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BY EMAIL and RESS

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July 6, 2018
Our File: EB20180143

Attn: Kirsten Walli, Board Secretary

Dear Ms. Walli:

Re: EB-2018-0143 – IESO 2018 – SEC Issues List Submissions

We are counsel to the School Energy Coalition ("SEC"). Pursuant to Procedural Order No. 1, please find SEC's submission on the Draft Issues List.

SEC requests the Board add the following issue to the final Issues List:

"Has the IESO adequately responded to the the findings and recommendations of the 2017 Annual Report of the Auditor General of Ontario?"

In its 2017 Annual Report released in December 2017, the Auditor General of Ontario ("AG") provided the results of an assessment of certain aspects of the Independent Electricity System Operator's operations[1] (a copy has been attached to these comments). While SEC accepts that some of the AG's findings and recommendations deal with matters outside of the scope of this proceeding, many others are directly or indirectly related to the Board's mandate in reviewing the IESO's revenue requirement submission. For example, the AG, in reviewing the Market Assessment and Compliance Division, recommended the IESO "assess the resources needed to eliminate its investigations backlog and conduct large-scale investigations that prove effective in recovering funds and identifying and sanctioning significant rules violations".[2] The Auditor General also made findings and recommendations in the area of stakeholder participation in the Market Renewal Process.[3] The Board has in the past made findings and commented on the issue of stakeholdering by one of the IESO's predecessor organizations, the Ontario Power Authority.[4] The IESO itself has also made commitments on the issue in the past.[5]

[1] Office of the Auditor General of Ontario, Annual Report 2017, Chapter 3, Section 3.06, *Independent Electricity System Operator - Market Oversight and Cybersecurity*)
[2] *Ibid*, p.359
[3] *Ibid*, p.355-356
[4] *Decision and Order* (EB-2013-0326 – OPA 2014), November 6 2014, p.9*; Decision and Order* (EB-2010-0279 – OPA 2011), July 8 2011, p.12-13
[5] See for example, EB-2015-0275 Exhibit S-1-1, Settlement Proposal, section 6.1, filed September 7 2016. Approved in in the *Decision and Order* (EB-2015-0275 - IESO 2016), December 1 2016

The issue identified by the AG should be explored in this proceeding and warrants a separate issue on the final Issues List.

Yours very truly,
Shepherd Rubenstein P.C.

Original signed by

Mark Rubenstein

cc: Wayne McNally, SEC (by email)
Applicant and interested parties (by email)

Ministry of Energy

Independent Electricity System Operator—Market Oversight and Cybersecurity

1.0 Summary

The Independent Electricity System Operator (IESO) operates the wholesale electricity market (electricity market). This includes receiving competitive price offers from power generators and electricity importers to supply electricity.

Ontario power generators generally set their offers in order to recover their marginal costs for producing electricity (i.e., the costs of the fuel (gas), labour used and other variable costs). At the same time, the IESO receives bids from a small number of large industrial consumers and out-of-province electricity importers indicating how much electricity they are willing to consume and at what price. The IESO chooses the power generators with the lowest-price offers to supply the electricity needed to meet consumer demand. A new market clearing price for electricity is set every five minutes, and the average of the 12 prices set per hour is the Hourly Ontario Energy Price charged to consumers.

Since 2015, the IESO has also been responsible for long-term planning for electricity and procuring the generation capacity Ontario needs. Procurement is done through signing contracts with electricity power generators. These contracts provide guaranteed payments that compensate generators for building generation equipment (for example, nuclear and gas plants) and maintaining it.

Responsibility for oversight of the electricity market is shared by the Ontario Energy Board (OEB) and the IESO as follows:

- The IESO is responsible for fixing weaknesses and flaws in the design of the market. The **IESO's Market Assessment and Compliance Division (IESO Oversight Division)** monitors and investigates suspicious activity by market participants signalling they may be breaking market rules, and fines rule-breakers. (Market rules originate in the *Electricity Act, 1998*, and are intended to ensure that the wholesale sale and purchase of electricity and ancillary services are efficient, competitive and reliable. They include provisions for making the rules; conveying electricity through the grid; authorizing who can participate in the market; selling, purchasing and dispatching electricity; resolving disputes; and monitoring, surveilling and investigating the activities and conduct of market participants.)
- The OEB reviews the ratepayer impact assessment that the IESO provides before the IESO implements a change to the design of the market. The OEB can revoke any market rule

change and ask the IESO Board to further review or reconsider the change if the OEB considers that the change does not meet any of the criteria of the *Electricity Act, 1998*, which includes, among other things, considerations of the public interest and impact on ratepayers. The **Ontario Energy Board's Market Surveillance Panel (OEB Panel)** monitors the market operated by the IESO, and investigates and reports on ways that the market is vulnerable to being abused by market participants because of weaknesses and flaws in its design.

We found that the OEB Panel has been effective in monitoring and reporting inappropriate market conduct, and recommending that the IESO fix problems with the market design. However, our audit also found that the Ontario Energy Board itself could have done more to protect ratepayers' interests by attempting to address the IESO's lack of action on the OEB Panel's repeated recommendations to fix certain weaknesses and flaws in the design of Ontario's electricity market.

As well, we noted that the IESO has a Market Renewal Initiative that consists of a working group helping to determine the future design of the electricity market in Ontario. In addition to there being little representation for residential ratepayers' interests in the working group, it has membership from market participants that have been, or are being, investigated for benefitting financially from existing market design problems.

Further, we found that the government has several times broadened participation in the Industrial Conservation Initiative (ICI), a program that allows industrial ratepayers to reduce their electricity charges by shifting their global adjustment costs to residential and small-business ratepayers. The OEB Panel reported on the impact of the ICI shortly after it was launched in January 2011. Electricity prices for about 65 large industrial ratepayers decreased by about 13%. In the first 10 months of the ICI, their global adjustment charge was reduced by about $245 million. This $245 million was added to the electricity bills of residential and small-business ratepayers. Since the initial launch, the ICI was further expanded three times, shifting a larger amount of global adjustment charge from large industrial ratepayers to residential and small-business ratepayers.

We also audited how well the IESO protects its critical IT assets and infrastructure, and found the IESO's cybersecurity system complies with power grid reliability standards. However, the IESO could be better equipped to defend itself from an advanced cyberattack should one occur.

Our specific findings include:

- **The Ontario Energy Board could have done more to protect ratepayers' interests.** Before the IESO Board implements changes to the market rules, it must give the Ontario Energy Board an assessment of the impact that approved changes have on ratepayers. If the Ontario Energy Board deems that changes are not in the ratepayers' interest, it can revoke the changes and ask the IESO for further consideration. The Ontario Energy Board could have, but has never, taken this action to challenge the IESO's lack of action on the OEB Panel's recommendations to fix problems with market design. This is especially the case for the Panel's recommendations for two programs, as follows:
  - In 2010, 2011, 2014, 2015 and 2016, the OEB Panel recommended that the Real-Time Generation Cost Guarantee Program (shortened in this report to the **Standby Cost Recovery Program**) be reviewed, reassessed, justified, and scaled back.
  - In almost all of its 28 reports (completed between 2002 and 2017), the OEB Panel expressed concerns about the Congestion Management Settlement Credits (shortened in this report to the **Lost Profit Recovery Program**).

The IESO's lack of action has resulted in gas and previous coal generators, as well as industrial consumers, receiving in many cases excessive payments

from these programs, including some from misusing market rules.

- **The IESO continues to pay gas generators about $30 million more per year than necessary despite the OEB Panel recommending that the IESO scale back its Standby Recovery Program.** Through the Standby Cost Recovery Program, the IESO pays generators for additional fuel, maintenance and operating costs to start and then operate their equipment while on standby to supply electricity. The IESO introduced the Standby Cost Recovery Program in 2003, at a time when electricity experts were concerned that Ontario was not prepared to meet its upcoming demands for electricity. Since then, Ontario has procured additional generation capacity, and, according to the OEB Panel, regularly finds itself in surplus power conditions and is a net exporter of electricity.

  OEB Panel reports in 2010 and 2011 recommended that the IESO revise (2010) and reassess (2011) whether the Standby Cost Recovery Program is providing any benefits for ratepayers, which the IESO did not do. A 2014 OEB Panel report recommended that the IESO provide detailed analysis to justify the need for the Program's continued existence, which the IESO did not provide.

  In 2015, the OEB Panel did its own detailed analysis of 2014 market data and reported that the Program was almost never needed (that is, it was relied on less than 1% of the time) to meet domestic demand, and less costly alternatives should be explored.

  Yet the Program continues—and furthermore, is inappropriately benefiting gas generators, as described in the next point.
- **Nine gas and coal generators claimed as much as $260 million in ineligible costs under the Standby Cost Recovery Program between 2006 and 2015.** About two-thirds of this amount ($168 million) has been recovered. Up until August 2017, the IESO's practice was to pay gas generators (and coal generators before they were completely shut down by 2014) for costs charged to the Standby Cost Recovery Program without first reviewing the claims. The OEB Panel was concerned that generators were submitting ineligible costs. In 2011, the Panel encouraged the IESO Oversight Division to audit the costs claimed by gas and coal generators. Nine of the 11 gas and coal generators registered with the Standby Cost Recovery Program at that time were audited. The audits identified almost $260 million (about 40%) in possible ineligible cost claims out of about $600 million paid out during the years that were audited. For example, generators claimed thousands of dollars annually for staff car washes, carpet cleaning, road repairs, landscaping, scuba gear and raccoon traps, which have nothing to do with running power equipment on standby. The Oversight Division found that one generator claimed about $175,000 for coveralls and parkas at one facility over a two-year period.
- **The Standby Cost Recovery Program allows gas generators to operate their equipment inefficiently, costing ratepayers more than necessary.** By shutting down and then restarting their power equipment, gas generators become eligible to charge some of their costs to the Standby Cost Recovery Program. But if they run their equipment continuously, they cannot claim these costs. In reporting about payments that generators received under the Standby Cost Recovery Program as a result of shutting down and then restarting their equipment within a short period of time, the OEB Panel estimated that, in summer 2010, about $19 million in additional costs were incurred because of this practice, nearly all of which was charged to ratepayers.
- **The IESO continues to pay market participants through the Lost Profit Recovery Program despite repeated warnings from**

the OEB Panel that generators and large industrial consumers take advantage of the Program at ratepayers' expense. The Lost Profit Recovery Program, which had paid market participants a total of about $1.6 billion from 2002 to the end of 2016, was set up in 2002 as a temporary measure to compensate market participants and maintain power system reliability when the IESO intervened in the market to relieve congestion in transmission lines in such a way that companies would lose money. As the Program was being set up for the opening of the competitive market in 2002, the OEB Panel reported that market participants could misuse some aspects of this Program to receive payment for lost profits they did not actually incur.

Identifying and investigating specific market participants is time-consuming and challenging, and the OEB Panel has reported on only six investigations so far. The OEB Panel reported that, in three of these cases, companies have misused the Lost Profit Recovery Program. For example, during an eight-month period from January 2010 to August 2010, a pulp-and-paper company was paid $20.4 million ($10.6 million was subsequently recovered). The Panel has also been concerned about large payments totalling $500 million paid out to market participants in northwestern Ontario since the Program started.

The OEB Panel has repeatedly recommended that the IESO fix the problems with the design of this program. The IESO has fixed some problems, but the Program continues, and the OEB Panel remains concerned that the Program continues to be open to market participants being compensated for lost profits that they did not actually incur.

- **Market participants have significant influence over IESO changes to the market rules.** The IESO's Board is responsible for fixing market design problems. This involves approving changes to market rules that govern the Standby Cost Recovery Program. The OEB Panel reported in late 2016 that gas generators and others that have a direct and substantial financial interest in IESO programs like the Standby Cost Recovery Program influence the process that the IESO uses to change market rules. We reviewed the IESO's Technical Panel meeting minutes and found that the latest market rule changes to the Standby Cost Recovery Program, approved by the IESO Board in 2017, were influenced by gas generators and that these changes did not address the OEB Panel's recommendations to stop reimbursing gas generators for certain operating and maintenance costs.

  The IESO has undertaken a Market Renewal Initiative to prepare the province for the electricity system of the future. A 23-member working group is advising the IESO on important issues involving the future design of the electricity market. Some members of this group, nominated by the IESO, work for companies that have claimed ineligible costs under the Standby Cost Recovery Program, and have been investigated and were found to have financially benefited from market design problems related to the Lost Profit Recovery Program.

- **Three investigations by the IESO's Oversight Division uncovered significant problems resulting in over $30 million in fines and settlement recoveries. However, the Division has limited resources and lacks explicitly legislated investigative powers to do more and timelier work.** The Director of the IESO Oversight Division, appointed in 2011, has led the completion of three major investigations in the past three years. Each led to a sanction or settlement with the company involved, and total fines and recoveries that exceeded $30 million. However, at the time of our audit, there was only enough staff to

investigate just one of five cases that the Director identified to be in the same significant recovery/fine range as the last three investigations. Also, an average of 30% of the Division's employees have left each year since 2012 because about a third of the Division's staffing allocation is for temporary positions only.

The Oversight Division lacks explicit legislative authority to compel the production of information and evidence in the course of its investigations. This slows down and prevents it from obtaining all evidence it needs to determine the extent of a violation in order to apply the appropriate penalty.

- **The IESO Oversight Division is not fully independent in doing its job.** The Director of the IESO Oversight Division reports to the senior management of the IESO rather than to the independent Board. The Director of the Oversight Division is thus less independent than the IESO's Director of Internal Audit, who reports to the Board. In Alberta, the Market Surveillance Administrator is a corporation independent of Alberta's Electricity System Operator. In the United States, oversight of electricity markets is conducted by the Federal Energy Regulatory Commission, which is independent from market operators, like the IESO.
- **The government has been expanding the Industrial Conservation Initiative (ICI). This results in increasing the electricity charges for residential and small-business ratepayers while decreasing the electricity charges for large industrial ratepayers.** The ICI allows eligible large industrial ratepayers reductions in the amount of global adjustment they are charged monthly. The amount of the reduction is based on how much they lower their use of electricity during the five hours that electricity demand is at its highest each year. The OEB Panel reported on the impact of the ICI shortly after it was launched in January 2011. Electricity prices for 65 large industrial ratepayers decreased by about 13%. In the first 10 months of the ICI, their global adjustment charge was reduced by about $245 million. This $245 million was added to the electricity bills of residential and small-business ratepayers. Since the initial launch, the ICI was further expanded three times, shifting a significant amount of the global adjustment charge from large industrial ratepayers to residential and small-business ratepayers. The decrease in the global adjustment charges to ICI participants has been, and will continue to be, shifted to residential and small-business ratepayers, increasing their electricity charges. For example, since the ICI was launched in January 2011, electricity charges for residential and small-business ratepayers have almost doubled from about 7 cents per kilowatt hour (cents/kWh) to 12 cents/kWh, while electricity charges for large industrial ratepayers have decreased from about 7 cents/kWh to about 6 cents/kWh as of June 2017.
- **The IESO's cybersecurity system complies with power grid reliability standards, but improvements would help it better address the risks of cyberbreaches and cyberattacks.** The IESO could do more to improve its cybersecurity, such as creating a senior executive position dedicated to cybersecurity; increasing its cybersecurity staff; having an IT cybersecurity vendor on standby; procuring technology that monitors authorized users' access to confidential information to prevent and identify breaches; and encrypting its backup tapes.

This report contains 18 recommendations, consisting of 22 actions, to address our audit findings.

Overall Conclusion

Our audit concluded that the Ontario Energy Board's Market Surveillance Panel (OEB Panel) has been effective in monitoring and reporting

on inappropriate market conduct by market participants and recommending that the IESO fix problems with electricity market design. However, the IESO has not implemented some important recommendations of the OEB Panel directed at the Standby Cost Recovery and Lost Profit Recovery programs. Also, the Ontario Energy Board itself could have revoked the most recent changes to the Standby Recovery Program and asked the IESO to reconsider them, as these changes did not address some important recommendations of the OEB Panel.

The financial impact of the Industrial Conservation Initiative (ICI) on residential and small-business ratepayers is not transparent. The Ontario Energy Board Panel estimates that the ICI has been shifting global adjustment costs from large industrial users to residential and small-business ratepayers since 2011. With the ICI being broadened in January and July, 2017, this shift will increase.

While the IESO's cybersecurity system complies with the North American Electric Reliability Corporation power grid reliability standards, internal operational improvements would help it even better address the risks of cyberbreaches and cyberattacks.

2.0 Background

2.1 Ontario's Electricity Grid

An electricity grid is an interconnected network for delivering electricity from producers to consumers. It consists of generating stations that produce electrical power, high-voltage transmission lines that carry power from distant sources to demand centres and distribution lines that connect individual customers. In Ontario, the power generated is of many types: nuclear, hydro, natural gas, wind, solar and bio-energy.

The Province of Ontario belongs to the Eastern Interconnection electricity grid, which supplies power to Manitoba, Minnesota, Michigan and New York, in addition to Ontario. Power generators sell power into the grid for use by the region's residents, institutions and businesses.

Ontario's electricity consumers' demand for electricity changes with the time of day and season. Because the cost to store electricity on a large scale has been prohibitive, the amount of electricity that is sold into the grid at any time must always be perfectly matched with demand. To maintain reliability, that requires constant adjustments to the amount of electricity going into the grid as demand fluctuates. It is the job of the Independent Electricity System Operator (IESO) to operate the Ontario grid, making these reliability adjustments and administering the Ontario market through which electricity is sold. The reliability adjustments made by the IESO must be in accordance with standards set by the North American Electric Reliability Corporation (NERC). The IESO also manages the exchange of power through interconnections with Manitoba, Quebec and the United Sates.

As shown in **Section 2.2** and **Appendix 1**, Ontario's grid and market took time to evolve and have undergone many changes in the past several decades.

2.2 The History of Ontario's Electricity Market

Prior to the late 1990s, Ontario's electricity generation and transmission were provided by a single government agency called Ontario Hydro.

