid price increases when demand is high.

Will Market Renewal save money?

A cost-benefit assessment prepared for the IESO estimates that Market Renewal can reduce future generation costs by between \$2.2 billion and \$5.2 billion over a ten-year period.¹⁷ But it is worth remembering that markets can produce lower prices when supply is ample and demand is low; markets can also produce rapid price increases when demand is high and supply is tight, as happened in Ontario's electricity market in the hot summer of 2002.¹⁸ As described in Q15, the LTEP does not account for the large increase in electricity use that will be needed to electrify other parts of the energy sector in order to meet Ontario's climate obligations. Thus, Figure 17.3 and the LTEP likely underestimate Ontario's future capacity needs. If so, Market Renewal may not reliably procure low-cost electricity.

The potential to avoid expensive new generation is the central appeal of capacity auctions. In PJM, the capacity auction deferred the need for higher-cost new generation resources for almost a decade. The IESO anticipates being able to dip its toes into the capacity market slowly, with the first auction looking for a small amount of capacity that will likely not require new generation.¹⁹ Of course, these low-cost opportunities may eventually run out.

Will a capacity auction get new generation facilities built?

Capacity markets have succeeded in getting some new resources built in some other jurisdictions, but not in others. For example, they worked better in New

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England and Pennsylvania-New Jersey-Maryland than in California.²⁰ Ontario's system is probably more comparable to California, because of the large amount of generation under long-term contract.

Short-term capacity auctions change the types of facilities that get built.

If so, what kind?

Even if they succeed in getting something built, short-term capacity auctions change the types of facilities that get built. These auctions favour generators with low initial capital costs (even if they have higher operating costs and emissions), and discourage generators with high capital costs, even if they have lower long-term costs and low emissions.²¹ Unless specific precautions are taken, they are therefore more likely to procure gas-fired generation²² than renewable, low-carbon resources or storage.²³

Another question is how fast new generation can be built. Ontario is proposing a "forward period" of perhaps 3-4 years between the auction and the commitment period, to enable new generation to be built. Several submissions to the IESO have noted that the development cycle for new generation can take six years or more (depending on resource type).²⁴ If so, a forward period of only 3-4 years would exclude certain resources (e.g., hydro).

Will Ontario's electricity mix stay low-carbon under Market Renewal?

The Long-Term Energy Plan notes that Market Renewal will take into account Ontario's greenhouse gas emission reduction requirements, but does not explain how.²⁵ The current elements of Market Renewal, including the capacity market, will not be enough to keep emissions from Ontario's electricity sector at their current low levels.

In 2016, gas-fired generators were called on to help meet market demand in roughly 17% of hours, and provided 8% of electricity (4% in 2017 preliminary numbers). Under the LTEP projections, this would increase moderately in the coming years, as gas is to play a larger role after the closure of the Pickering nuclear station and during the refurbishments of Bruce and Darlington nuclear stations (Q14). Greenhouse gas emissions from the electricity sector would increase slightly as a result (Figure 17.4).

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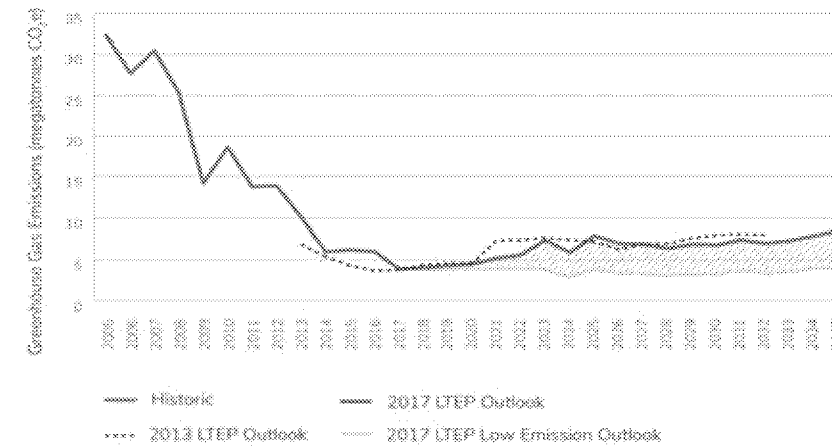


Figure 17.4. Ontario's electricity sector emissions (2005-2035).

Source: Ontario Ministry of Energy, Ontario's Long-Term Energy Plan 2017: Delivering Fairness and Choice (Ontario: Queen's Printer, 2017) at 109.

Again, this projection assumes essentially flat electricity demand. If, instead, demand grows to displace fossil fuels from heating and transportation (Q15), and no new low-carbon generation is built, emissions from gas-fired generators will soar.²⁶

Electricity markets on their own will not necessarily achieve emissions reductions in the absence of a market-based carbon policy. If no carbon pricing exists or carbon prices are too low to achieve the desired level of emissions reductions, then the wholesale electricity market will simply minimize other costs without fully considering the public policy value of avoiding carbon emissions.²⁷

So far, Market Renewal lacks any mechanism to keep Ontario's new electricity supplies low-carbon or low-polluting. The capacity market on its own is unlikely to bring on new renewable generation. The wholesale market is also unlikely to provide enough revenue to procure new renewable generation, at least in the early years of Market Renewal, because the average wholesale electricity price is so low, as shown in Figure 17.1. A higher-demand future would increase the

Market Renewal lacks any mechanism to keep Ontario's new electricity supplies low-carbon or low-polluting.

average wholesale price of electricity, because gas-fired generation would set the market-clearing price in more hours, and the offer price for gas-fired generation in these hours will be higher, due to cap and trade.²⁸ However, this would still likely be insufficient incentive for new renewable generation to be built.

