



ECONOMIC GROWTH AND INNOVATION

## Plugging into Savings: A New Incentive-Based Market Can Address Ontario's Power-Surplus Problem

By

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- After years of looming power shortages, Ontario faces instead a periodic problem of excess electricity supply at the same time that new generation capacity is being added. Since Ontario government agencies that purchase power have long-term, fixed-price contracts with many electricity generators, Ontario consumers pay for electricity produced by some generators even when that electricity has little value, particularly during periods of high wind production and low demand.
- To deal with temporary oversupply, we recommend paying the generators who operate under existing fixed-price contracts to reduce output, when doing so would save money for the system as a whole. The premise of our recommendation is the creation of market incentives that would make existing producers more flexible, at the least possible cost.
- For the long term, the province should create financial incentives for constructing flexible generation capacity.

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After years of concern that Ontario would not have enough electricity, the province has increased generation capacity and now has the problem of periodically having too much electricity. At many times so far in 2011, particularly during periods of high wind production and low demand, hourly Ontario electricity prices were negative: wholesale buyers were paid to take electricity.

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Thanks to the many reviewers of this paper and to those who provided data for our analysis. We take full responsibility for the contents of this paper.

Box 1: The Ontario Electricity Market

Ontario's baseload electricity – the usual minimum level of demand that must always be met – is mostly supplied by generators that are most efficient when producing electricity at all times (nuclear power) or must generally run at all times when possible (hydro facilities powered by river flow). Provincially owned Ontario Power Generation receives regulated fixed prices from wholesale buyers for electricity it produces from nuclear and hydro facilities, whose output cannot easily be adjusted. Other producers with fixed-price contracts also provide electricity that meets baseload demand, such as numerous smaller natural gas cogeneration facilities – known as Non-Utility Generators (NUGs) – who are contracted to the Ontario Electricity Financial Corporation. Solar- and wind-power producers with Feed-in-Tariff contracts,<sup>a</sup> or contracts under previous renewable subsidy programs, have 20-year (in some cases, longer) contracts with provincial agencies – mainly the Ontario Power Authority – to provide electricity at prices well above hourly market prices and they may produce when demand is low.

When demand is low and these generators actively fulfil their contracts, there is often a surplus supply of electricity. The result may be negative hourly Ontario electricity prices, where some large customers (inside and outside Ontario) are paid to take electricity. When Ontario's market was first envisioned, the negative hourly prices were expected to limit instances of oversupply. However, electricity producers, including the growing number of wind generators, who are paid fixed prices do not limit their supply in the face of low or negative market prices. Consumption does not appreciably increase at low prices because price-sensitive industrial consumers, such as pulp and paper mills, are operating at much lower levels today, and because most small consumers pay regulated prices that do not send price signals to encourage consumption during periods of surplus generation.

Ontario consumers pay the producers who operate under fixed-price contracts the difference between market prices and the contract price, through a charge on consumer bills, known as the Global Adjustment. Households and other small consumers pay the Global Adjustment through their utility bills to cover the previous month's difference between market prices and the contract price of contracted producers.

a A Feed-in Tariff is a contractually agreed price that electricity producers receive for power they offer to the grid.

In a normal market, suppliers would not produce power at low or negative prices. However, much electricity production in Ontario is unresponsive to hourly prices. The reason that some producers do not respond to market price signals is that many generators – especially wind and several natural gas-fired generators – are guaranteed fixed payments.<sup>1</sup>

The combination of a number of factors – low demand, demand that is not price responsive, increased supply of intermittent wind power, and electricity producers who have no incentive to respond to market prices (see Box 1 and Figure 1) – will result in periodic gluts of electricity over the coming years and higher costs for Ontario consumers (IESO, 2010a).