In the 1970s and 80s, Ontario Hydro constructed three nuclear plants; over the next 10 years, budget overruns and delays in their construction cost the province billions of dollars. In the early 1990s, Ontario faced a recession, which significantly reduced the demand for electricity. Reduced demand means higher electricity prices, since electricity costs have to be covered by fewer users. As a result of this reduced demand, electricity prices increased by 40%, and generation capacity exceeded demand by 50%. In an effort to stabilize electricity rates for consumers, in 1993

the Ontario government introduced a rate freeze for the next 10 years. This caused Ontario Hydro's long-term debt to increase.

In 1995, Ontario began to transform its electricity industry from a government-owned structure to a competitive marketplace. Ontario's electricity marketplace opened on May 1, 2002. Almost immediately, with a potential shortage of supply and an increased demand for electricity during the summer of 2002, electricity rates began to increase significantly; the government responded by freezing rates and agreeing to pay the difference between the higher market price and the lower frozen rate charged to consumers until May 2005. Ontario determined that it needed to introduce non-market mechanisms for generators to recover their costs and operate profitably. It became challenging to attract private investments into Ontario's electricity sector. At the same time, existing nuclear plants required significant restoration, and the province was facing a potential shortfall in the supply of electricity.

In 2004, the government created the Ontario Power Authority (OPA) to be responsible for long-term planning of the electricity industry. The OPA entered into long-term contracts with gas, wind and solar generators, typically covering a 20-year period or longer for nuclear and hydroelectric generators. These contracts guaranteed payments to generators for building and maintaining equipment to produce electricity. In 2007, the government introduced a regulation that required Ontario's four coal-fired power plants to cease burning coal by the end of 2014. In 2009, the OPA moved toward procuring renewable energy and streamlining the development of renewable energy projects. On January 1, 2015, the OPA merged with the IESO, to operate the electricity grid, administer the electricity market, and continue long-term planning and conservation efforts.

Appendix 1 gives the history of Ontario's electricity market in greater detail.

2.3 Ensuring a Reliable Supply of Electricity

2.3.1 Building Long-Term Capacity through Contracts with Generators

Long-term contracts with generators provide guaranteed payments that compensate generators for building generation equipment (for example, nuclear and gas plants) and maintaining it. These contracts also obligate the generators to make their generation equipment available to provide electricity to the IESO-managed electricity market.

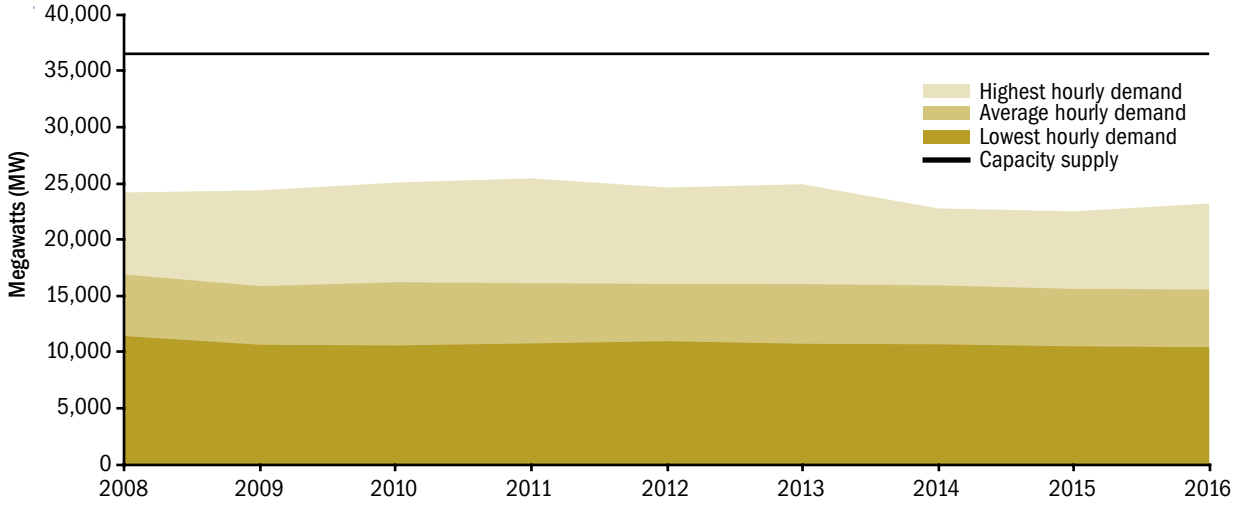
2.3.2 Allocating Resources to Meet Different Demand Levels

Ensuring a reliable supply of electricity means that there must always be enough supply to meet fluctuating demand. Demand can be divided into three levels: a minimum amount that must be continuously supplied, the average demand, and demand that peaks significantly higher than average. For example, in 2016, Ontario's hourly demand for electricity averaged about 15,600 megawatt hours (MW). However, during one hour on September 7, 2016, demand peaked at about 23,200 MW, or almost 50% more. To put this into perspective, for all of 2016, Ontario's demand for electricity exceeded 20,000 MW in only 5% of hours in the year. Given that most electricity in Ontario is supplied by a number of large-scale generators (see below), this means that some generators actually produce electricity for only a very short time when demand is peaking or when another generator breaks down. Ontario's total generation capacity as of September 2017 was about 36,500 MW, well above both the average demand and the historic peak demand. However, a portion of this generating capacity cannot sustain operation at all times because of fuel limitations (for example, wind and solar).

Figure 1 shows the three levels of demand over a recent 10-year period.

Figure 1: Ontario's Hourly Electricity Demand and Capacity Supply, 2008–2016

Source of data: Independent Electricity System Operator (IESO)



The continuously supplied electricity to meet the minimum demand is typically from large-scale, reliable generators with lower operating costs: that is, nuclear energy and hydroelectric suppliers.

When demand peaks to high levels, the additional power is typically supplied by natural-gas electricity generators. This more flexible resource is "dispatchable," which means that generation levels can be more easily changed (ramped up or down) to match changes in demand. Wind and solar energy output is dependent on weather conditions, so their contribution to meeting demand must be managed by dispatchable generators such as natural gas.

2.3.3 Managing the Market and Grid to Balance Supply and Demand in Real Time

The IESO manages the market and grid to achieve the best possible balance between supply and demand in real time. It does this as one way to help keep both cost and supply stable and predictable.

While generators recover their capital and maintenance costs through long-term contract payments, most contracts are structured so that generators' additional operating costs (such as buying and burning gas) are recovered through the market price. Generators submit offers into the market to sell electricity, and they compete with one another. The IESO pays the chosen generators the market clearing price, calculated every five minutes based on supply and demand, for the electricity they produce and sell into the market.

To ensure electricity supply during peak demand times, the IESO arranges for certain generators to have their equipment turned on and waiting on standby so their power can be dispatched quickly. The IESO compensates the generators for their fuel, maintenance and operating costs for being on standby. This compensation comes from the Real-Time Generation Cost Generation Program (which we will refer to as the Standby Cost Recovery Program).

To avoid congestion that could damage transmission lines, the IESO may request a chosen generator to stop supplying electricity and another generator to supply the electricity instead, overriding the market's supply arrangements. The IESO may also request large industrial consumers to adjust their demand to ease congestion. In all these cases, the IESO compensates the generators for any profits they have lost as a result of these IESO interventions to maintain power system reliability. The compensation is called Congestion Management Settlement Credits (which we will refer to as the Lost Profit Recovery Program).

2.4 The Electricity Charge on Ratepayer Bills

The electricity charge—a single line on most residential and small-business electricity bills—actually has two components: the market price and the global adjustment. By far the biggest component (85% of the electricity charge in 2016) is the global adjustment. Specifically, of the total electricity charge paid by ratepayers in 2016 of $14.8 billion, $12.3 billion went to the global adjustment and $2.5 billion went to the market price.

Figure 2, along with the next three subsections, provides details on these two components of the electricity charge as well as the costs of reliability programs that, in addition to the IESO administrative costs, are recovered through the regulatory charge on ratepayer bills.

2.4.1 The Market Price

The market price (technically, the Hourly Ontario Electricity Price, or HOEP), is the hourly average of the market clearing price paid to generators. As explained in **Section 2.3.3**, generators offer to supply electricity into the market based on the cash they need to cover their marginal maintenance and operating costs to produce electricity—basically, buying and burning gas or whatever fuel is involved, as well as other incremental costs. Ontario's market price (HOEP) can therefore be viewed as a partial reflection of a competitively generated electricity market price. Another major portion of Ontario's electricity charge, through which generators recover their costs to build and maintain generation facilities through their long-term contracts, is the global adjustment.

2.4.2 The Reliability Programs

The IESO operates several reliability programs that supplement or override the market price to ensure electricity supply is steady and reliable. In 2016, market participants received about $500 million from these programs, which are governed by market rules and include the two programs (Standby Cost Recovery and Lost Profit Recovery) that are the focus of this audit. Costs associated with the reliability programs are recovered through the regulatory charge on ratepayer bills.

2.4.3 The Global Adjustment

The global adjustment, introduced in 2005, is mainly the cost of building and maintaining

Figure 2: Understanding the Electricity Charge on Consumers' Electricity Bill

Prepared by the Office of the Auditor General of Ontario

1. The **Global Adjustment** consists of:
   - **Nuclear Refurbishment:** Refurbishing and maintaining Ontario's nuclear fleet.
   - **Natural Gas:** Building and maintaining natural gas generation.
   - **Non-Utility Generators:** Building and maintaining about 30, mostly privately owned, generators under contracts negotiated with the Ontario Electricity Financial Corporation.
   - **Renewables:** Building and maintaining wind, solar, biomass and other renewable generation.
   - **Ontario Power Generation:** Electricity produced by OPG's nuclear and hydroelectric facilities at regulated rates set by Ontario Energy Board.
   - **Conservation Programs:** Energy-saving programs administered by the Independent Electricity System Operator and local distribution companies.
2. The **Market Price [Hourly Ontario Energy Price (HOEP)]** consists of **Electricity (Commodity) Production Costs:** buying and burning gas and other fuels to produce electricity, and variable operating costs.
3. The total of the Global Adjustment and Market Price (HOEP) is the **Electricity Charge to Consumers** that consumers pay, broken down into on-peak, mid-peak and off-peak hours. Residential and small-business consumers paying under the Regulated Price Plan pay time-of-use prices, set by the Ontario Energy Board.

generation capacity (Nuclear Refurbishment, Natural Gas, Independent Generators and Renewables in **Figure 2**), the cost to produce electricity by Ontario Power Generation's nuclear and hydroelectric generating stations (mostly at Ontario Energy Board–regulated rates) and Conservation programs.

The breakdown on the 2016 total global adjustment charge of $12.3 billion is as follows:

- $2.9 billion for **Nuclear Refurbishment and Hydroelectric**—This amount was in the form of contract payments to Bruce Power, operating the Bruce A and B Nuclear Generating Stations, and four suppliers of hydroelectric power.
- $1 billion for **Natural Gas**—This amount was in the form of contract payments to over 30 natural-gas power generators.
- $840 million to **Non-Utility Generators** (Independent Generators)—This amount was in the form of contract payments to about 30 independent generators.
- $3.5 billion for **Renewables**—This amount was in the forms of contract payments and Feed-In Tariff Program payments to producers of renewable energy.
- $3.5 billion to **Ontario Power Generation**—This amount paid for the power produced from the Pickering and Darlington Nuclear Generating Stations, 66 hydroelectric stations, and one wind turbine. The prices for most of this power were set by the Ontario Energy Board.
- $600 million for **Conservation Programs**—This amount is for costs associated with energy conservation programs administered by the IESO and Local Distribution Companies.

In **Section 3.05** of our *2015 Annual Report*, we presented our observations from our audit of the former Ontario Power Authority's (OPA) electricity power system planning process. Most of the costs included in the global adjustment result from the government's energy policies and electricity power system planning conducted by the former OPA, which merged with the IESO on January 1, 2015. As just detailed, these include the long-term contracts to build and maintain generation capacity, the government programs that fund the development of wind and solar generation, and the construction of new gas-powered plants to generate the capacity lost from the elimination of coal-fired power plants.

Figure 3 shows how each component of the global adjustment has changed between 2011 and 2016.

2.4.4 Global Adjustment Is Growing and Market Price Is Shrinking

Figure 4 shows how the average electricity charge on ratepayers' bills has been divided up between the global adjustment and the market price from 2008 to 2016.

The IESO has attributed the decline in the market price partially to a decrease in the operating costs to produce electricity. That runs contrary to the increasing costs of building and maintaining generation capacity. According to the IESO, electricity has been becoming cheaper to produce because of a decrease in natural gas prices and an increase in wind and solar generation (whose operating costs are extremely low, as they do not burn any fuels).

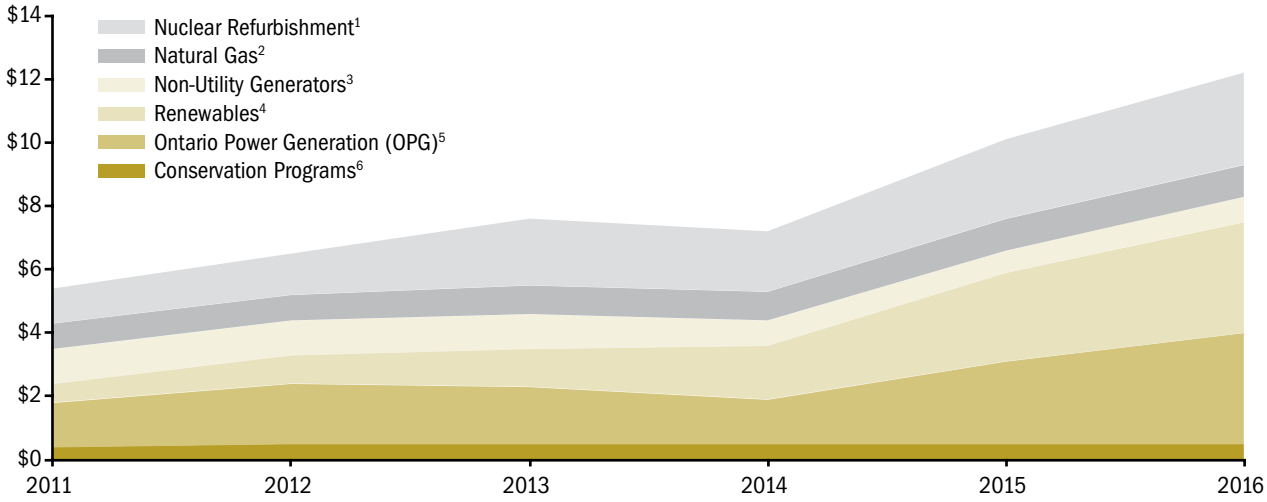
2.5 Oversight of the Electricity Market and of the IESO

The IESO manages the market and, under the *Electricity Act, 1998*, establishes the rules for its operation. The rules are in place to:

- ensure that the market works reliably to supply electricity, and that generators and industrial consumers participate in the market responsibly;
- govern IESO Reliability programs that supplement or override the market price to ensure that electricity supply is steady and reliable; and

Figure 3: Cost Components in the Global Adjustment ($ billion)

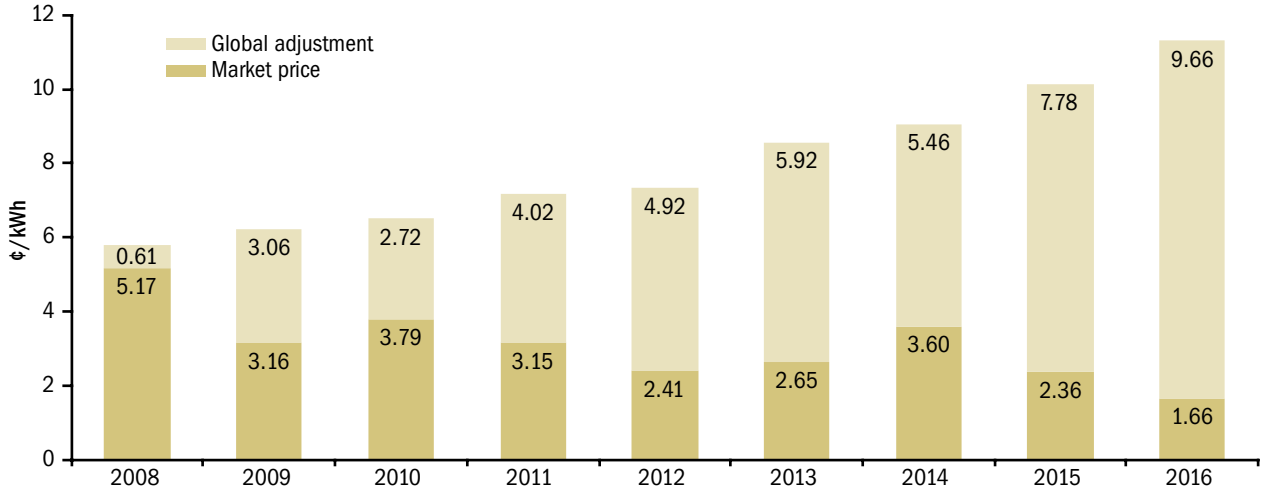
Source of data: Independent Electricity System Operator (IESO)



1. **Nuclear Refurbishment:** Nuclear and hydroelectric generation under long-term contracts with the IESO.
2. **Natural Gas:** Natural-gas generation under long-term contracts with the IESO.
3. **Non-Utility Generators:** Power produced by about 30, mostly privately owned, generators under long-term contracts with the Ontario Electricity Financial Corporation.
4. **Renewables:** Wind, solar, biomass and other renewable generation under long-term contracts with the IESO and under the Renewable Energy Standard Offer Program (RESOP) and the Feed-In Tariff (FIT). On October 1, 2009, the RESOP program was replaced by FIT.
5. **Ontario Power Generation (OPG):** Baseload power produced by OPG's nuclear and hydroelectric facilities under regulated rates set by the Ontario Energy Board.
6. **Conservation Programs:** Conservation programs include the Conservation Fund, which provides financial support for electricity conservation technologies, practices and research.