Under current proposals, neither will these markets greatly expand the role of conservation in reducing electricity use and emissions. The capacity market is likely to attract new demand response resources, but experience to date suggests that, once procured, these resources will not be utilized very frequently to reduce electricity use. This is because they may require a higher price than gas-fired generation to be dispatched in the wholesale electricity market.²⁹

Potential solutions

The IESO has recognized this dilemma, and has established a special Market Renewal working group, the Non-Emitting Resources Subcommittee.³⁰ This group is looking at how to integrate low-carbon resources into auctions, what other services they can provide to the grid, and whether there is a need for additional incentive mechanisms to value environmental attributes.³¹

Potential approaches could include:

- 1. Explicit government policy limiting the amount of fossil fuels that can bid into the market
- 2. Dedicated auctions, perhaps with longer commitment periods, limited to clean energy and conservation resources, and
- 3. Additional markets that provide an explicit value for environmental benefits.

It is far from clear how to reconcile a market approach focussed on minimizing short term costs with Ontario's other public policy goals, including clean air and mitigating climate change.

Conclusion

Market Renewal may reduce Ontario's electricity supply costs, at least in the short run and if demand growth is limited. However, it is far from clear how to reconcile a market approach focussed on minimizing short term costs with Ontario's other public policy goals, including clean air and mitigating climate change. Market Renewal may not reliably procure low-cost and/or low-carbon electricity in a high-electrification future.

If Ontario is to meet its climate change obligations, the need for new low-carbon resources will be greater than the Ministry of the Energy and the IESO are planning for. Decisions will need to be made as to whether these resources can be procured through the redesigned markets, or whether other approaches are needed. With a capacity gap opening by 2023, Ontario does not have a lot of time to get this right.

Endnotes

1. "Overview of Market Renewal", online: Independent Electricity System Operator <www.ieso.ca/en/sector-participants/market-renewal/overview-of-market-renewal>. [Accessed 15 March 2018]

2. Winfield, M., and B.MacWhirter, "Competing paradigms, Policy Windows and the Search for Sustainability in Ontario Electricity Policy," in G.Albo and R.McDermid, eds., Divided Province: Ontario in the Age of Neo-Liberalism" Queens-McGill University Press - in press.

3. Johannes Pfeifenberger et al., The Future of Ontario's Electricity Market, a Benefits Case Assessment of the Market Renewal Project (Toronto: IESO, 20 April 2017) at iv.

4. Ontario currently operates a two-schedule market, where price is first set in a schedule that ignores transmission limitations, and then a second schedule is needed that corrects for the transmission constraints and adjusts which generators will operate. This can lead to out-of-market payments and opportunities for gaming. Generators may offer into the market, knowing that their electricity cannot be used due to transmission constraints, but that they may end up receiving compensation payments.

5. Brattle Group, "Market Design for a Clean Grid, Unlocking the Potential of Non-Emitting and Emerging Technologies" (presentation to IESO Non-Emitting Resource Subcommittee, January 2018), slide 13.

6. Independent Electricity System Operator, "Introduction, Non-Emitting Resource Subcommittee" (presentation, 22 January 2018), slide 38-51.

7. Ontario Ministry of Energy, Ontario's Long-Term Energy Plan 2017: Delivering Fairness and Choice (Ontario: Queen's Printer, 2017) at 43-44.

8. Johannes Pfeifenberger et al., The Future of Ontario's Electricity Market, a Benefits Case Assessment of the Market Renewal Project (Toronto: IESO, 20 April 2017) at 66.

9. More information on the IESO's Demand Response Auction is available at "Demand Response Auction", online: Independent Electricity System Operator <www.ieso.ca/sector-participants/market-operations/markets-and-related-programs/demand-response-auction>. [Accessed 15 March 2018]

10. Independent Electricity System Operator, "2017 DR Auction Results" (presentation to the IESO Demand Response Working Group, 30 January 2018).

11. Independent Electricity System Operator, "Improvements to Hourly DR Data" (presentation to the IESO Demand Response Working Group, 6 April 2017), slide 9.