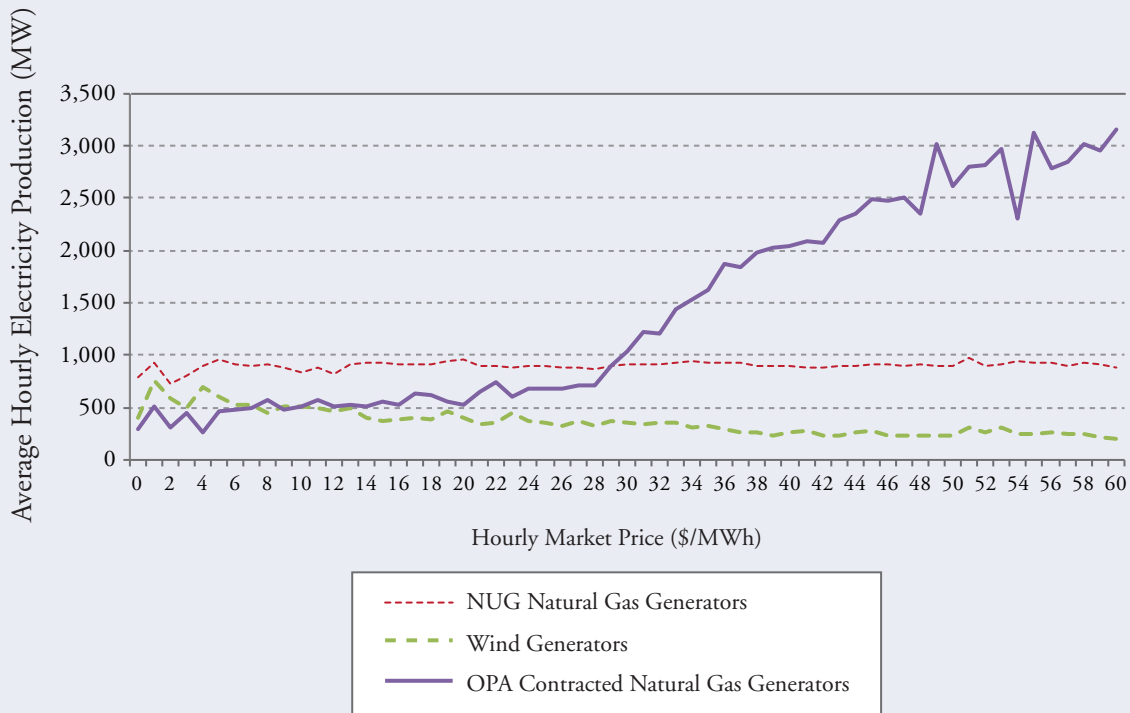
*Fixing the Oversupply Problem*

To deal with temporary oversupply, we recommend paying the generators who operate under existing fixed-price contracts to reduce output, when doing so would save money for the system as a whole. The premise of our recommendation is the creation of market incentives that would make existing producers more flexible, at the least possible cost. Market tools to reduce production could manage the system with reduced costs to Ontario consumers, as compared with doing nothing or ordering producers to reduce output.<sup>2</sup>

1 These payments are defined by long-term contracts that Ontario entered into, over the past 20 years, to speed capacity construction.

2 There is a limited ability to reduce the amount of electricity from natural-gas powered Non-Utility Generators (NUGs); see, for example, Macquarie (2010).

Figure 1: Electricity Output and Hourly Market Prices in Ontario, 2010



Source: Authors' calculations from Independent Electricity System Operator (IESO).

In the longer term, as the current fixed-price contracts that govern current payments expire, renewals should better incorporate market prices to create incentives for efficient operation.

### The Short-Term Solutions

It is economically wasteful for producers to spend more to make a product than what consumers are willing to pay.<sup>3</sup> When generators produce electricity at a cost greater than the value consumers place on it, consumers and electricity producers could be better off if producers were paid not to produce. In addition, it is wasteful to purchase from a high-cost producer when a low-cost producer is available.<sup>4</sup>

Negative prices in the Ontario hourly market sometimes occur when producers with fixed price contracts or inflexible facilities (and who do not have an incentive to reduce generation) produce electricity even when demand is very low. The Independent Electricity System Operator (IESO) could reduce or eliminate the consequences of surplus electricity generation by facilitating a market that created incentives for these generators to reduce output when their electricity was not needed.

3 For most small consumers this is the Regulated Price Plan (RPP) prices, either the two-tiered prices or, for an increasing proportion, the Time-of-Use (TOU) prices.