Figure 4: The Global Adjustment and Market Price Components of the Average Electricity Charge, 2008–2016

Source of data: Independent Electricity System Operator (IESO)



- give the IESO the authority to monitor and investigate market participants for breaking or misusing the rules.

In 2005, under the *Electricity Restructuring Act*, the government transferred some of the IESO's oversight responsibilities to the Ontario Energy Board. Specifically, the Ontario Energy Board became responsible for the Market Surveillance Panel (OEB Panel) that monitors whether the market is being operated fairly and efficiently by the

IESO, and for investigating and reporting on ways that market participants could, if not actually break the rules, misuse and exploit them for their own ends. **Figure 5** shows how the oversight function is shared between the IESO and the Ontario Energy Board, and the two bodies' staffing.

Under the *Electricity Act, 1998*, the IESO must give the Ontario Energy Board an assessment on the impact on ratepayers of any approved changes to market rules before the IESO implements them. The Ontario Energy Board can revoke any market rule change and ask the IESO's board to further review or reconsider the change if the Ontario Energy Board considers that the change does not meet any of the criteria of the *Electricity Act, 1998*, which include, among other things, considerations of the public interest and impact on ratepayers. These criteria in the Act are referred to in our report as impact on ratepayers.

To assist it in its functions, the OEB Panel has the right under the *Electricity Act, 1998*, to compel information, but it cannot impose fines. In contrast, the IESO, which operates under market rules, has the right to impose fines but no explicit legislative authority to compel information.

2.6 IESO's Computer Systems

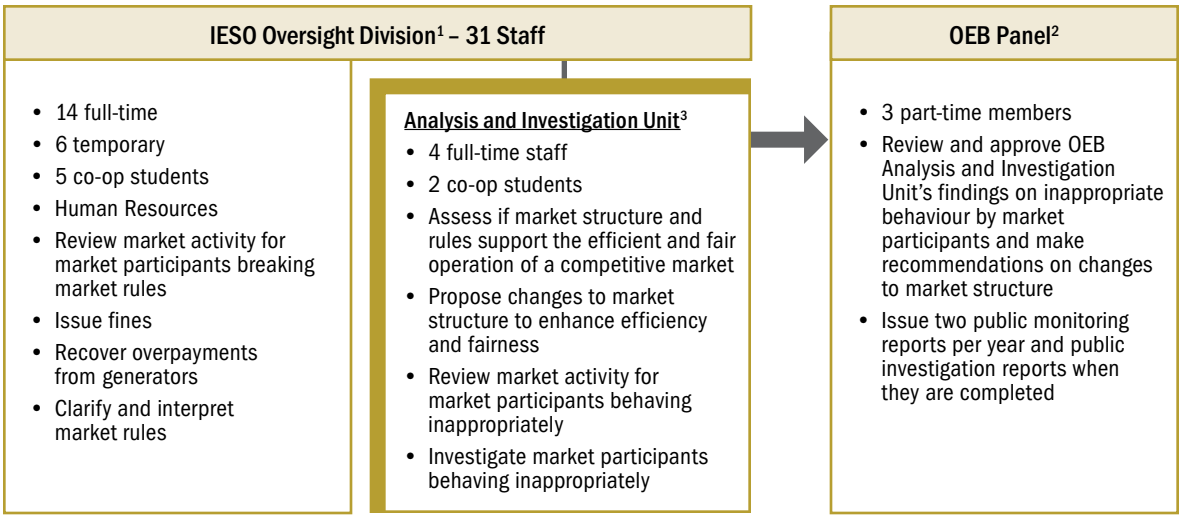
Figure 6 describes the three computer systems the IESO relies on to support its functions.

2.6.1 The Grid System

The grid system is connected to a network of over 75,000 electronic sensors scattered across the province. This network enables the electricity grid to operate. All of the electricity grids in the Eastern Interconnection Grid, Ontario's included, fall under the authority of the North American Electric Reliability Corporation (NERC). NERC is a not-for-profit international regulatory authority that develops and enforces standards for power grid reliability. The IESO's grid system must meet these standards. This entails having systems for ensuring

Figure 5: Assignment of Oversight Responsibilities at the Independent Electricity System Operator (IESO) and the Ontario Energy Board (OEB) as of September 1, 2017

Source of data: Independent Electricity System Operator (IESO)



1. The official name is the Market Assessment and Compliance Division.
2. The official name is the Market Surveillance Panel.
3. In 2005, the OEB and the IESO entered into an agreement whereby the IESO would create and maintain a separate and independent unit to support the OEB (in this audit report, we call it the Analysis and Investigation Unit). Although the Unit operates under the IESO Oversight Division and is staffed by IESO personnel, its files and information are shielded from the IESO and available only to the OEB Panel. This is indicated by the thicker borders walling the unit off from the IESO.

Figure 6: Key Functions Performed by the Independent Electricity System Operator's (IESO) Computer Systems
Source of data: Independent Electricity System Operator (IESO)

Grid System	Market System	Administration System
• Collects and processes weather information • Forecasts electricity demand • Calculates and communicates dispatch instructions to generators • Monitors the transmission system and generators' performance	• Accepts and validates market bids and offers • Collects electricity production data from generators • Processes payments and issues trade confirmations • Processes electricity production and consumption information used for public reporting	• Supports administration of conservation programs • Supports market oversight analysis and investigation • Contains databases and electronic records for administration services, including email, telephone, accounting, payroll and contracts

the grid system is secure, and for analyzing and monitoring threats to security in real time.

2.6.2 The Market System

The market system is connected to a network of about 560 market participants that include generators, electricity exporters and local distribution companies. The market system also processes payments to market participants. In 2016 these payments totalled about $17.5 billion.

2.6.3 The Administration System

The administration system contains databases and electronic records for administration services, and also supports the administration of conservation programs and market oversight analysis and investigation.

2.7 Cyberattacks

Cyberattacks are launched by hackers trying to find a way to install malicious software (malware) onto a network or computer system, or embed malware in an email attachment or website. Malware is designed to exploit vulnerabilities in the system to enable the attacker to, for example, take control of the system, delete files, extract confidential information, or damage physical equipment.

2.7.1 Cyberattacks in the Electricity Sector

According to the Canadian Cyber Incident Response Centre, the energy and utilities sector is the third-most attacked sector after the technology and finance sectors. Seven percent of all cyberattacks target the electricity sector. In July 2017, the U.S. government warned that a hacking campaign was specifically targeting the nuclear and energy sectors.

The following are examples of successful cyberattacks that have already occurred in the energy sector:

- In 2012, a cyberattack on the national oil company of Saudi Arabia damaged about 35,000 computers and deleted all of the company's data. Operations were disrupted for over two weeks.
- In 2015, a cyberattack on the Ukrainian electricity grid temporarily disrupted the flow of power, causing blackouts that affected almost 230,000 for close to six hours.
- In September 2015, the security of the IESO's network was breached, and market participants had access to the confidential contract information of one market participant for seven minutes.
- In December 2016, an employee at St. Catharines Hydro responded to a fraudulent email that appeared to be from the utility's bank. The employee entered the utility's banking login information, and $655,000 was stolen.

Monitoring systems at the IESO identified that during a recent week, the following attempted cyberattacks were prevented by the IESO's cybersecurity systems:

- Almost 22,000 spam emails containing malware were sent.
- About 6,000 random intrusions into the IESO's computer networks were attempted.
- About 7.4 million attempted data transfers were flagged as suspicious and possibly indicative of random hackers trying to extract confidential information.

3.0 Audit Objective and Scope

Our audit objective was to assess whether the Independent Electricity System Operator (IESO) had effective systems and processes in place to ensure that:

- oversight of electricity market participants is sufficient and market participants operate in accordance with market rules; and
- critical IT assets and infrastructure are protected so that the reliability of the grid is maintained.

Before starting our work, we identified the audit criteria we would use to address our audit objective. These criteria were established based on a review of applicable legislation, policies and procedures, and internal and external studies. Senior management at the IESO and the Ontario Energy Board reviewed and agreed with the suitability of our audit objective and related criteria as listed in **Appendix 2**.

We focused on the Ontario Energy Board's oversight of the IESO and the IESO's activities in the five-year period ending March 31, 2017, and considered relevant data and events in the last 10 years. We conducted our audit from January to July 2017, and obtained written representation from the IESO and the Ontario Energy Board that, effective November 21, 2017, they have provided us with all the information they were aware of that could significantly affect the findings or the conclusion of this report.

In conducting our work, we reviewed documents and interviewed staff at two of the IESO's office locations. We also reviewed publications from leading IT security intelligence organizations and IT frameworks and good practice guidance such as COBIT 5 (which is a framework for the governance and management of enterprise IT).

Specifically, we interviewed senior management at the IESO, staff at the Oversight Division, staff in the IT Department and IESO Internal Audit, the Chief Information Officer, and the Chair of the IESO's Board of Directors. The documents we reviewed included policies and procedures, investigations and recoveries completed. We also collected and analyzed market oversight investigation and payment recovery information.

We reviewed IT records and examined related documentation such as threat and risk assessment reports, cybersecurity vulnerability assessments, IT policies, service-level agreements, backup and system recovery plans and procedures as well as reports on the IESO's compliance with North American Electric Reliability Corporation IT security standards.

We also reviewed the semi-annual electricity market monitoring reports published by the Ontario Energy Board Market Surveillance Panel for the past 10 years and its special report on Congestion Payments in Ontario's Wholesale Electricity Market published in 2016, and all six investigation reports the Panel has issued since 2003. We also met with the Ontario Energy Board, the current chair and members of the Market Surveillance Panel and the former chair of the Market Surveillance Panel. Throughout our report, we refer to some of the information reported by the Market Surveillance Panel. For the purpose of providing a clearer explanation of the technical information reported by the Panel, we had to interpret

and simplify what the Market Surveillance Panel has reported.

In addition, we did a jurisdictional scan and engaged with the current head of the Market Surveillance Administrator in Alberta, the former head of the Market Surveillance Administrator in Alberta and the IESO Oversight Division in Ontario, and the head of an external oversight body for the New York Independent System Operator.

We engaged an expert with knowledge of the fields of electricity and energy to assist with interpretation of technical information that we reviewed as part of this audit and to provide knowledgeable insight and perspective on the issues we identified.

4.0 Detailed Audit Observations—Market Oversight

As explained in **Section 2.4**, ratepayers' bills have an electricity charge that is made up of the global adjustment and the market price. In addition, there is a regulatory charge through which the costs of reliability programs operated by the Independent Electricity System Operator (IESO) are recovered.

In 2016, ratepayers paid about $12.3 billion in global adjustment and an additional $2.5 billion for electricity bought as a commodity on the market (i.e., market price), as well as about $500 million for the reliability programs.

The Ontario Energy Board has oversight responsibility for about 29% of the $12.3-billion global adjustment (or $3.5 billion), which is paid to Ontario Power Generation. The remaining 71%, or $8.8 billion, is paid to generators under long-term contracts procured mostly by the former Ontario Power Authority that on January 1, 2015, was merged with the IESO. The IESO has oversight responsibility for about $500 million relating to the reliability programs.

In **Section 4.1**, we present our findings that relate to Ontario Energy Board oversight of IESO reliability programs governed by market rules and explain how the Ontario Energy Board could have done more to protect ratepayers' interests. In **Section 4.2**, we discuss the impacts of the government's decision to implement the Industrial Conservation Initiative, which allows large industrial ratepayers to reduce the amount of global adjustment they pay.

4.1 The IESO and Ontario Energy Board Could Have Done More to Support the OEB Panel's Recommendations

Under the *Electricity Act, 1998*, the IESO must give the Ontario Energy Board an assessment of the impact on ratepayers of any approved changes to market rules before the IESO implements them. The Ontario Energy Board has the authority to revoke the changes to market rules and send them back to the IESO for further consideration. The Ontario Energy Board, however, cannot order that the IESO make specific changes to market rules. Also, the IESO is not required to make changes or reapprove market rules revoked by the Ontario Energy Board. The Ontario Energy Board has never revoked a market rule change approved by the IESO Board.

The OEB Panel has made numerous recommendations to the IESO Board relating to the Real-Time Generation Cost Guarantee Program (shortened in this report to the Standby Cost Recovery Program) and Congestion Management Settlement Credits (shortened in this report to the Lost Profit Recovery Program):

- In 2010, 2011, 2014, 2015 and 2016, it recommended that the Standby Cost Recovery Program be reviewed, reassessed, justified or scaled back, and questioned if the program needs to be retained. As detailed in **Section 4.3**, this Program on average pays gas generators about $60 million per year and, according to an OEB Panel estimate, if the

IESO eliminates the reimbursement of certain operating and maintenance costs, the cost of the Program would be reduced by approximately $30 million annually.

- In almost all of its 28 reports (between 2002 and 2017), the OEB Panel expressed concerns about or recommended changes to the Lost Profit Recovery Program. As detailed in **Section 4.4.2**, this program on average pays market participants about $110 million per year, and, according to the OEB Panel, its weaknesses have allowed market participants to offer or bid prices into the market not based on actual costs or electricity supply needs but for the sole purpose of getting payments from the program.

These programs are governed by market rules, and their costs are charged to ratepayers through the regulatory charge on ratepayer bills. In the cases where the OEB Panel has concerns, the Ontario Energy Board has never revoked and sent back to the IESO for reconsideration a market rule change.

The OEB Panel has also pointed out that gas generators and others that have a direct and substantial financial interest in IESO programs like the Standby Cost Recovery Program influence the process that the IESO uses to change market rules. In this situation, the Ontario Energy Board's responsibility to protect ratepayers' interests should be even more heightened.

We made similar observations in our *2011 Annual Report* (see **Section 3.02** on our audit of regulatory oversight of the electricity sector). In our 2013 follow-up of the 2011 audit (see **Section 4.02** of our *2013 Annual Report*), the Ontario Energy Board informed us that in 2011, the Board began a correspondence with the IESO regarding the recommendations the OEB Panel made in its report to the IESO and that it requested and received in writing the following information from the IESO:

- steps the IESO intends to take in response to any recommendations made to it in the OEB Panel report;
- estimated timelines for completion of those steps; and
- whether, in the IESO's view, any actions or market rule amendments beyond those noted in the OEB Panel's report should be taken.

Based on this information provided to us in 2013 by the Ontario Energy Board, we concluded that our recommendation had been substantially implemented. However, during our 2017 audit, we found that the IESO has not always taken all the steps it could to meaningfully implement the OEB Panel's recommendations pertaining to the Standby Cost Recovery and the Lost Profit Recovery programs.

RECOMMENDATION 1

To ensure that ratepayers' interests are protected and that recommendations made by the Ontario Energy Board Market Surveillance Panel to improve market rules are addressed, we recommend that the Independent Electricity System Operator (IESO):

- implement the Ontario Energy Board Market Surveillance Panel's (OEB Panel) recommendations in an effective and timely way; and
- where the OEB Panel submits a report to the Independent Electricity System Operator that contains recommendations relating to the misuse, abuse or possible abuse of market power, the IESO should use its authority to amend the market rule immediately and submit it to the Ontario Energy Board for its review.

IESO RESPONSE

The IESO supports the OEB Panel's work and acknowledges the recommendation made by the Auditor General. The IESO carefully considers every OEB Panel recommendation and the OEB Panel's underpinning analysis, and responds to each recommendation outlining the actions it will take in a letter directed to the Chair and CEO of the Ontario Energy Board. The IESO has acted on a number of the recommendations

made by the OEB Panel in the past and has made a number of market rule amendments as a result. The IESO will further continue to analyze and assess OEB Panel recommendations and consider possible amendments to market rules to address those recommendations, while also balancing the need to ensure the reliability of the electricity network, to consider the impact upon market design, including potential unintended adverse effects, and to assess the ability of the IESO and market participants to implement the change.

Where the OEB Panel submits a report to the IESO that contains recommendations related to market power, the IESO will take the action required of it under the *Electricity Act, 1998*,including amending the market rules where so ordered by the Board.

RECOMMENDATION 2

To ensure that ratepayers' interests are protected and that recommendations made by the Ontario Energy Board Market Surveillance Panel (OEB Panel) to improve market rules are addressed, we recommend that the Ontario Energy Board (OEB) use its legislative authority to revoke and refer a market rule amendment back to the Independent Electricity System Operator (IESO) for further consideration when the OEB's review determines that an amendment to the market rule is not in the best interest of ratepayers, having regard to the fact that it does not address the Market Surveillance Panel's recommendations. The OEB should continue to revoke and refer such a market rule amendment back to the IESO until it is satisfied that the market rule amendment is in the best interest of ratepayers.

ONTARIO ENERGY BOARD RESPONSE

The Ontario Energy Board (OEB) agrees with the importance that the Auditor General attaches to outcomes that are in the best interests of ratepayers. The OEB supports the recommendations of its OEB Panel, and will continue to use the tools at its disposal to signal that support while respecting its own mandate and processes and the authority and responsibilities of other agencies.

Since 2011, the OEB has regularly corresponded with the IESO regarding the recommendations the OEB Panel makes in its reports. When the OEB renewed the IESO's licence in 2013, a new licence condition was included that requires the IESO to make annual filings to the OEB on the status of actions taken further to recommendations in OEB Panel reports, including the rationale for not taking action where a recommendation remains outstanding.

The OEB will continue to work with the IESO to ensure that high-priority recommendations made by the OEB Panel are appropriately addressed in a timely manner.

OFFICE OF THE AUDITOR GENERAL RESPONSE

Although the OEB obtains annual filings from the IESO on the status of actions taken on the OEB Panel's recommendations, we noted that these status updates do not meaningfully address the recommendations pertaining to the Standby Cost Recovery and Lost Profit Recovery programs.

RECOMMENDATION 3

To ensure that ratepayers' interests are protected and that recommendations made by the Ontario Energy Board Market Surveillance Panel (OEB Panel) to improve market rules are addressed, we recommend that the Ministry of Energy review the legislative power and authority of the Ontario Energy Board to conduct a review of a market rule on its own motion, and to consider expanding its authority under the *Electricity Act, 1998*, when misuse and abuse of a market rule is brought forward by the OEB

Panel and is not effectively being addressed by the Independent Electricity System Operator (IESO) in a timely manner.