12. Ibid, slide 5-8.

13. "About Demand Resources", online: Independent System Operator New England <www.iso-ne.com/markets-operations/markets/demand-resources/about>. [Accessed 15 March 2018]

14. Independent System Operator New England, "Demand Resources Working Group" (presentation, 31 January 2018), slide 2 and 3, online<www.iso-ne.com/static-assets/documents/2018/01/a01_intro_drwg_mtg_02_01_2017.pptx>

15. Under this program, non-residential customers and solution providers lock in their incentives for energy efficiency projects through a bidding process. Incentives for a project can range from \$25,000 to \$1,000,000. Participants have to bid in a year ahead to partake in achieving the state's energy efficiency goals (AEP Ohio, Bid4Efficiency FAQ (Canton: AEP Ohio, 2016) at 1, online <aepohio.com/global/utilities/lib/docs/save/business/programs/aepohio/EnergyEfficiencyAuction/34E%20FAQ%202017%20072617%20v2.pdf>

16. The IESO has taken a step in the direction by offering a "Pay-for-Performance" program which compensates customers for overall reductions in electricity use, allowing customers wide latitude in how to achieve these savings. However, compensation is at a fixed rate, not through an auction as in the AEP process.

17. Johannes Pfeifenberger et al., The Future of Ontario's Electricity Market, a Benefits Case Assessment of the Market Renewal Project (Toronto: IESO, 20 April 2017) at iii.

18. Winfield, M., and B.MacWhirter, "Competing paradigms, Policy Windows and the Search for Sustainability in Ontario Electricity Policy," in G.Albo and R.McDermid, eds., Divided Province: Ontario in the Age of Neo-Liberalism" Queens-McGill University Press - in press.

19. Independent Electricity System Operator, "Introduction, Non-Emitting Resources Subcommittee" (presentation, 22 January 2018), slide 45.

20. Johannes Pfeifenberger et al., The Future of Ontario's Electricity Market, a Benefits Case Assessment of the Market Renewal Project (Toronto: IESO, 20 April 2017) at 67-69.

21. This is because a short-term capacity market introduces substantial investment risk for new generators, whereas long-term contracts place most risk on electricity ratepayers (at least once a facility is built and operating). A business case to build new generation with a long capital payback period would rely on the uncertain possibility of the generator being repeatedly successful in future capacity auctions at similar prices, or making revenue from other markets (e.g., the wholesale electricity market). Over the long operating life of generators, there is substantial risk that any assumptions made regarding these revenue streams may not prove accurate, due to electricity policy changes or other factors.

22. The Energy Information Administration shows gas-fired generation has currently having the lowest "overnight" cost per installed megawatt of electricity generating technologies, and the advantage of gas will be even greater, considering its capacity contribution at time of peak (U.S. Energy Information Administration, Cost and Performance Statistics of New Generating Technologies, Annual Energy Outlook 2018 (Washington D.C.: US EIA, January 2018), at 2).

23. Other jurisdictions with auctions that recognize or incentivize low- or non-emitting resources include: California, New York, and New England. Johannes Pfeifenberger et al., The Future of Ontario's Electricity Market, a Benefits Case Assessment of the Market Renewal Project (Toronto: IESO, 20 April 2017) at 5, 29.

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24. Letter from the Ontario Waterpower Association to the Independent Electricity System Operator (17 January 2018), "Request for Information – Non Emitting Resources", online: <www.ieso.ca/-/media/files/ieso/document-library/working-group/market-renewal/nersc/nersc-20180117-owa.pdf?ia=en>; Letter from EDF EN Canada Development Inc. to the Independent Electricity System Operator (17 January 2018), "Re: Request for feedback on the upcoming Non-Emitting Resources Request for Information ("NER RFI")", online: <www.ieso.ca/-/media/files/ieso/document-library/working-group/market-renewal/nersc/nersc-20180117-edf-en-canada.pdf?ia=en>.

25. Ontario Ministry of Energy, Ontario's Long-Term Energy Plan 2017: Delivering Fairness and Choice (Ontario: Queen's Printer, 2017) at 51.

26. Even if no new gas-fired generation is added, Ontario's existing gas-fired generators have ample ability to ramp up production and meet much of the additional electricity demand.

27. Johannes Pfeifenberger et al., The Future of Ontario's Electricity Market, a Benefits Case Assessment of the Market Renewal Project (Toronto: IESO, 20 April 2017) at 114.

28. This is because Ontario's cap and trade system now requires gas-fired generators to internalize the cost of carbon allowances into their market offer prices. For example, a carbon price of \$20 per ton would translate into an increased offer price of about 0.85 cents per kilowatt-hour.

29. The offer price for demand response resources into the wholesale energy market has tended to be well above \$100/MWh. Independent Electricity System Operator, "Improving Utilization of HDR Resources" (presentation to the IESO Demand Response Working Group, 30 January 2018), slide 20, online: <www.ieso.ca/-/media/files/ieso/document-library/working-group/demand-response/drwg-20180130-improving-utilization-hdr-resources.pdf>.

30. "Market Renewal: Non-Emitting Resources Subcommittee", online: Independent Electricity System Operator <<http://www.ieso.ca/en/sector-participants/market-renewal/non-emitting-resources-subcommittee>>. [Accessed 15 March 2018]

31. Independent Electricity System Operator, "Request for Information: Non-Emitting Resources" (webinar and information session, 21 December 2017) at slide 18-22, online: <www.ieso.ca/-/media/files/ieso/document-library/working-group/market-renewal/ner-rfi-20171221-presentation.pdf>.

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