4 For example, when electricity users pay a gas-fired generator to produce output and reject generation from producers with low or zero incremental fuel costs, such as hydroelectric, nuclear or wind producers, both electricity users and producers could be better off if electricity users paid the gas-fired producers not to produce.

Box 2: An Example of Savings from Paying Generators Not to Produce

Assume that an NUG has a contract price of \$90/MWh and variable operating costs of \$65/MWh. This generator would be willing to shut down temporarily if it were paid at least \$25/MWh for each MWh not generated. Assume that large consumers are paying \$40/MWh, consisting of both the hourly Ontario electricity price and the Global Adjustment (see Box 1 for the calculation of the Global Adjustment). The NUG could be paid, for example, \$30/MWh not to generate. The NUG earns \$5/MWh (30-90+65) more profit by shutting down than by generating. The system pays \$30/MWh for non-generation instead of taking a loss of \$50/MWh (90-40). If, instead, the system ordered the NUG not to produce it might have to pay the full contract price anyway, \$90/MWh. Because some generators can increase or decrease output only over a period of several hours, a forward electricity market that anticipated prices and NUG knowledge of how quickly they could resume production would also determine the price at which they would reduce output.

Some producers, such as NUGs, may have high marginal costs to produce, but would need to reduce production for many hours, foregoing potential future production revenues. Other producers, such as wind, may have low marginal costs, but would be able to stop and start production at short notice. The IESO will never fully know the trade-off producers face on these lines, whereas a market would reveal these costs through the bids at which producers are willing to reduce output.

The alternative to a market to encourage producers to shut down would be bilateral negotiations between the NUG and the contract holder. However, such a negotiation would lack the benefit of producers revealing cost information through competitive bids. No negotiated solution would be as efficient at responding to changing market conditions as competitive bids, while risks to both parties from a less responsive contract would be higher.

*The Mutual Benefits of Reducing Excess Generation*

Having a large share of electricity generation from inflexible facilities or those with fixed-price contracts that are insensitive to market prices leads to oversupply. The contracts for Ontario’s fixed-price generators embody prices and other terms that are not public knowledge. But the operator of each facility knows that facility’s cost of production and the economics of reducing output and returning to full production.<sup>5</sup> Many types of producers might be willing to reduce output at the right price.

The generators likely to accept an offer to limit output, during low-price periods, would be natural gas-powered Non-Utility Generators (NUGs). Each generator faces different financial consequences of reducing production, which suggests the use of a market for each to reveal its output reduction costs. Paying the producers who can reduce output at the greatest saving could reduce costs to Ontario consumers and increase profits for NUGs: a win-win solution (see Box 2).

Furthermore, production costs for natural-gas powered generators, unlike wind and solar, include the cost of fuel. Therefore, these NUGs have greater cost reductions when they reduce output, with the result that encouraging them to reduce production would involve a lower payment in return. This would result in a potentially lower cost to consumers than if the IESO ordered producers with low costs of production, such as wind and solar generators, to reduce output, even if their contracts specified the same price for their generation.<sup>6</sup>

5 For example, run-of-river hydroelectricity plants are constrained by the flow of the river and environmental regulations on the amount of water released downstream. When nuclear units shut down they usually cannot restart for several days.

6 To reduce the incidence of surplus generation, the IESO plans to constrain wind generators to offer into the market at no less than \$0/MWh (IESO 2010b). However, because of existing contracts, wind generators will receive payment for every MWh they offer, regardless of whether it is accepted. The IESO’s plans to limit output from wind producers may not be the lowest-cost option because it may be less expensive to reduce output from NUGs or other producers.

### *Output Reduction Payments as an Alternative to Negative Prices*

We suggest creating a market in which, at times of excess electricity generation, fixed-price generators would be offered payments to reduce their output, with the amount offered being less than the cost to the system of accepting their power at the contract price. Because the contract terms and prices vary, depending on the producer, the output reduction offer would have to be producer-specific. Producers may be willing to accept reduction offers that are less costly to Ontarians than the compensation specified by their contracts if the IESO ordered them to reduce output.<sup>7</sup>

This market would identify those producers most willing to suspend production. If some producers were able to save on fuel or other input costs or reduce wear and tear on machines, these producers might be willing to accept a payment to not feed electricity into the system.