MINISTRY RESPONSE

The Ministry of Energy supports the Ontario Energy Board (OEB) and the IESO in the important roles they play to ensure that Ontario's electricity market operates efficiently.

The Ministry, in consultation with both the OEB and the IESO, will review the *Electricity Act, 1998*, regarding the market rule approval process. The Ministry will also review the authority of the OEB.

4.2 Government Not Transparent about the Effect of Expanding the Industrial Conservation Initiative

4.2.1 Overview

The government introduced the Industrial Conservation Initiative (ICI) to provide large industrial ratepayers with an incentive to reduce their consumption when the demand for electricity is at its peak. The government announced at the time of its launch in 2011 that by encouraging less consumption, the ICI could reduce the need to procure new generation resources. However, new generation resources have been procured since 2011.

The incentive the ICI provides is a reduction in the amount of global adjustment eligible ratepayers have to pay each month (recall from **Section 2.4** that the global adjustment is the larger of the two components of a ratepayer's electricity charge, the other being the market price of electricity). Under the ICI, an eligible industrial ratepayer has its global adjustment charge reduced in accordance with its portion of the overall provincial demand for electricity in the five hours of the year demand is at its highest.

To illustrate how this works, **Figure 7** presents hypothetical ratepayer data, and **Figure 8** shows the calculations.

Figure 7: Hypothetical Data for an Industrial Ratepayer Eligible for the Industrial Conservation Initiative

Prepared by the Office of the Auditor General of Ontario

5 Hours With Highest Demand	Ratepayer's Demand (MW)	Overall Provincial Demand (MW)
July 1, 5–6 p.m.	5.2	23,000
July 12, 4–5 p.m.	5.5	22,500
August 22, 5–6 p.m.	5.7	23,800
August 23, 3–4 p.m.	5.1	23,500
September 4, 2–3 p.m.	5.8	24,000
Total	**27.3**	**116,800**

The electricity charge for the hypothetical industrial ratepayer in this example will be the market price plus $255,366 each month. Once the industrial ratepayer's global adjustment amount is calculated, the payment amount is fixed for the whole year, regardless of the amount of electricity the industrial ratepayer actually consumes at any time other than the five hours provincial peak demand is at its highest.

The more the industrial ratepayer reduces its electricity consumption during the five hours of highest peak demand, the lower its fixed monthly global adjustment charge will be. If the industrial ratepayer reduces consumption to zero during those five hours, the global adjustment component of its monthly bill will be eliminated altogether, and it pays just the market price for electricity every month for a full year. This can be a very significant discount—as **Figure 4** shows, for 2016, the global adjustment made up 85% (9.66 cents per kilowatt hour [cents/kWh] of the total 11.32 cents/kWh) of Ontario ratepayers' electricity charge.

To be eligible when the ICI was first launched in 2011, an industrial ratepayer's monthly peak demand had to average out, over the 12 months from May 1 to April 30, to at least 5 MW. Since then, eligibility was expanded three times (that is, the minimum average monthly peak demand was lowered three times), as follows:

- July 2015—from 5 MW to 3 MW;
- January 2017—from 3 MW to 1 MW; and

Figure 8: Calculations for Hypothetical Industrial Ratepayer's Global Adjustment Charge
Prepared by the Office of the Auditor General of Ontario

Ratepayer's Portion of Overall Annual Provincial Demand

Total Ratepayer Demand	÷	Total Overall Provincial Demand		
27.3 MW	÷	116,800 MW	=	0.00023373

Ratepayer's Fixed Global Adjustment Monthly Payment

Ratepayer's Portion of Overall Provincial Demand	×	Total Monthly Global Adjustment		
0.00023373	×	$1.076 billion	=	$255,366

- July 2017 (under the *Ontario Fair Hydro Plan Act, 2017*)—from 1 MW to 0.5 MW.

To put this into perspective, the initial requirement of a minimum 5 MW peak demand restricted eligibility to very large industrial electricity consumers, such as car manufacturing plants, cement companies, mining companies and pulp-and-paper mills. The latest lowering of the requirement to a minimum 0.5 MW peak demand makes commercial operations as small as greenhouses eligible for the ICI.

4.2.2 OEB Panel Reports that the ICI Increases Electricity Charges to Residential and Small-Business Ratepayers

The OEB Panel reported on the impact of the ICI shortly after it was launched. In summer 2011, electricity prices for large industrial ratepayers had decreased by about 13% compared to the summer before. In the first 10 months of the ICI, about 65 large industrial ratepayers reduced their global adjustment charge by about $245 million. This $245 million was added to the electricity bills of residential and small-business ratepayers.

Electricity prices continued to decrease for eligible industrial ratepayers in the ensuing years as a result of the ICI. The average monthly electricity prices they paid stayed below what they paid in 2010 (with the exception of three months in winter 2014 when the market price spiked because of a sudden rise in gas prices).

In the same time period, electricity prices for residential and small-business ratepayers almost doubled, as shown in **Figure 9**.

As of December 2016, about 80 industrial ratepayers participated in the ICI. With the government's significant lowering of the eligibility threshold in January and July 2017 (on the latter date as part of the Fair Hydro Plan), many more non-residential ratepayers are eligible to participate in the ICI. As a result, more global adjustment charges have been shifted to residential and small-business ratepayers.

RECOMMENDATION 4

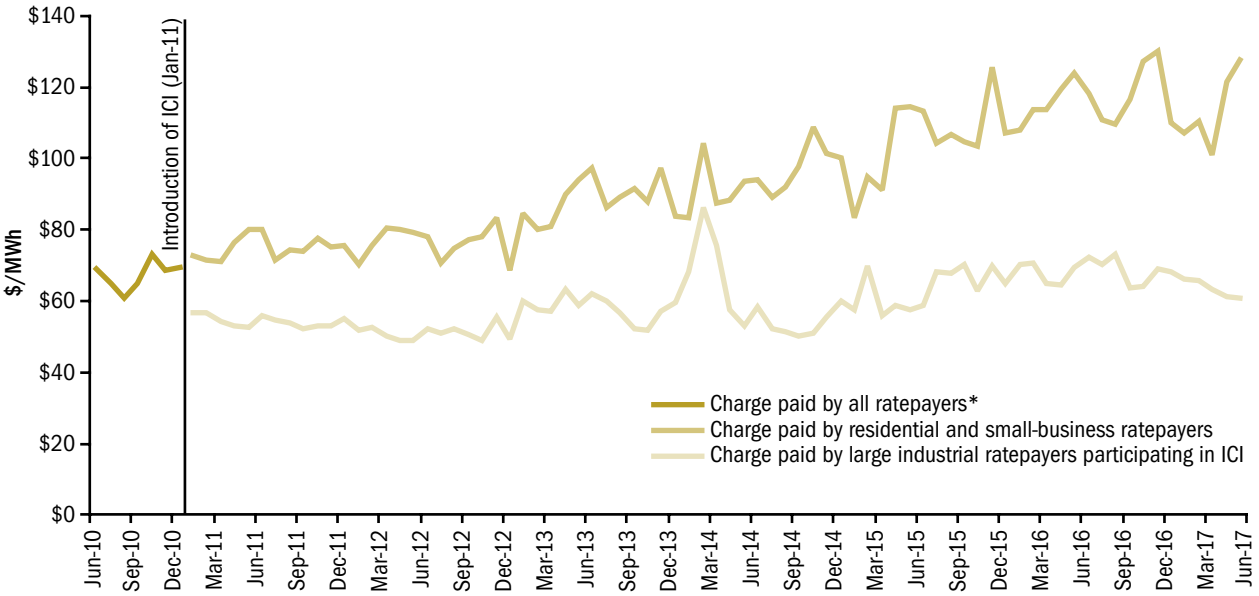
To ensure the transparency of government decisions, we recommend that the Ministry of Energy review the impact of the Industrial Conservation Initiative on low-energy-consuming ratepayers and publicly report this information.

MINISTRY RESPONSE

The Ministry continues to monitor the impact of the Industrial Conservation Initiative (ICI) on the electricity system in reducing peak demand and the impact on all classes of electricity consumers. The recovery mechanism under ICI maintains the relationship between a consumer's electricity costs and their contribution to provincial peak demand.

Figure 9: Electricity Charge Before and After the Introduction of the Impact of Industrial Conservation Initiative (ICI)

Source of data: Independent Electricity System Operator (IESO)



* The Industrial Conservation Initiative (ICI) split the charge paid by all ratepayers into two charges: one for large industrial ratepayers participating in ICI, and a second one paid by all other (residential and small-business) ratepayers.

Lowered peak demand reduces the need for supply resources and ultimately the projection for electricity system cost. The Independent Electricity System Operator (IESO) estimates that ICI reduced peak demand by about 1,300 megawatts in 2016. ICI supports a fair cost allocation framework where consumers who are contributing the least to peak demand pay a smaller portion of these related long-run costs. It is also worth noting that the IESO publishes on its website the allocation of global-adjustment costs each month, as well as the consumption for each class of consumer.

The Ministry would also like to clarify that the benefit for residential and small-business consumers will not be influenced by ICI expansion. The Ontario Fair Hydro Plan reduced electricity bills for residential consumers by an average of 25% and will hold any increases to the rate of inflation for four years.

4.3 The IESO Continues to Administer the Standby Cost Recovery Program Despite Reasons Not To

The Standby Cost Recovery Program pays generators for costs to start and then run their equipment while on standby to supply electricity. The generators enrolled in the Program are gas plants (prior to their closures by 2014, coal-fired power plants were also enrolled), whose equipment needs to be warmed up, running and ready to go so the IESO can dispatch them to supply electricity very quickly should demand spike suddenly or unexpectedly.

When the Program was introduced in 2003, it reimbursed generators only for their fuel costs for being on standby. In 2009, the program was expanded to also reimburse them for their additional operating and maintenance costs while on standby.

4.3.1 The IESO Has Not Implemented the OEB Panel's Recommendation to Reassess and Change the Standby Cost Recovery Program

The OEB Panel reported in 2015 that the electricity supplied by the gas generators that claimed $61 million in costs in 2014 under the Standby Cost Recovery Program was used for less than 1% of the hours to meet Ontario demand.

The OEB Panel was concerned that the Program is overused, at a time when Ontario regularly finds itself in surplus power conditions and is a net exporter of electricity.

OEB Panel reports in 2010 and 2011 recommended that the IESO revise (2010) and reassess (2011) whether the Standby Cost Recovery Program is providing a net benefit for ratepayers, which the IESO did not do. A 2014 OEB Panel report recommended that the IESO provide detailed analysis of market data to justify the need for the Standby Cost Recovery Program's continued existence, which the IESO did not provide. In its 2016 report, the OEB Panel again questioned the need for this Program and why the IESO does not stop reimbursing gas generators for certain operating and maintenance costs, which, according to the OEB Panel, would save ratepayers millions.

The IESO has asserted that the Program is still needed for reliability purposes. However, the IESO has yet to provide any detailed analysis to justify the need for the Standby Cost Recovery Program and its concerns about reliability if the program was discontinued.

4.3.2 Changes to the Standby Cost Recovery Program Do Not Encourage Generators to Be Efficient—Costing Ratepayers More than Necessary

In 2009, the type of costs reimbursed by the Standby Cost Recovery Program expanded from just gas and coal generators' standby fuel costs to their maintenance and operating costs as well.

This change has reduced the incentive for gas and coal generators (prior to their closure) to try to operate more efficiently by managing costs. Costs associated with the Standby Cost Recovery Program are directly passed through to ratepayers.

In 2015, the OEB Panel reported that ratepayers would save about $30 million annually if the Program stopped reimbursing gas generators for certain maintenance and operating costs.

In addition to the savings, this change would provide an incentive for generators to operate more efficiently and minimize these costs, as they would no longer be automatically reimbursed.

The IESO has not implemented the Panel's recommendations. As a result, the Program continues today to reimburse gas generators for their maintenance and operating costs.

4.3.3 Nine Gas and Coal Generators Have Claimed $260 Million in Ineligible Costs under the Program—About $168 Million Recovered

In response to a suggestion by the OEB Panel, in 2012 the IESO Oversight Division started auditing the costs claimed by nine of the 11 gas and coal generators registered under the Standby Cost Recovery Program at that time. Since then, the number of generators registered under the Program has increased to 17. The audits conducted by the Oversight Division identified almost $260 million in possible ineligible cost claims out of a total of about $600 million paid out to gas and coal generators under the Program. The Oversight Division recovered about $168 million (about two-thirds) of the $260 million through settlements with individual generators, and at the time of our audit it was trying to recover another $10 million that generators were disputing. **Figure 10** shows the results of the audits.

Only fuel, maintenance and operating costs that gas and coal generators incur for being on standby are eligible to be claimed under the Standby Cost Recovery Program. The IESO was not reviewing all

Figure 10: Results of Audits of Costs Claimed by Nine Generators under the Standby Cost Recovery Program
Source of data: Independent Electricity System Operator (IESO)

Generator*	Years of Submissions Covered by Audits	Total Claims Paid ($ million)	Ineligible Costs		Ineligible Costs Recovered	
			($ million)	% of Total Paid	Total Recovered ($ million)	% of Ineligible Costs Recovered
Company A	2009–15	240.0	162.1	68	110.0	68
Company B	2006–15	147.0	50.9	35	22.0	43
Company C	2006–15	78.0	22.7	29	17.4	77
Company D	2008–14	72.0	2.1	3	1.3	62
Company E	2010–12	23.0	7.5	33	7.5	100
Company F	2009–12	17.0	6.5	38	3.5	54
Company G	2010–12	7.9	4.1	51	2.7	66
Company H	2006–12	3.6	2.3	64	2.3	100
Company I	2006–15	2.4	1.2	50	0.8	67
Total		**590.9**	**259.4**	**44**	**167.5**	**65**
Average				**41**		**71**

* Audit information is designated confidential information under the provisions of the Market Manual, Market Rules and the *Electricity Act, 1998*. We therefore refer to generators in this figure anonymously as "Company A," "Company B," and so on.

cost claims submitted by generators before paying. Generators claimed thousands of dollars annually for staff car washes, carpet cleaning, road repairs, landscaping, scuba gear and raccoon traps, which have nothing to do with running power equipment on standby. For example, the Oversight Division found that one generator claimed about $175,000 for coveralls and parkas at one facility over a two-year period.

In October 2017, the OEB Panel released a public report detailing the results of its investigation of the Goreway Power Station's misuse of the Standby Cost Recovery and Lost Profit Recovery programs. Through review of Goreway's internal records and documents and other information, the OEB Panel found the following:

- Goreway claimed $17 million in costs for which it could not provide any supporting records.
- Goreway claimed an extra $25,000 in costs each time it started its power equipment. The total of payments it received under the Standby Cost Recovery Program as a result was $5 million.
- Goreway claimed ineligible costs that included $6.5 million for gas to fuel a steam turbine that does not consume any gas and $300,000 for landscaping.
- Goreway provided to the IESO Oversight Division, which was conducting its own audit, documents containing fictitious costs. Some related to equipment parts worth about $27 million that Goreway had no intention of purchasing and that would be redundant.

4.3.4 Electricity Bought at Higher Cost from Gas Generators Because Gas Generators Used the Standby Cost Recovery Program to Suppress the Market Price

Besides filing ineligible claims for costs that have nothing to do with fuel, maintenance or operating costs, some gas generators have filed Standby Cost Recovery Program claims for their costs to produce electricity, instead of reflecting those costs in their offer to sell electricity to the market (those costs would then be recovered through the market price, as explained in **Section 2.4**). Only incremental costs to run equipment on standby should be

claimed under this Program, not generators' costs to produce electricity for sale to the market. The OEB Panel reported on this in 2010.

Claiming their costs to produce electricity under the Standby Cost Recovery Program enabled gas generators to lower the price they offered to be chosen to produce electricity. **Figure 11** shows how the market price is suppressed when gas generators misuse the Program by claiming their costs to produce electricity.

This has led to the IESO's inefficiently selecting which gas generators will produce electricity (that is, the IESO buys electricity from a gas generator that produces it for a higher overall cost), resulting in a depressed market price and an inflated global adjustment.

According to a Panel estimate, the market price for electricity from January to April 2010 was artificially lower by as much as 85% than it would have been if generators had not claimed their costs from the Standby Cost Recovery Program. The OEB Panel also estimated that between December 9, 2009, and April 30, 2010, the loss associated with the IESO's buying electricity from one gas generator that produced it for a higher overall cost was about $16.3 million.

The OEB Panel has not done any similar reviews since 2010.

4.3.5 Electricity Costs Higher Because Gas Generators Do Not Continuously Run Their Equipment When on Standby

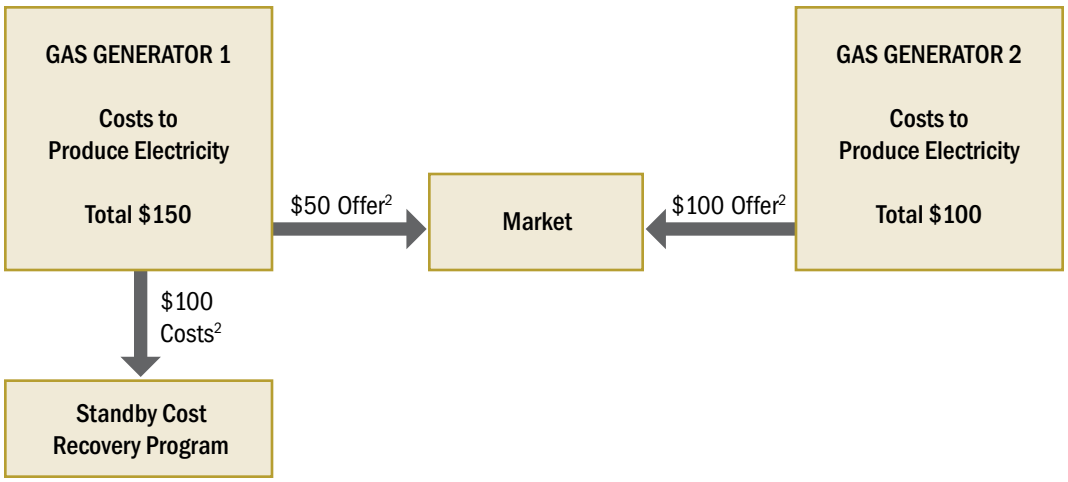
Another way reported by the OEB Panel that gas generators can raise electricity costs is by shutting down their equipment while on standby, only to restart it again within two hours. This allowed generators to submit their equipment start-up costs under the Standby Cost Recovery Program. Running their equipment continuously would have saved money, but generators could not have then submitted the additional start-up costs for reimbursement. The OEB Panel reported that in summer 2010, nearly all of the $19 million in extra electricity costs charged to ratepayers was because of this practice.

RECOMMENDATION 5

To protect ratepayers' interests and to improve the transparency of the decisions of the Independent Electricity System Operator (IESO),

Figure 11: Standby Cost Recovery Program—How Market Price Is Suppressed[1]

Prepared by the Office of the Auditor General of Ontario



1. This figure is for demonstration purposes only and does not reflect an actual transaction that has occurred.
2. Based on an artificially lower offer, Generator 1 would be selected by the Independent Electricity System Operator (IESO) to produce electricity over Generator 2, even though Generator 1's cost to produce electricity is $50 higher. Generator 1 recovers $100 worth of costs through the Standby Cost Recovery Program, which is charged directly to ratepayers.

we recommend that the IESO provide a detailed analysis to the Ontario Energy Board Market Surveillance Panel (OEB Panel) to support its assertion that the Standby Cost Recovery Program is necessary to ensure a reliable supply of electricity for Ontarians.

IESO RESPONSE

In 2018, the IESO will present to the OEB Panel a detailed analysis supporting the rationale for its previous assertions to the OEB Panel that a real-time generator commitment mechanism (currently the Real-Time Generator Cost Guarantee Program, referred to in this report as the Standby Cost Recovery Program) is necessary to allow the IESO to comply with North American power system reliability standards and ensure a reliable supply of electricity for Ontarians.

RECOMMENDATION 6

To ensure that ratepayers are not charged for unnecessary costs, we recommend that, if the Independent Electricity System Operator does not cancel the Standby Cost Recovery Program, it fully implement the Ontario Energy Board Market Surveillance Panel's (OEB Panel) recommendations and not reimburse generators for operating and maintenance costs under the Program.

IESO RESPONSE

The IESO acknowledges the recommendation made by the Auditor General and notes that the total costs of the Real-Time Generator Cost Guarantee Program (referred to in this report as the Standby Cost Recovery Program) have fallen from $61 million in 2014 to $23 million in 2016. In light of OEB Panel recommendations, the IESO implemented a new cost recovery framework for this Program on August 1, 2017. Under this new framework, the values for 14 of 15 eligible costs are now set and approved in advance of participating in the Program for each program participant. This change introduced transparency and removed the potential for overpayments and the need for after-the-fact audits for these components. One cost component is still subject to audit, as it cannot be pre-approved, but this cost component was not identified as an issue in the Standby Cost Recovery Program audits.

The IESO acknowledges issues with the current Standby Cost Recovery Program in our responses to previous OEB Panel reports and has committed to replace it. The IESO has initiated a $200-million comprehensive program to fundamentally overhaul Ontario's electricity market. Market Renewal is estimated to result in up to $5.2 billion in savings, the majority of which is estimated to be realized by ratepayers (see "The Future of Ontario's Electricity Market, A Benefits Case Assessment of the Market Renewal Project," **http://www.ieso.ca/-/media/files/ieso/document-library/engage/me/benefits-case-assessment-market-renewal-project-clean-20170420.pdf?la=en** and **http://www.ieso.ca/sector-participants**). The Enhanced Real-Time Unit Commitment initiative of Market Renewal will replace the current Standby Cost Recovery Program with a transparent and competitive mechanism that will ensure reliability through a more efficient commitment of resources near real time.

4.4 The IESO Continues to Pay Market Participants under the Lost Profit Recovery Program without Addressing the Program's Flaws and Weaknesses

4.4.1 Overview

The Lost Profit Recovery Program was established in May 2002. The Program compensates market participants if they lose money from a change that the IESO makes to the way it has scheduled power to be dispatched. The need to make these

interventions, and then to pay compensation, is built into Ontario's market design: one scheduling approach considers system constraints (such as transmission line capacity) to determine which generator produces power, but another scheduling approach, based on an unconstrained (competitive and open) transmission system, is used to determine market price.

One of the reasons for the IESO's intervention in the market schedule is to keep transmission lines from being overloaded. Another is to fill an unexpected shortfall in supply. Here are three scenarios where this program comes into play:

- Generator A has successfully offered to supply electricity for the market for a given time period. However, the IESO must order it to stop supplying electricity because of a potentially damaging overload in the transmission lines. Generator A loses money as a result. The Program compensates Generator A for the lost profit.
- There is a shortfall in electricity because the IESO has ordered Generator A to stop supplying. The IESO orders Generator B, whose bid to supply electricity was too high to be chosen, to supply the shortfall at the market price. Generator B's costs to supply the electricity are higher than the market price. The Program compensates Generator B for the difference between its costs to supply electricity and the market price.
- A large industrial consumer offers, for a price, to reduce its high demand for electricity at a given time. The IESO cannot accept this offer as it already planned to supply the electricity, and sending the supply through the transmission lines without the consumers needed to draw down the supply would cause a potentially damaging overload in the transmission lines. The IESO orders the large industrial consumer to keep its demand high, and the large industrial consumer loses money as a result. The Program compensates the large industrial consumer for this loss.

Between 2002 and the end of 2016, market participants have been paid about $1.6 billion, or $110 million annually on average, under this Program.

4.4.2 The OEB Panel Has Reported the Potential for Participants to Misuse Market Rules under the Lost Profit Recovery Program

A 2016 OEB Panel special report on the Lost Profit Recovery Program states: "Since market opening, no element of Ontario's wholesale electricity markets has attracted the attention and concern of the Market Surveillance Panel [OEB Panel] more than [Lost Profit Recovery Program] payments."

Even before the market opened in 2002, the OEB Panel reported that the market participants could offer or bid prices not based on actual costs or supply needs but for the sole purpose of getting payments from the Program.

Soon afterwards, the OEB Panel was reporting not just on the potential for this to happen, but also on actual situations of market participants misusing the program. The OEB Panel began reviewing the payments market participants received under the Program after the market opened in 2002, and also investigating the behaviour of certain participants. The results of five investigations, some of which took from two to four years to complete, have been made public by the OEB Panel. These are summarized in **Figure 12**.

The OEB Panel has also reported on large payments made under the Program. As of the end of 2015, about $500 million of the total $1.5 billion paid out went to market participants in northwestern Ontario. The generators in that region represent less than 5% of Ontario's generation capacity, and the demand for electricity in that region has fallen. The concern is that the market participants involved may be submitting bids and offers into the market to create the conditions under which they can claim lost profits that they may not have incurred.

Figure 12: Investigations into the Lost Profit Recovery Program Reported by the Ontario Energy Board (OEB) Panel[1]

Source of data: Ontario Energy Board (OEB)

Year	Market Participant	Summary of Results
2016	Goreway Power Station	A substantial portion of the $11 million paid to Goreway under the Program between June 2009 and June 2012 is believed by the OEB Panel to have resulted from misuse of the rules.
2015	Resolute Forest Products Inc.[2]	During an eight-month period in 2010, the company misused market rules to gain $20.4 million. The OEB Panel reported that the company used one of the Panel's past reports, which recommended that the IESO fix the rules, to learn how to misuse the rules. As a result of a subsequent investigation by the IESO's Oversight Division, Resolute repaid $10.6 million.[3]
2014	Greenfield Energy Centre	Between December 2010 and August 2011, the company misused market rules to gain $432,000. Greenfield Energy later repaid the amount in full to the IESO.
2012	TransAlta Energy Marketing Corp.	The investigation exposed weaknesses in certain market procedures, which the OEB Panel recommended that the IESO fix.
2012	West Oaks Energy NYINE, LP	The investigation exposed weaknesses in certain market procedures, which the OEB Panel recommended that the IESO fix.

1. The only other investigation conducted by the OEB Panel since 2003 did not relate to the Lost Profit Recovery Program (it was a complaint about possible withholding by Ontario Power Generation of coal-fired generation).
2. In 2011, Abitibi Bowater Inc. (Abitibi) was renamed Resolute Forest Products Inc. At the time, Abitibi owned and operated Bowater Canadian Forest Products Inc. and Abitibi-Consolidated Company of Canada.
3. The OEB Panel does not have the authority to issue fines or sanctions against market participants. It can report and make recommendations, and refer the matter to the IESO Oversight Division. The Division can issue fines; however, it has to conduct its own independent investigation. For further discussion see **Section 4.7.5**.

As mentioned in **Section 4.3.3**, the OEB Panel released a public report detailing a generator's misuse of the Standby Cost Recovery and Lost Profit Recovery programs. The OEB Panel found that this generator received under the Lost Profit Recovery Program a large portion of $11 million for claimed lost profits that did not exist. The OEB Panel also reported that some of the IESO's fixes to the market rules that the generator misused may still leave the Program open for other generators to misuse.

The OEB Panel has analyzed the Program in almost all of its 28 reports and made several recommendations for the IESO to fix the rules' flaws that allow market participants to claim artificial losses. The Panel has also recommended that the IESO restrict this Program. The IESO has fixed some of the flaws, but sometimes not to the full extent recommended by the Panel. The IESO has otherwise responded to the OEB Panel that it is deferring making any major changes to the Program until the working group of its Market Renewal Initiative completes its work. However, changes resulting from this work will not be implemented for another five years. (See **Section 4.6.2** for more information on this working group.)

RECOMMENDATION 7

To ensure that ratepayers are not charged for unnecessary costs associated with the Lost Profit Recovery Program, we recommend that the Independent Electricity System Operator (IESO) implement the recommendations of the Ontario Energy Board Market Surveillance Panel (OEB Panel) regarding this Program.

IESO RESPONSE

The IESO acknowledges the recommendation made by the Auditor General and carefully considers every OEB Panel recommendation

and the OEB Panel's underpinning analysis, and responds to each recommendation outlining the actions it will take in a letter directed to the Chair and CEO of the OEB. The IESO has acted on a number of the recommendations made by the OEB Panel related to Congestion Management Settlement Credits (referred to in this report as the Lost Profit Recovery Program) and has implemented more than a dozen market rule amendments regarding the Program. In light of the recommendations made by the OEB Panel over the years, the IESO will continue to consider the OEB Panel recommendations when assessing amendments to market rules while also balancing the need to ensure the reliability of the electricity network, to consider the impact upon market design including potential unintended adverse effects and to assess the ability of the IESO and market participants to implement the change.

The IESO has initiated a $200-million comprehensive program to fundamentally overhaul Ontario's electricity market. Market Renewal is estimated to result in up to $5.2 billion in savings, the majority of which is estimated to be realized by ratepayers (see "The Future of Ontario's Electricity Market, A Benefits Case Assessment of the Market Renewal Project," **http://www.ieso.ca/-/media/files/ieso/document-library/engage/me/benefits-case-assessment-market-renewal-project-clean-20170420.pdf?la=en** and **http://www.ieso.ca/sector-participants**). The Single Schedule Market (SSM) initiative of Market Renewal will eliminate the Lost Profit Recovery Program.

4.5 Market Participants Benefiting from Market Flaws Are Involved in Changing Market Rules and Market Design

4.5.1 Overview of the Market Rule Amendment Process

The IESO Board has the authority and responsibility to amend market rules. Anyone, including the IESO or market participants, can request an amendment to the market rules. Before the IESO Board approves any amendment, it is first reviewed by the IESO Technical Panel, appointed by the IESO Board, made up of members who are mostly industry and generators' representatives. **Figure 13** shows the most recent composition of the Technical Panel as of June 27, 2017.

The Technical Panel considers each proposed amendment and decides if:

- the amendment should not be adopted;
- the amendment should be adopted and recommended for IESO Board approval; or
- the amendment needs further clarification or stakeholder input and should then be resubmitted to the Technical Panel for reconsideration.

Figure 13: Composition of Technical Panel
Source of data: Independent Electricity System Operator (IESO)

Member*	Representation
1	Consumer
2	Energy-Related Business/Services
3	Natural Gas Industry
4	Independent Electricity System Operator (IESO)
5	Market Participant
6	Generator
7	Generator
8	Residential Consumer Group
9	Industrial Consumer Group
10	Electricity Wholesalers
11	Transmitters
12	Chair

* Number of members can fluctuate.

4.5.2 Gas Generators Are Involved in the Rule-Changing Process of the Standby Cost Recovery Program

As mentioned in **Sections 4.3.1** and **4.3.2**, the OEB Panel has repeatedly recommended that the market rules that govern the Standby Cost Recovery Program be changed. The OEB Panel specifically recommended that the IESO stop reimbursing gas generators for their maintenance and operating costs. The following is a chronology of key events relating to issues with the Standby Cost Recovery Program:

- 2011 and 2014—The OEB Panel recommends that the Standby Cost Recovery Program be reviewed to assess its benefits for ratepayers and whether it continues to be needed.
- 2012–2014—The IESO Oversight Division audits payments made between 2006 to 2015 under the Program and finds $260 million paid to gas and coal generators was for possibly ineligible costs.
- 2015—The OEB Panel again recommends that the IESO define the eligible costs more precisely.
- April 20, 2016—IESO management submits a proposal to its Technical Panel to amend the market rules governing the Standby Cost Recovery Program. The amendments are to clarify and better define the operating and maintenance costs eligible for recovery, and to reduce the scope and frequency of audits conducted by the IESO Oversight Division (because clarifying and better defining eligible costs will reduce or eliminate generator claims for ineligible costs).
- September 13, 2016—At a public meeting held by the Technical Panel, IESO management tells the panel that generators are continuing to submit ineligible cost claims, that IESO staff are burdened with having to review these claims, and that these costs need to be more clearly defined for generators. Generators tell the Technical Panel that the IESO has not sufficiently consulted them on the changes it is considering making to the Standby Cost Recovery Program. The Technical Panel votes six to four against recommending to the IESO Board that changes be made to the Standby Cost Recovery Program. The rationale provided by the six members voting no is primarily that IESO management has not allowed generators to review the proposed changes and provide input on the technical details supporting them.
- October 2016–March 2017—The IESO obtains input from gas generators on the technical details, revises its proposed changes and resubmits them to the Technical Panel.
- March 21, 2017—The Technical Panel votes seven to four (with one abstention) in favour of recommending the changes to the IESO's Board for approval.
- April 2017—The IESO Board approves market rule changes to better define and pre-approve costs that generators can claim and to reduce the scope and frequency of audits of generator cost claims under the Standby Cost Recovery Program.
- May 2017—IESO management says to the Technical Panel that involving generators in the process of drafting technical details that support market rules (as was done between October 2016 and March 2017) contravenes its usual procedures.

In reviewing these events, we were particularly concerned about the involvement of generators in the process of drafting technical details that support market rules. This involvement was apparently based simply on generators' assertion that they were not sufficiently consulted on the changes to the technical details that support market rules—yet such consultation is not a normal procedure.

At the time of our audit, the IESO had not meaningfully addressed the recommendations made by the OEB Panel, and gas generators continued to be reimbursed for their operating and maintenance costs under the Standby Cost Recovery Program. We noted as well that neither had the Ontario

Energy Board used its authority to revoke the IESO Board–approved changes to the Program and send the changes back to the IESO for reconsideration on the basis that they are not in the best interest of ratepayers.

4.5.3 Market Participants Are Heavily Involved in the Market Renewal Process

In 2016, the IESO started a Market Renewal Initiative (Initiative) to address known issues with the current market design. These issues relate to the fact that, over the 15 years the market has been in place, two different schedules have governed its operations. One scheduling sequence determines market price based on an unconstrained transmission system. The second scheduling sequence considers transmission constraints to schedule which generator produces power. The "two-schedule" system was intended to be only temporary when the market opened in 2002, but this problem has not been resolved to date. This system also prompted the need for the Lost Profit Recovery Program and has resulted in the inefficiencies that have been reported by the OEB Panel and that we have highlighted in **Section 4.4**.

The IESO stated in a 2017 report published as part of the Market Renewal Initiative that one area the Initiative will specifically address is changes to the Lost Profit Recovery Program. The IESO told us that it expects to implement these changes sometime in 2022.

A 23-member working group is leading the Initiative, advising the IESO on strategic, policy and market design issues. Its members represent generators, consumers and other stakeholders.

Figure 14 shows the make-up of the working group. Some of the members that are on the working group are representing companies that have been found by the OEB Panel and/or the IESO Oversight Division to have misused market rules. More specifically:

- Goreway (whose representative is co-chairing the Initiative)—was found by the OEB Panel to have claimed ineligible or fabricated costs under the Standby Cost Recovery Program totalling $89 million and took advantage of market rules that govern the Lost Profit Recovery Program to obtain a substantial portion of the $11 million it received for lost profits that were not incurred. (See **Section 4.4.2** for details.)
- Resolute Forest Products—was found by the OEB Panel to have obtained $20.4 million by misusing market rules that govern the Lost Profit Recovery Program and was found by the IESO Oversight Division to have broken market rules by repeatedly submitting false bids to withdraw electricity from the grid when

Figure 14: Members of the Market Renewal Initiative Working Group as of October 1, 2017
Source of data: Independent Electricity System Operator (IESO)

Representing Generators	Representing Consumers	Representing Other Stakeholders
Co-Chair/Goreway Power Station	Co-Chair/Tembec	EnerNOC
Brookfield Renewable Power	Ivaco Rolling Mills	HQ Energy Marketing
Vacant	Gerdau	NRStor
NextEra	Resolute Forest Products	Energy Storage Canada
Northland Power	Association of Major Power Consumers in Ontario	Alectra
Ontario Power Generation	Vacant	Market Surveillance Panel
TransCanada Energy	Power Consumer	Opus One Solutions
Association of Power Producers of Ontario	Canadian Manufacturers and Exporters	Peak Power Energy
		Milton Hydro

it could not do so and by defying the IESO's dispatch instructions. (See **Section 4.4**.)