### *Dispatch Down Services: A Method of Paying for Output Reduction*

One method of paying for reduced output is a spot market for “Dispatch Down Services” (DDS), such as was introduced in Alberta in December 2007, in which the highest-cost producers are paid to reduce output when there is excess supply. The excess supply in Alberta arises from market rules that require some generators to run to ensure transmission reliability, which occasionally drives the market price to zero, despite positive generation costs. This is like the Ontario case where electricity is produced irrespective of demand. Alberta’s solution: generators that continue to produce pay marginal generators not to produce, pushing the price of electricity toward the average production cost of other marginal generators who continue to produce.<sup>8</sup>

### *Creating an Ontario Dispatch Down Market*

In an Ontario DDS market, generators and the provincial agencies with whom they have contracts would make bids and offers on an hourly, and forward, basis for payments to reduce output. The agencies would select the lowest-cost offers among generators who bid to reduce output. The parties would make these trades up to the point where the offers to reduce output cost more than the losses the agency would incur if it instead accepted the unneeded electricity.

In such a market, the IESO thus requires no information about production costs or contracts to allow the parties to reach an efficient outcome. Such a market solution would cost less than if the IESO had to make the decisions about which producers to order to reduce output.

### *Caveats to Creating a DDS Market*

Creating a DDS market will involve costs and take time. The IESO should estimate these costs, compare them to the potential savings of reduced surplus baseload generation and determine whether foreseeable surplus baseload will be resolved before this market can be created.

<sup>7</sup> For example, wind producer who signed Feed-in-Tariff contracts must be paid their full contract price if they are operating and the System Operator unilaterally refuses to accept their electricity into the market. They still receive positive cash flows from generating unless the output reduction payments approach their contract price of \$135/MWh.

<sup>8</sup> This market was worth \$13 million in 2009 and \$7.4 million in 2010. The remaining suppliers share the cost of the dispatch down service based on their production in the relevant hour. This is then reflected in an “uplift charge” paid by all producers through levies by the Alberta Electric System Operator (AESO 2006). Alberta considered expanding the market further in response to oversupply in 2010 (Minhas 2010), but ultimately did not do so.

Table 1: Contract Expiry Date of Major Non-Utility Generators

Year Contract Expires	MW of Capacity
2010	48
2012	106
2014	266
2015	141
2016	177
2017	316
2018-2022	161
<b>Total</b>	<b>1215</b>

Source: Butters (2010).

Note: This excludes small producers that are not listed in the IESO generation totals.

## Long-Term Solutions

While paying generators to reduce output is a practical solution for short-term oversupply, there still remains the question of long-term solutions once their contracts expire, particularly for NUGs (Table 1). The Ontario Power Authority should determine, through a competitive process in which NUGs compete among themselves and other potential entrants, who is willing to enter into contracts to construct flexible generating capacity, for the lowest price per MW of installed capacity.

This is known as a capacity market, which provides financial incentives to build generation facilities. We recommend that those contracts should pay NUGs the hourly market price for their production. This would encourage them to generate when the hourly price exceeded their variable generation costs and to reduce output when the hourly price is less. They will thus contribute to a competitive market that yields an hourly price equal to the marginal cost of production.<sup>9</sup> This will increase the proportion of Ontario electricity generation that is responsive to market prices, improving the efficiency of the system.

## Conclusion

Because of a confluence of factors – decreased demand, increased wind capacity and existing long-term contracts – Ontario’s electrical system is experiencing episodes of excess supply and, ironically, excessive costs for Ontario electricity consumers. The short-run solution is to pay some generators to reduce output. Our recommendation is a Dispatch Down Service market based loosely on Alberta’s. The long-run solution, as long-term contracts expire, is to ensure that producers are paid the hourly price for generation. Both solutions will increase the proportion of electricity generation that is responsive to spot market prices, increasing the efficiency of the electricity system in Ontario.

<sup>9</sup> The Directive of the Minister of Energy to the Ontario Power Authority of November 23, 2010, regarding negotiation of new contracts with the NUGs seems a step in the right direction.

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