The 23-member working group also includes three other organizations that have or are being investigated by the IESO Oversight Division for misusing market rules:

- a market participant that was being investigated by the IESO Oversight Division at the time of our audit for major breaches of market rules that govern the Lost Profit Recovery Program involving a potential $20 million in related payments;
- a market participant that submitted ineligible cost claims under the Standby Cost Recovery Program that the IESO Oversight Division estimated to be about $51 million (see **Section 4.3**); and
- a market participant that claimed ineligible costs under the Standby Cost Recovery Program totalling $7.5 million (see **Section 4.3**).

Audit information and the names of market participants under investigation are designated confidential under the provisions of the Market Manual, market rules and the *Electricity Act, 1998*. We therefore do not disclose the names of these market participants in our report.

We also noted that the representation of consumers in the working group is weighted in favour of high-volume electricity consumers, as opposed to medium- and low-volume electricity consumers.

RECOMMENDATION 8

To ensure that the Market Renewal Initiative (Initiative) considers and protects all ratepayers' interests, we recommend that the Independent Electricity System Operator (IESO):

- immediately prohibit representatives from companies that have been found by the Ontario Energy Board Market Surveillance Panel or the IESO Oversight Division to have misused IESO programs from participating in the Initiative working group;
- establish a minimum number of working group members representing low-power consumers and ensure that those positions are always filled; and
- publicly report in clear language how the results of the Initiative will be in the best interests of all ratepayers.

IESO RESPONSE

The IESO acknowledges the recommendations of the Auditor General and will continue to evaluate the membership of the working groups used for Market Renewal.

The IESO will also continue to ensure that its stakeholder engagement processes, including Market Renewal, seek representation from low-volume consumers where appropriate. The IESO's stakeholder engagement processes seek the input from a wide representation of participants—generators, traders, consumers, stakeholders, First Nations and Metis Peoples, communities, and the general public—and are guided by seven engagement principles that were put in place in November 2015 (see **http://www.ieso.ca/sector-participants/engagement-initiatives/overview/engagement-principles**).

One of the principles, which applies to Market Renewal, seeks to ensure adequate representation in each engagement of the public or those that have a tendency to remain silent or reluctant to engage. Where practical, a variety of engagement methods will be offered to provide flexibility to participate.

The IESO is also required by statute (the *Electricity Act, 1998*, S.O. 1998, c. 15, Sched. A, s. 188) to have a Stakeholder Advisory Committee that provides appointed stakeholder representatives with the opportunity to present advice and recommendations on key initiatives like Market Renewal directly to the IESO's independent Board of Directors and Leadership Team. Members include low-volume consumers (see **http://www.ieso.ca/-/media/files/ieso/document-library/sac/sac_tor.pdf**).

4.6 The IESO Oversight Division's Ability to Uncover Significant Rule Violations Is Limited

In addition to conducting its own market monitoring, the Oversight Division receives information from the IESO about suspicious or anomalous market activity that could signal rule violations. Market participants can also self-report rule violations. The Oversight Division investigates the activity and, if there was a violation, warns or fines the guilty party. **Figure 15** lists the range of possible sanctions that the Oversight Division can issue for rule violations.

4.6.1 Limited Investigations Have Uncovered Significant Rule Violations

The focus of the Oversight Division's investigations between 2003 and 2014 was on self-reported partial and full non-compliance of market rules: 341 investigations resulting in fines or payment recoveries were completed, and 70 market participants were issued fines totalling about $2.5 million.

In contrast, between 2015 and 2017, the focus shifted to major investigations; only three such investigations were completed, but they uncovered repeated non-compliance over an extended period: the total fines or settlements exceeded $30 million. **Figure 16** summarizes the investigation results.

The scale of these last three investigations was much larger than the earlier investigations, and there was less co-operation from the investigated market participants. The average time to complete them was three-and-a-half years.

4.6.2 IESO Oversight Division Under-Resourced, Resulting in a Backlog of Investigations

One reason for the large-scale investigations taking years to complete was the Oversight Division's lack of staff. Only two active investigators did the work. At the time of our audit, the Division Director had identified, out of a total 78 possible rule violations, five potential major violations requiring large-scale investigations. However, only one investigation was under way. Four others were suspended because of a lack of resources.

In addition, as of June 2017, the Division had a backlog of 43 investigations of minor breaches of market rules.

4.6.3 Ontario Has Similar Staffing to Alberta But Faces Greater Investigative Challenges

We conducted a comparison of Ontario's Oversight Division to the most comparable Canadian jurisdiction, Alberta. Alberta is the only other province that operates an electricity wholesale market and has a market oversight function that is similar to Ontario's.

We found that both provinces' oversight functions have similar levels of staffing. At the time of

Figure 15: Range of Possible Sanctions Issued by the Independent Electricity System Operator (IESO) Oversight Division

Source of data: Independent Electricity System Operator (IESO)

Level of Non-compliance	Level of Co-operation	Range of Sanctions per Breach
Partial compliance	Self-report, full co-operation	Warning letter or fine of up to $2,000
Full non-compliance	Self-report, full co-operation	Warning letter or fine of up to $4,000
	No self-report, partial co-operation	Warning letter or fine of up to $6,000
	No self-report, no co-operation	Fine of $1,000 to $10,000
Repeated full non-compliance*	Not applicable	Fine of up to $1,000,000

* Repeated non-compliance or a breach during a declared emergency or market suspension, or if the breach had an impact on market or electricity grid reliability.

Figure 16: Results of Three Large-Scale Investigations by Independent Electricity System Operator's (IESO) Oversight Division

Source of data: Independent Electricity System Operator (IESO)

Year Completed	Market Participant	Description of Breach	Settlement/Fine ($ million)
2017	Manitoba Hydro	From October 2011 to September 2012, Manitoba Hydro repeatedly breached market rules and submitted misleading market offers to sell electricity into the market and refused to co-operate during the investigation.	9.6
2016	Resolute Forest Products Inc. pulp and paper facilities in Fort Frances and Thunder Bay	From October 2004 to September 2013, Resolute repeatedly breached market rules and submitted false bids to withdraw electricity from the grid when it could not do so, and did not follow IESO's dispatch instructions.	10.6
2015	Goreway Power Station	Between June 10, 2009, and March 31, 2013, Goreway repeatedly made false claims to IESO's Cost Recovery Program totalling $12 million.	10.0*

* The IESO's Oversight Division negotiated settlements with Manitoba Hydro and Resolute Forest Products. In contrast, Goreway was fined an extra $10 million and repaid the $12 million as part of a larger negotiated settlement that was recovered from Goreway as a result of the audits of its claims under the Standby Cost Recovery Program.

our audit, the IESO Oversight Division had 14 full-time staff, while Alberta's oversight function had 12 full-time staff.

Working with about the same number of staff, however, Ontario has greater investigative challenges. Ontario's Standby Cost Recovery Program and the Lost Profit Recovery Program have presented a number of issues that required enforcement action and, as a result, required significant financial resources from the IESO Oversight Division. Similar programs with significant enforcement issues do not exist in Alberta's electricity wholesale market, which has resulted in less extensive investigative work by its staff, and far smaller fines issued, compared to Ontario. In 2015 and 2016, Alberta issued a combined total of 1,071 fines, averaging only about $230 each. Further, most rule violations in Alberta have been self-reported by market participants, not uncovered by large-scale investigations.

Adding to the comparison, Alberta's electricity market is only half the size of Ontario's: Alberta's installed generation capacity is about 16,300 MW, while Ontario's is about 36,500 MW, and Alberta's highest demand for electricity in 2016 was about 11,000 MW, versus Ontario's of about 23,200 MW.

4.6.4 High Employee Turnover in the IESO Oversight Division

At the time of our audit, the IESO Oversight Division had a budget to employ a total of 24 full-time staff and 10 temporary staff. We found that only 60% of these positions were filled—that is, 20 staff were employed at the Division (14 full-time and six temporary staff).

In Ontario, many staff hired for the temporary positions leave, contributing to an average staff turnover of almost 30% per year since 2012. This turnover has meant that new staff often lack the experience and need more time to conduct effective, thorough and in-depth investigations. This is a serious shortcoming given that, as detailed in **Section 4.6.1**, the focus of the Oversight Division has shifted to larger-scale, more challenging probes into significant non-compliant conduct by market participants.

RECOMMENDATION 9

To ensure that the Independent Electricity System Operator (IESO) Market Assessment and Compliance Division can conduct proper

oversight of the market, we recommend that the IESO:

- assess the resources needed to eliminate its investigation backlog and conduct the large-scale investigations that have proven effective in recovering funds and identifying and sanctioning significant rule violations; and
- attract and retain staff with experience in market rules and expertise in investigation.

IESO RESPONSE

The IESO agrees with the Auditor General's recommendation, as it is consistent with recent increases in staff at the Oversight Division and the process of ongoing review of priorities.

As part of the IESO Business Planning process for 2018, the IESO is evaluating the risk profile of a variety of its priorities, including the enforcement of market rules. As part of this exercise, consideration is being undertaken to both increase the total level of resources made available for enforcement, as well as the conversion of some current resources to full-time and non-temporary staff. In doing so, attracting staff with expertise in market rules and investigations will be a priority.

4.6.5 IESO Oversight Division Has No Explicitly Legislated Investigative Authority

The IESO Oversight Division has no explicit legislative authority to compel the subjects of its investigations to provide information. Instead, the Division must rely on market-rule-based obligations that are more limited than the investigatory powers given to the OEB Panel under the *Electricity Act, 1998*. This means that there is no way of ensuring that its investigations:

- uncover the full extent of rule violations committed by market participants; and
- issue appropriate penalties for those violations.

In contrast, under the *Electricity Act, 1998*, the OEB Panel is empowered to compel the subjects of its investigations to provide information. This means that the OEB Panel can obtain complete evidence to determine the full extent of market participants' behaviour. However, the OEB Panel is not empowered to sanction or fine the market participants it investigates. It can refer matters to the IESO Oversight Division.

The IESO Oversight Division must conduct its own investigations of these market participants, without explicit legislative authority to compel the subjects of its investigations to provide information.

As a result, for example:

- The Oversight Division was not able to uncover the full extent of rule violations committed by Manitoba Hydro, which in 2011 and 2012 submitted misleading offers to sell electricity (see **Figure 16**) and then, while being investigated by the Oversight Division, refused to answer some questions and provide requested information.
- The Oversight Division's ongoing investigation of one market participant for allegedly breaking market rules that govern the Lost Profit Recovery Program to gain an estimated $20 million has been prolonged and hampered by this market participant's refusal to provide some requested information.

RECOMMENDATION 10

To enable the Independent Electricity System Operator Market Assessment and Compliance Division (Oversight Division) to conduct thorough and effective investigations, we recommend that the Ministry of Energy give the Oversight Division explicit legislative authority under the *Electricity Act* to compel information and evidence in the course of its investigations.

MINISTRY RESPONSE

The Ministry of Energy supports the vital role that the Oversight Division plays in investigating potential infractions in Ontario's electricity system.

To ensure that the Oversight Division can effectively conduct its investigations, the Ministry will consult with the Independent Electricity System Operator regarding the potential need for additional legislative authority to assist the Oversight Division in performing its mandated duties.

4.6.6 IESO Oversight Division's Computer System Lacks Functionality

The Oversight Division uses a computer system developed in-house in 2003 to log, track and analyze information about possible breaches of market rules. When Oversight Division staff demonstrated the system to us, we found that it can no longer support the Oversight Division's oversight activities. For example:

- it lacks the basic functions needed to analyze trends in the information it contains;
- it is prone to freezing (it stopped working a number of times during the demonstration, and staff informed us that they were afraid the system would crash if they demonstrated certain functions); and
- staff are unable to enter fines issued to generators where the fine amounts are more than five digits.

At the time of our audit, the Oversight Division staff providing IT support for the system did not have IT expertise. As shown in **Figure 6**, the system is part of the larger administration system for the IESO; the IESO's IT Department provides support to the grid and market systems but not to the system used by the Oversight Division.

When we asked why the system had not been replaced, the IT Department and the Oversight Division's Director told us that plans were made in 2011 to replace it, but:

- the Oversight Division lacked staff with the skills needed to help implement a new system; and
- IT resources were too constrained as a result of the merger of the IESO and the OPA to procure the replacement.

In the absence of a sufficiently functional computer system, Oversight Division staff manually track and analyze some market activity information in spreadsheets. But due to a lack of resources, these spreadsheets are not always updated and the updates, entered manually, are prone to errors, which we identified when we reviewed them.

RECOMMENDATION 11

To ensure that the Independent Electricity System Operator (IESO) Market Assessment and Compliance Division (Oversight Division) can conduct proper oversight of the market, we recommend that the IESO replace the Oversight Division's computer system as soon as possible.

IESO RESPONSE

As part of the IESO Business Planning process for 2018, the IESO is evaluating the risk profile of a variety of its priorities, including the sufficiency of resources directed towards the Oversight Division's IT support and replacement of the computer system.

4.7 Oversight Division Not Independent of the IESO

Since market opening, a letter between the IESO CEO and the Oversight Division Director has delegated the IESO's rule enforcement responsibilities to the Oversight Division. The Oversight Division is empowered to investigate not just market participants for rule violations, but also the IESO itself. This makes it critical that the Oversight Division operates independently of the IESO.

The IESO Oversight Division is not fully independent given that IESO senior management is involved in Oversight Division activities and operations. For example:

- In one instance, we found that senior management was involved in negotiating a settlement with a generator to recover ineligible overpayments identified through the audits of the

Standby Cost Recovery Program (discussed in **Section 4.3**). In contrast, the Alberta Electricity System Operator has no direct involvement with Alberta's oversight function. Rather, the head of Alberta's oversight division is appointed by and reports directly to the Minister of Energy, who evaluates the performance of the division. This separation of functions would prevent Alberta's system operator from interfering with the activities of Alberta's oversight division. The instance we cite here is further inappropriate in that the IESO is considered a market participant under Ontario market rules, and the IESO Oversight Division even has the authority to sanction the IESO.

- The IESO's CEO is responsible for approving the Division's budgets and approving any budget increases. In Alberta, the Chair of the Alberta Utilities Commission (with similar functions to the Ontario Energy Board) approves its oversight division's yearly budget, which is then funded by Alberta's Electricity System Operator. To avoid any conflict of interest, the Chair of the Alberta Utilities Commission cannot sit on any commission proceedings that are initiated by Alberta's oversight division.
- In the United States, electricity markets are monitored and investigated by the Division of Energy Market Oversight that operates within the Federal Energy Regulatory Commission. The Commission is responsible for the regulation of the interstate transmission of electricity, natural gas and oil, and is an independent agency. Its members are appointed by the President of the United States with the advice and consent of the Senate.

RECOMMENDATION 12

To strengthen independence of the Independent Electricity System Operator (IESO) Market Assessment and Compliance Division (Oversight Division), we recommend that the IESO change the Oversight Division's reporting structure.

IESO RESPONSE

The IESO agrees with the Auditor General's recommendation.

The IESO's independent Board of Directors approved in October 2017 a new reporting structure whereby the Director of the Oversight Division will report directly to the IESO Board of Directors and report only administratively to the IESO CEO.

5.0 Detailed Audit Observations—Cybersecurity

5.1 The IESO Lacks Dedicated Cybersecurity Resources

Given the realistic threat of a cyberattack on the operations of the IESO, best practices suggest that the IESO should have individuals specifically dedicated to ensuring that it is protected from a cyberattack. The qualified individuals need to be at the senior executive level as well as in the front lines of the organization. The IESO is lacking in both.

5.1.1 No Senior Executive Position Is Dedicated to Cybersecurity

The IESO does not have a designated senior executive responsible for cybersecurity.

Leading frameworks and good practice guidance such as COBIT 5 (which is a framework for the governance and management of enterprise IT) and NIST Special Publication 800-12 (which gives guidelines for maintaining the security of information travelling across networks) suggest that organizations appoint a senior official who is accountable for the security of all enterprise information and for defining, operating and monitoring a system for information security management. NIST Special

Publication 800-52 further recommends that this senior official be provided "resources to coordinate, develop, implement, and maintain an organization-wide information security program."

Comparable organizations that follow this best practice and have a dedicated senior executive solely responsible for reporting cybersecurity matters to senior executives and the Board of Directors include Hydro One and grid operators in New York, New England and California. In these cases, the senior executive position is the Chief Information Security Officer.

At the IESO, the most senior individual directly responsible for cybersecurity is a Team Lead who reports to the IT manager. The IT manager in turn reports to the Chief Information Officer, who reports to the Board. The problem with this is that the person with the most responsibility for cybersecurity does not have the authority to make the decisions needed to ensure the IESO has sufficient cybersecurity measures in place. Correspondingly, the people who do have the authority to make top-level decisions may not understand the impact their decisions will have on IESO cybersecurity.

RECOMMENDATION 13

To strengthen its cybersecurity governance, we recommend that the Independent Electricity System Operator (IESO) create a senior-level position for cybersecurity and establish a formal reporting process to both IESO executives and the IESO Board of Directors.

IESO RESPONSE

The IESO agrees with the Auditor General's recommendation.

The IESO is already in the process of recruiting a new Chief Information Officer (CIO) with an increased focus on cybersecurity, and will consider creating a senior-level position for cybersecurity with formal reporting to both IESO executives and the IESO independent Board of Directors.

5.1.2 Number of Cybersecurity Staff Is under the Recommended Level

At the time of our audit, the IESO had four cybersecurity staff, a number that had not increased over the past decade. One of the four was eligible for retirement. However, during the past decade, IESO staff have almost doubled in number, and cyberattacks have become more sophisticated and frequent.

Having so few cybersecurity staff can increase the risk of the IESO falling prey to a cyberattack and responding to it too slowly. The risk is greatly increased should two cyberattacks happen at the same time. For example, in January 2017, hackers attacked a computer system that supported the operations of the former Ontario Power Authority (part of the IESO from the January 1, 2015, merger—see **Appendix 1**). The IESO's four cybersecurity staff worked overtime for several days to contain this one attack. If a second attack had been launched during this time, there would not have been sufficient staff to respond to it quickly enough.

Two external consultants who conducted separate reviews of the IESO's IT environment in 2015 and 2016 both recommended that the IESO should have at least seven dedicated cybersecurity staff.

An alternative to increasing the number of internal staff is to engage an external IT cybersecurity vendor to be on standby to provide immediate support or cybersecurity experts to help deal with a second or more sophisticated attack. The Alberta Electric System Operator has such a vendor on standby.

RECOMMENDATION 14

To ensure there are sufficient cybersecurity resources in place to respond to cyberattacks, we recommend that the Independent Electricity System Operator (IESO) increase the number of cybersecurity staff to the recommended level of seven and/or engage an external IT cybersecurity vendor to be on standby.

IESO RESPONSE

The IESO complies with all applicable North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection standards, which include standards for cybersecurity. The IESO is in the process of implementing an independent consultant's recommendation to increase the number of current cybersecurity staff in a manner consistent with the Auditor General's recommendation. The IESO has also retained the services of a cybersecurity vendor to augment the existing staff in the event of a cybersecurity event. The IESO is also an active member of the North American Cybersecurity Mutual Assistance Program (CMA), which provides access to cybersecurity specialists from over 150 North American utilities in the event of a cyberincident.

5.1.3 Role of Cybersecurity in IT Planning Needs to Be Heightened

According to leading security intelligence organizations, having an independent cybersecurity department with clearly defined roles and responsibilities ensures that security is at the forefront of all IT project planning, reducing cybersecurity risks. The IESO does not have such a department, and it is up to the IT project managers to decide whether and when to involve cybersecurity staff in IT planning.

We found that in a number of instances, project managers involved cybersecurity staff only in the later stages of a project. This increased the risk that something was missed that could make the IESO more vulnerable to an attack or that costly redesigns would be necessary at the late stage when cybersecurity staff pointed out what had been missed.

For example, the IESO did not involve cybersecurity staff when it moved its email service to the cloud for external storage. It did not realize that the firewall needed to be updated to allow the external use of the cloud. After the move, the email service stopped working. Only when cybersecurity staff were brought in was the problem identified. The disruption to email and the additional time and cost taken to resolve the issue could have been avoided if cybersecurity staff had been consulted during the planning phase of the project.

The relatively low priority assigned to cybersecurity issues is also a problem when cybersecurity has to compete with other IT issues. For example, in March 2017, cybersecurity staff found that the IESO's cybersecurity technology was malfunctioning and asked the IT department to fix it. The IT department delayed the fix because of a shortage of resources and competing priorities, and the IESO's cybersecurity risk was heightened until the technology was fixed.

RECOMMENDATION 15

To reduce cybersecurity risk and to prevent potential costly IT project redesigns, we recommend that the IT department of the Independent Electricity Sector Operator (IESO) involve its cybersecurity staff in the early stages of all IT projects that could pose cybersecurity risks.

IESO RESPONSE

The IESO complies with all applicable North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection standards, which include standards for cybersecurity. It is the IESO's current practice that security risk assessments are incorporated in the IT project management practices. Having said that, the IESO will continue to enhance its approach to ensure "cybersecurity by design" in all of its IT-related projects. That means ensuring that the cybersecurity requirements are being considered early in the process of any new IT program design and that sufficient cybersecurity staff are allocated at this important part of any project. This will be further facilitated by the formation of the IESO's new Program Management Office, which will ensure an enterprise-holistic view on all IESO projects.

5.2 No Centralized Control and Monitoring of User Access

The IESO's market system stores and processes an average of about 135,000 transactions involving confidential information per day. This makes the IESO a potential target for hackers wanting to access or steal this information.

Although the IESO has monitoring technology that works well to identify threats and risks in instances of spam and to block suspicious data traffic, we identified a weakness: the IESO's cybersecurity systems do not monitor the activities of privileged users in real time to proactively trigger alerts for unusual behaviour. About 14% of IESO employees have privileged-user access, meaning that they have almost unrestricted freedom to access any part of the computer system or network. Privileged users can abuse their authority and hack a system, or a hacker can try to steal the privileged user's log-in credentials and use them to launch a cyberattack.

Also, the IESO's cybersecurity system cannot support real-time analysis and investigation of certain types of breaches. In addition, because of the way some computer systems are connected, the cybersecurity system cannot record certain hacker activity during an attack.

This may have been a factor in a 2015 breach where the confidential contract information of one market participant was accessible to other participants for about seven minutes. The breach was not identified by the IESO but rather by a generator that alerted the IESO.

RECOMMENDATION 16

To reduce the cybersecurity risk of the Independent Electricity System Operator (IESO), we recommend that the IESO procure technology that prevents and identifies breaches of confidential information and monitors staff access to confidential information in real time.

IESO RESPONSE

The IESO agrees with the Auditor General's recommendation.

The IESO complies with all applicable North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection standards, which include standards for cybersecurity. The IESO has procured technology that prevents and identifies breaches of confidential information and monitors staff access to confidential information in real time through the Advanced Malware project, and is implementing that technology now, with a target completion date of the end of the fourth quarter of the 2017 fiscal year.

5.3 No Cybersecurity Policy for External Vendors

External vendors providing specialized IT services are usually given log-in credentials that then reside outside the IESO, increasing the risk of their being stolen and used by hackers to attempt a cyberattack. The IESO does not have a strong, uniform policy that holds vendors accountable for maintaining high security over these credentials.

Instead, each department is responsible for managing its own relationship with vendors and can decide whether or not to enforce cybersecurity requirements with vendors.

Also, the cybersecurity team does not review the contracts and does not assess on an ongoing basis the security risk of external vendors. Information security does perform an initial evaluation of third-party vendor risk but it also does not monitor this risk on an ongoing basis. Changes might occur in the vendor's environment that may introduce new unassessed risk to the IESO.

RECOMMENDATION 17

To reduce the cybersecurity risk of the Independent Electricity System Operator (IESO), we recommend that:

- the IESO establish an external vendor cybersecurity policy; and
- the cybersecurity team conduct a regular assessment of the security risk that external vendors pose to the IESO.

IESO RESPONSE

The IESO complies with all applicable North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection standards, which include standards for cybersecurity. The cybersecurity team works directly with the procurement and legal processes to ensure security requirements are met. The IESO was an active participant in the development of the NERC Supply Chain risk standards, and is in the process of developing and implementing supply chain risk management measures to comply with these standards, which will also include processes that are responsive to the recommendation.

5.4 Backup Tapes Not Adequately Protected

The IESO's policies pertaining to storage of its system backup information could be improved in two ways.

First, the tapes on which the IESO stores system backup information are not encrypted. This means that anyone accessing the tapes can access the information.

Second, some backup tapes are stored on-site. If the IESO's location were to sustain physical damage, the tapes could also be damaged. As a result, it would take the IESO longer to recover from a potential attack or natural disaster.

RECOMMENDATION 18

To ensure that backup tapes are adequately protected and available when needed, we recommend that the Independent Electricity System Operator (IESO):

- properly encrypt all backup tapes; and
- store them in a secure off-site location.

IESO RESPONSE

The IESO complies with all applicable North American Electric Reliability Corporation (NERC) Critical Infrastructure Protection standards, which include standards for cybersecurity.

Access to backup tapes is tightly controlled both in on-site and off-site storage. The IESO will investigate the feasibility of storing all backup tapes off-site and of further protecting backup tapes with encryption. The IESO does not rely on backup tapes as a primary recovery mechanism as all of our critical systems are high availability and site redundant through our Backup Data Centre.

Appendix 1: Ontario's Electricity Grid—Key Events and Historical Outline

Prepared by the Office of the Auditor General of Ontario

Period	Key Events
1970–1980s	Ontario Hydro constructed the Bruce, Pickering and Darlington Nuclear Generation Stations. Construction delays reached 10 years and cost overruns reached billions of dollars.
1990–1992	Ontario experienced a recession that reduced electricity demand. Electricity rates increased by 40%, while generation capacity exceeded demand by 50%.
1993	The Ontario government froze electricity rates for almost the next 10 years. This caused Ontario Hydro's debt to rise.
1995	The government embarked on a program to transform the electricity industry from a government-owned Ontario Hydro to a competitive market-based structure.
1996	The government's Advisory Committee on Competition in Ontario's Electricity System delivered a report recommending the breakup of Ontario Hydro and a move toward a competitive electricity market.
1998	With the passage of the *Energy Competition Act, 1998*, Ontario Hydro ceased to exist. Ontario Hydro was replaced by five entities: • Ontario Power Generation (OPG), an electricity generator; • Hydro One Inc., responsible for the transmission and distribution of electricity to consumers; • the Ontario Electricity Financial Corporation (OEFC), responsible for retiring Ontario Hydro's debt; • the Independent Electricity Market Operator (IMO), the IESO's predecessor, responsible for operating the new electricity market; and • the Electrical Safety Authority, responsible for regulating electricity inspections.
1999	Ontario Energy Board (OEB), which had been regulating the province's natural gas sector since 1960, was tasked with regulating the electricity sector.
2002	The Electricity Wholesale Market opened on May 1, 2002. Following the market opening, with a potential shortage of supply and an increased demand for electricity during the summer of 2002, electricity rates began to increase significantly. The government passed the *Electricity Pricing, Conservation and Supply Act, 2002* on December 9, 2002, to freeze electricity rates for most consumers until 2005.
2003	The Electricity Conservation and Supply Task Force was set up to create an action plan to attract new generators in Ontario. The task force projected that as early as 2006, Ontario might not have enough power to meet peak demand. It recommended a future electricity sector that relied less on the competitive market price of electricity and more on long-term contract pricing.
2004	The government passed the *Electricity Restructuring Act, 2004*, to create the Ontario Power Authority, which became responsible for long-term planning and procurement of power under long-term contracts.
2005	In May 2005, the government ended the electricity price freeze and the OEB's Regulated Price Plan took effect; the plan was designed such that the rate charged to residential and small-business consumers approximately reflects the full cost of electricity.
2007–2009	The government ordered the closing of coal-fired plants by December 31, 2014. The *Green Energy and Green Economy Act, 2009* empowered the OPA in the renewable energy field.
2015	The IESO merged with the OPA and acquired responsibility for long-term planning, procurement and conservation efforts.

Historical Outline

Government's Control of Electricity Until 2002

Prior to the 1980s, having the government supply electricity was viewed as the most cost-effective way to provide electricity to consumers. The government's provision of electricity was seen as a natural monopoly. This precluded the entry of the private sector, since the lack of competition would greatly reduce the chance to make a profit.

The government-owned company that used to provide Ontario's electricity was called Ontario Hydro. In the 1970s and 1980s, Ontario Hydro constructed the Bruce, Pickering and Darlington Nuclear Generation Stations. Construction delays stretched to 10 years and cost overruns reached billions.

The Ontario government faced a new challenge in the early 1990s with a recession that reduced electricity demand. Electricity rates increased by 40%, while generation capacity exceeded demand by 50%. In response, in 1993, the government froze electricity rates for almost the next 10 years. This caused Ontario Hydro's debt to rise even higher. Over the next five years, Ontario Hydro's total long-term debt increased from $33 billion to $38.1 billion.

Advances in generation technology and the expansion of the transmission system during this period challenged the view that electricity was best provided by government. The idea grew that electricity generation could be a competitive enterprise. Beginning in the 1990s, in response to rising electricity prices, several jurisdictions around the world, including the United States, began to create electricity wholesale markets where electricity became viewed as a commodity that could by bought and sold. The vision was that private-sector involvement in these competitive markets would lead to efficiencies that would result in lower electricity prices.

The Move toward a Competitive Electricity Market in Ontario

In 1995, the government embarked on a program to transform the electricity industry from government-owned Ontario Hydro to a structure based on a competitive market. In 1996, the government's Advisory Committee on Competition in Ontario's Electricity System delivered a report recommending the break-up of Ontario Hydro to accomplish this. In 1998, with the passage of the *Energy Competition Act*, Ontario Hydro was replaced by five organizations:

- Ontario Power Generation (OPG), an electricity generator;
- Hydro One Inc., responsible for the transmission and distribution of electricity to consumers;
- the Ontario Electricity Financial Corporation (OEFC), responsible for retiring Ontario Hydro's debt;
- the Independent Electricity Market Operator (IMO), the IESO's predecessor, responsible for operating the new electricity market; and
- the Electrical Safety Authority, responsible for regulating electricity inspections.

In 1999, the Ontario Energy Board, which had been regulating the province's natural-gas sector since 1960, was tasked with regulating the electricity sector.

Ontario's electricity market opened on May 1, 2002. Almost immediately, electricity rates began to increase significantly, from about 3 cents per kilowatt hour (/kWh) to over 8 cents/kWh by August 2002. In response to pressure from consumers distressed over high prices, the government passed the *Electricity Pricing, Conservation and Supply Act*. This Act froze electricity rates for most consumers at 4.3 cents/kWh effective December 9, 2002. The market continued to operate, but the government paid the difference between the higher market price and the lower frozen rate charged to consumers until May 2005.

Other jurisdictions that have tried to set up a wholly competitive market have had similar experiences to Ontario. Only when demand is high and supply is low can the price rise high enough to enable generators to recover all their costs just through the market price. The rest of the time, it would not be economical for generators to operate, which would force them out of business and risk electricity shortages. In North America, only the state of Texas has been able, for the most part, to successfully implement an electricity market where generators recover most of their costs from the market price. In all other jurisdictions, some other mechanism besides market price has been set up for generators to recover their costs.

The Need to Attract New Generators in Ontario

In June 2003, the government established the Electricity Conservation and Supply Task Force. It determined that a number of factors had contributed to a climate of regulatory and financial uncertainty that was deterring private-sector investment in Ontario's electricity sector. Those factors included:

- numerous delays in opening the market (it took five years from when government committed to it to when it opened);
- the subsequent rate freeze; and
- the collapse of Enron, a large publicly traded American company involved in wholesale trading of electricity that engaged in elaborate, systematic accounting fraud, which led to scandal, its bankruptcy in 2001 and the shutdown of Arthur Andersen, one of the country's biggest accounting firms, after being found guilty of criminal charges for how it handled its audits of Enron.

At the same time that the private sector was wary of participating in Ontario's electricity sector, the province was facing a potential looming electricity supply shortfall. Nuclear plants were approaching the end of their operating lives and would need to be temporarily shut down for refurbishment. The task force projected that as early as 2006, Ontario might not have enough power to meet peak demand. It recommended a future electricity sector that relied less on the competitive market price of electricity and more on long-term contract pricing.

Most of the task force's recommendations were adopted by the government in the *Electricity Restructuring Act*, passed in December 2004. This Act created the Ontario Power Authority (OPA), responsible for long-term planning and procuring power under long-term contracts starting in 2005. The contracts signed with generators typically covered a 20-year period (for gas, wind and solar generators) or even longer (for nuclear and hydroelectric generators). Generators receive guaranteed payments during the life of the contracts.

In May 2005, the Ontario Energy Board's Regulated Electricity Price Plan took effect. This plan unfroze electricity rates; it was designed such that the rate charged to residential and small-business consumers approximately reflects the full cost of electricity.

Under this framework of an electricity market with limited competitiveness, long-term contracts guaranteeing payments to generators, and regulated electricity prices, the government continued bringing on new generators. In 2007, it issued a regulation requiring Ontario's four coal-fired power plants to stop burning coal by December 31, 2014. In 2009, it passed the *Green Energy and Green Economy Act*, which empowered the OPA to procure renewable energy and to streamline the development of renewable energy projects.

The Merging of the IESO and the OPA

In 2015, through amendments to the *Electricity Act*, the IESO merged with the OPA. This meant that, in addition to operating the electricity grid and administering the electricity market, the IESO is now also responsible for long-term planning, procurement and conservation efforts.

Appendix 2: Audit Objectives and Criteria

Prepared by the Office of the Auditor General of Ontario

Audit Objective

To assess whether the Independent Electricity System Operator (IESO) has effective systems and processes in place to ensure that:

- oversight of electricity market participants is sufficient and that participants operate in accordance with market rules; and
- critical IT assets and infrastructure are protected so that the reliability of the grid is maintained.

Audit Criteria

- Roles and responsibilities are clearly defined and accountability requirements are established to facilitate monitoring of the electricity market and reliability of the grid, in accordance with legislative, contractual and program requirements.
- Cost-effective procedures, controls and processes are in place to monitor the electricity market in accordance with market rules.
- Current evidence and best practices are used to inform the development of strategies, action plans and programs to maintain reliability of the electricity grid.
- Appropriate procedures, controls and processes are in place to detect security attacks, threats, weaknesses and vulnerabilities, and assess their impact on IESO's security posture while supporting key program objectives.

Appendix 3: Glossary of Terms

Prepared by the Office of the Auditor General of Ontario

Section 1: Market Oversight

Alberta Electricity System Operator (AESO): the independent operator of Alberta's electric system. The mandate of the AESO under the *Electric Utilities Act, 2003*, is to direct the reliable operation of the Alberta interconnected electric system, plan the transmission system and operate the wholesale electricity market. The AESO also evaluates Alberta's current and short-term electricity needs, and the adequacy and reliability of the integrated power system to meet those needs.

Alberta Market Surveillance Administrator (MSA): established in 2007, the Market Surveillance Administrator is a monitor, reporter, investigator and adviser for Alberta's electricity industry. One of the MSA's roles is to protect and promote the fair, efficient and openly competitive operation of Alberta's wholesale and retail electricity markets.

Alberta Utilities Commission (AUC): an independent, quasi-judicial agency of Alberta that regulates the utilities sector, and is responsible for ensuring that the delivery of Alberta's utility service is fair, responsible and in the public interest.

Analysis and Investigations Unit: the term used in this report to refer to the Market Assessment and Investigations Unit. This is the independent unit that supports the Ontario Energy Board's (OEB) Market Surveillance Panel (Panel). In 2005, the Independent Electricity System Operator (IESO) and the OEB established a protocol where employees of the IESO's Market Assessment and Compliance Division (Oversight Division) would assist the OEB Panel in carrying out its functions. The IESO established the Analysis and Investigations Unit to carry out this role, which is housed in the IESO's Oversight Division.

bid: in the wholesale electricity market, the price quoted for an immediate purchase of electricity. Retailers, distribution system owners and other market participants submit bids to purchase electricity from the power pool (wholesale market).

bioenergy: energy produced from a biomass living or recently living plant or animal source, such as waste, wood, agricultural residues, animal manure, food processing by-products and kitchen waste.

capacity: (1) a measure (in megawatts) of the output of a power plant. (2) the maximum sustainable amount of electricity that can be generated or carried in an instant. (3) the amount of electricity delivered to or required by an electric system component such as a power plant, turbine or transmission circuit.

coal-fired power plant: a type of power plant that makes use of the combustion of coal in order to generate electricity.

congestion: a situation that arises when there is a mismatch between power offered and the ability of the transmission lines to deliver that power, blocking the path between generators and consumers. A congested transmission system is a bit like a traffic jam on a highway. Too much electricity running through the system at a particular point in time limits the ability of some generators to move their power to various locations.

conservation (of electricity): any activity that reduces the amount of electricity used overall, or shifts the consumption of electricity from a peak time to a time of lower demand. Conservation includes energy efficiency, demand management, fuel switching and customer-based generation.

distribution system: a network that carries electricity from the transmission system and delivers it to consumers. Typically, the network would include medium-voltage power lines, substations and pole-mounted transformers, low-voltage distribution wiring and electricity meters.

dispatch instructions: physical operating instructions issued by the Independent Electricity System Operator either in the real-time dispatch process or in those dispatch intervals when administrative prices were applied.

dispatchable: a term describing generation sources that can increase or decrease their output when requested as demand fluctuates or the availability of other sources changes. Dispatchable generators submit offers to supply electricity in different quantities and prices for each hour of the day. They must be able to adjust the amount of electricity they generate in response to new instructions issued every five minutes by the Independent Electricity System Operator. An example of a dispatchable generation source is natural gas.

Eastern Interconnection Electricity Grid: the alternating-current power grid (or "interconnection") that reaches from Central Canada eastward to the Atlantic coast (excluding Québec), south to Florida and west to the foot of the Rockies (excluding most of Texas). It is one of the two major interconnections in North America (along with three minor interconnections). All of the electric utilities in the Eastern Interconnection are electrically tied together during normal system conditions and operate at a synchronized frequency operating at an average of 60 Hertz.

Electricity Act, 1998: Ontario legislation to ensure the adequacy, safety, sustainability and reliability of electricity supply in the province.

Electricity Charge: the charge shown on consumer electricity bills that incorporates both the Hourly Ontario Energy Price and global adjustment fees.

Electricity Conservation and Supply Task Force (ECSTF): a task force formed in response to the August 2003 blackout in eastern North America to provide recommendations on the current market approach.

electricity demand: the rate at which electric energy is delivered to or by a system or part of a system, generally expressed in kilowatts or megawatts, at a given instant or averaged over any designated interval of time.

electricity grid: a centrally operated, interconnected network of generating plants, substations and power lines. Also referred to as an **electricity system** and a **transmission system**.

electricity supply: in Ontario, the energy supplied to the market by generators located within Ontario and by imports from neighboring jurisdictions.

electricity system: the interconnected system of generating plants, substations and power lines that carries electricity from producers to consumers. Also referred to as an **electricity grid** and a **transmission system**.

energy storage: the collection of energy so it can be used at a later date. Examples include batteries and hydro-electric dams.

Federal Energy Regulatory Commission (FERC): an independent agency in the United States that regulates the interstate transmission of electricity, natural gas and oil. FERC also reviews proposals to build interstate natural gas pipelines, natural gas storage projects and liquefied natural gas terminals; and licenses non-federal hydro power projects. The Energy Policy Act of 2005 gave FERC authority to oversee the reliability of the bulk power system. This includes the authority to approve mandatory cyber security reliability standards.

Feed-In Tariff Program: a program to procure renewable energy launched in September 2009 under the direction of the Minister of Energy, providing renewable energy generators with significantly higher contract prices than the previous procurement initiative, the Renewable Energy Standard Offer Program (RESOP), which it replaced.

generation: the production of electricity.

generation capacity: the amount of capacity available to generate power at a time of peak electricity demand.

generator: a company that produces electricity and feeds electricity into the Ontario electricity grid. Ontario Power Generation, a Crown corporation, is Ontario's largest power generator, operating electricity-producing stations throughout Ontario. Over the North American bulk electricity system, electricity can also be received from out-of-province power generators

global adjustment: a component of electricity bills whose amount is calculated to make up the difference between the revenues obtained from the electricity market price and the total payments made to regulated and contracted generators (whose prices are guaranteed) and the former Ontario Power Authority's conservation programs.

Green Energy and Green Economy Act: the Act enacted in May 2009 with provisions intended to attract investment in renewable energy, promote a culture of energy conservation, create a competitive business environment, increase job opportunities and reduce greenhouse gas emissions.

Hourly Ontario Electricity Price (HOEP): in the electricity market administered by the Independent Electricity System Operator, the HOEP is charged to local distribution companies and other non-dispatchable loads, and paid to self-scheduling generators. Businesses that use more than 250,000 kilowatt hours (kWh) per year pay the hourly price. The HOEP is also the basis for regulated rates charged to residential and small business customers. The HOEP values are reported as dollars per MegaWatt hour ($/MWh).

hydroelectric generation: a type of power generation that converts the energy of falling or flowing water into electricity.

IESO Oversight Division: the term used in this report to refer to the Independent Electricity System Operator's Market Assessment and Compliance Division.

Independent Electricity System Operator (IESO): the administrator of the Ontario wholesale electricity market to match electricity supply with demand. Also responsible for forecasting Ontario's long- and short-term electricity requirements and providing direction to electricity transmitters and distributors on the capital work needed to increase the capacity of Ontario's electricity system.

IESO-administered grid: the portion of the Ontario transmission system that is controlled by the Independent Electricity System Operator (IESO). This includes all transmission lines equal or greater than 50 kiloVolts. These are high-voltage transmission lines that provide wholesale electricity to large industrial consumers, and to distributors who then provide electricity at the retail level.

installed generation capacity: the maximum intended power output from a facility.

kilowatt (kW): a standard unit of power equal to 1,000 watts (W).

kilowatt hour (kWh): a way of measuring energy production or consumption over time. A kilowatt hour measures 1,000 watts produced or consumed in one hour.

large industrial consumers: electricity consumers that are connected to the high-voltage grid and purchase wholesale electricity from the Ontario electricity market.

local distribution companies (LDCs): companies that own and operate infrastructure to convert high-voltage electricity to lower-voltage electricity through the use of transformers, and deliver electricity through distribution lines to residential and small business customers.

Lost Profit Recovery Program: the term used in this report to refer to Congestion Management Settlement Credits (CMSCs). These credits are out-of-market payments made to suppliers (generators and importers) and dispatchable consumers (dispatchable loads and exporters) in the IESO-administered markets. CMSCs are paid to these participants whenever they are constrained on or off. They are constrained on or off whenever their market schedule and dispatch schedule quantities are different.

market design flaw: a defect in the market design, poorly specified rules or procedures, or a gap in the market rules or procedures that creates opportunities for exploitation by market participants without necessarily involving breaches of market rules.

market participant: an entity authorized by market rules to participate in the IESO-administered market or to cause or permit electricity to be transmitted into, through or out of the IESO-controlled grid.

market price: the price of energy or operating reserve determined in the real-time electricity market.

Market Renewal Initiative Working Group (MRWG): a representative stakeholder forum to guide, advise and inform the Independent Electricity System Operator (IESO) on important strategic, policy and design issues that will impact the overall success of the IESO's Market Renewal Initiative.

market rules: the rules that govern the operation of the wholesale electricity market in Ontario, administered by the Independent Electricity System Operator (IESO). Market rules define the roles and obligations of the IESO and all market participants that own or operate elements and facilities in the electricity grid. In order to participate in the market, participants must comply with all market rules and applicable reliability standards. Failure to comply with the standards can result in sanctions issued by the IESO Oversight Division.

market schedule: the dispatch schedule that would have resulted in the absence of transmission constraints on the IESO-controlled grid.

megawatt (MW): a standard unit of power equal to 1,000 kilowatts (kW) or 1 million watts (W).

megawatt hours: a way of measuring energy production or consumption over time. A megawatt hour (MWh) measures 1 million watts produced or consumed in one hour.

Ministry of Energy: the Ontario government ministry responsible for setting the legislative and policy framework to assure a clean, reliable and affordable energy system for all Ontarians. It develops and advises on all aspects of energy policy for Ontario, including policies for electricity, natural gas and oil. It oversees the Ontario Energy Board and the Independent Electricity System Operator, and represents the shareholder—the provincial government—in dealings with Hydro One and Ontario Power Generation.

net exporter of electricity: a jurisdiction that exports more electricity than it imports. Ontario is an example. Ontario imports electricity, primarily from its neighboring provinces of Québec and Manitoba, and exports electricity, primarily to Michigan and New York State.

North American Electricity Reliability Corporation (NERC): a not-for-profit regulatory authority whose mission is to assure the reliability of North America's bulk electricity system. NERC develops and enforces reliability standards that must be followed by North American electricity transmitters.

nuclear power: power derived from the use of nuclear reactions that release nuclear energy to generate heat, which most frequently is then used in steam turbines to produce electricity in a nuclear power plant.

Ontario Energy Board (OEB): the regulator of electricity and natural gas in Ontario. OEB's objective is to promote a viable, sustainable and efficient energy sector that serves the public interest and assists consumers in obtaining reliable energy services at a reasonable cost. It licenses electrical generators, transmitters and distributors, and sets rules that they must follow. It also approves the rates that electrical utilities can charge their customers, as well as the construction of any electrical transmission lines that are more than two kilometres long.

OEB Panel: the term used in this report to refer to the Market Surveillance Panel (MSP). The MSP is housed under the Ontario Energy Board, and consists of three part-time panel members including a panel Chair, and is supported by the Analysis and Investigations Unit from the IESO Oversight Division. The MSP is mandated to monitor and report on the following:

1. inappropriate or anomalous conduct by market participants, including gaming behaviour;
2. whether IESO activities have had an impact on market efficiencies or effective competition;
3. whether the market rules or IESO rules and procedures are flawed or inefficient; and
4. market design flaws or whether other aspects of the structure of the IESO-administered markets are consistent with the efficient and fair operation of a competitive market.

Ontario Power Authority (OPA): the entity formerly responsible for forecasting electricity demand and procuring electricity supply to meet the province's power needs.

Ontario Power Generation (OPG): an Ontario-based electricity generation company whose principal business is the generation and sale of electricity in Ontario. Its focuses are the efficient production and sale of electricity from its generation assets, and maintaining a safe, open and environmentally responsible operation.

peak capacity: the maximum power output for which a generating unit, generating station or other electrical apparatus is rated. Common units include kilowatts (kW) and megawatts (MW). Also used to refer to the maximum potential output for the entire electricity system.

peak demand: the maximum amount of electricity used on the system in any given time period. Peak demand can be measured per hour for a customer, a group of customers or the system as a whole. Also a measure of the amount of power needed to serve all customers during times of high power use. Peak demand is measured in kilowatts (kW) or megawatts (MW). It is often stated as the highest hourly consumption of electricity during a year

procurement: the purchase of electrical energy for resale to consumers.

ramp up/down: the rate at which a generator or load can change from one level of production or consumption to a different level of production or consumption. For example, if a generator can move from a production level of 50 MW at the beginning of a five-minute dispatch interval to 100 MW at the end of the five-minute dispatch schedule, the generator has a ramp rate of 10 MW per minute.

rate regulation: the process by which regulatory bodies determine the rates charged to customers in regulated industries, including gas and electricity. In Ontario, the Ontario Energy Board (OEB) sets rates for natural gas distribution and electricity transmission and distribution based on cost estimates submitted by the utilities and allowances of an approved capital structure and return on capital. These costs are scrutinized by the OEB prior to setting rates.

real time: the actual time when a process (such as electricity generation) occurs.

Regulated Price Plan: A time-of-use pricing plan for residential and small-business consumers developed by the Ontario Energy Board that sets the prices for electricity during peak, off-peak and mid-peak periods of the day.

renewable energy: energy generated by natural processes, the four major forms of which are hydro (energy generated from the movement of water), wind (energy generated by turbines from air currents), solar (energy generated by photovoltaic cells that capture radiant light and heat from the sun) and bioenergy (energy generated by burning organic forestry residues and agriculture wastes).

renewable energy generation facility: a generation facility that generates electricity from a renewable energy source.

residential and small-business consumers: electricity consumers that pay time-of-use rates, which offer different prices for on-peak, mid-peak and off-peak periods. This pricing structure encourages users to shift some of their usage from high-price peak hours to less expensive off-peak hours and reduce their impact on the system.

side payments: a term used by the OEB Panel in its reports to describe payments like Congestion Management Settlement Credits (CMSCs).

solar power: the radiant energy of the sun that can be converted into other forms of energy, such as heat (solar thermal) or electricity (photovoltaic).

sanction: an action taken by the IESO Oversight Division against a market participant found to be in breach of market rules or reliability standards. Sanctions range from non-compliance letters to financial penalties. Persistent breaches may result in de-registration, suspension or termination of the right to participate in the market.

Standby Cost Recovery Program: the term used in this report to refer to the Real-Time Generation Cost Guarantee Program.

submitting bids/offers: the bids and offers settled every five minutes in the wholesale electricity market, resulting in the Market Clearing Price (MCP). For each five-minute interval, dispatch instructions specify the required amount of energy that sellers should add into or buyers should withdraw from the IESO-controlled grid based on their accepted offers and bids.

Technical Panel: a group that proposes and reviews amendments to market rules and, if requested, advises the Independent Electricity System Operator Board of Directors on specific technical issues relating to the operation of IESO-administered markets.

transmission: the transfer of high-voltage electricity over interconnecting lines that link points of supply to points where energy is delivered to other electric systems or transformed to low voltage for distribution to consumers

transmission lines: the movement of electricity at high voltages from generation sites to local distribution systems and consumers.

transmitter: an electrical utility, such as Hydro One, that transfers electricity over long distances at voltages above 50 kilovolts between electricity generators (such as Ontario Power Generation) and local distribution companies or large industrial users.

two-schedule electricity market: the electricity wholesale market design used in Ontario. It consists of two dispatch algorithms: the market algorithm and the dispatch algorithm. The market algorithm balances electricity supply and demand assuming no internal congestion constraints, and determines the uniform Market Clearing Price (MCP) used for settlement purposes. The dispatch algorithm recognizes internal congestion constraints and re-dispatches generation and dispatchable load so as to respect all constraints.

wholesale electricity market: the market in which electricity is sold to retail companies or provided to distributors, which pass through the price to their customers.

wind power: electricity produced from a system of airfoils or blades that capture the energy of the wind to spin a drive shaft to run an electricity generator.

Section 2: Cybersecurity

backup information: files, equipment, data and procedures available for use in the event of a failure or loss, if the originals are destroyed or out of service.

backup tapes: the tapes on which data from a primary storage device is periodically copied so the data can be recovered if there is a hard disk crash or failure

cloud storage: convenient, on-demand network access to a shared pool of resources that can be rapidly provisioned and released with minimal management effort or service-provider interaction.

COBIT 5: a complete, internationally accepted framework for governing and managing enterprise information and technology (IT) that supports enterprise executives and management in their definition and achievement of business goals and related IT goals. COBIT describes five principles and seven enablers that support enterprises in the development, implementation, and continuous improvement and monitoring of good IT-related governance and management practices.

cyberattack: an assault against a computer system or network.

cybersecurity: the protection of information assets by addressing threats to information processed, stored and transported by internetworked information systems.

cybersecurity governance: a governance view that ensures that information and related technology support and enable the enterprise strategy and the achievement of enterprise objectives; this also includes the functional governance of information technology (IT), i.e., ensuring that IT capabilities are provided efficiently and effectively.

data breach: an incident wherein information is stolen or taken from a system without the knowledge or authorization of the system's owner.

data traffic: typically refers to overall network usage at a given moment. However, it can refer to specific transactions, messages, records or users in any kind of data or telephone network.

encryption: the process of taking an unencrypted message (plaintext), applying a mathematical function to it (encryption algorithm with a key) and producing an encrypted message (ciphertext).

firewall: a system or combination of systems that enforces a boundary between two or more networks, typically forming a barrier between a secure and an open environment such as the Internet.

hackers: individuals who attempt to gain unauthorized access to a computer system.

Information Technology (IT): the hardware, software, communication and other facilities used to input, store, process, transmit and output data in whatever form.

IT cybersecurity vendor: an organization that sells cybersecurity. Refers to both manufacturers and distributors as long as they sell cybersecurity products to the general public.

IT environment: the set of hardware, software and facilities that integrates an enterprise's IT assets.

IT projects: a structured set of activities concerned with delivering a defined capability (that is necessary but not sufficient to achieve a required business outcome) to the enterprise based on an agreed-on schedule and budget.

login credentials: one of three types of identity data. Login credentials to a managed system usually consist of a user ID and password. Identification may also involve a PKI certificate, and authentication may use tokens, biometrics or a set of personal questions that the user must answer.

NIST Special Publication: a type of publication issued by National Institute of Standards and Technology. The Special Publication 800-12 reports on the Information Technology Laboratory's research, guideline, and outreach efforts in computer security, and its collaborative activities with industry, government, and academic organizations.

privileged users: users who, by virtue of function and/or seniority, have been allocated powers within the computer system that are significantly greater than those available to the majority of users.

security intelligence organizations: organizations that analyze and refine information about potential or current attacks that threaten an organization's security.

spam: computer-generated messages sent as unsolicited advertising.