

**TESTIMONY ON AUGUST 14, 2003 POWER BLACKOUT**

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**BEFORE THE  
UNITED STATES HOUSE OF REPRESENTATIVES COMMITTEE  
ON  
ENERGY AND COMMERCE**

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## **SUMMARY**

Ontario's electricity system has been fully integrated with neighbouring U.S. systems for many decades. There is significant import/export capability with the states of New York, Michigan and Minnesota that can total up to 2700 MW. Trade with our neighbouring jurisdictions is considerable, amounting to several hundred million dollars/year.

The Independent Electricity Market Operator (IMO) was created in 1999 as part of Ontario's restructuring of its electricity sector, and is the functional equivalent of a U.S. based ISO or RTO, such as New York ISO, PJM, or ISO-New England. The IMO has full statute-based authority for establishing, monitoring and enforcing reliability standards in Ontario.

On August 14, 2003, the IMO was observing normal conditions prior to the disturbance, with demand at 24,050 megawatts. Ontario was importing approximately 2,300 megawatts from Quebec, New York, Manitoba and Michigan to help meet electricity demand in the province and take advantage of attractively priced imports.

The IMO information indicates that Ontario's power system was hit with unexpected power swings that dramatically increased and reversed electricity flows over the Michigan and New York interconnections. These swings caused large declines in frequency and voltage on the Ontario system, resulting in the loss of generation, transmission and load, as the power system began to shut down.

While additional lessons will be identified as the event analysis proceeds, it is the submission of the IMO that the following principles should be adopted by the Committee, and acted on at the earliest possible date:

### **1. Maintain and enhance the integration of systems and markets:**

The interconnections with our neighbours have yielded substantial reliability and trading benefits for all parties over the years. These benefits are significant and must be preserved. I say this even though Ontario is one of the jurisdictions hardest hit when this disturbance cascaded across our borders.

### **2. Mandatory enforceable reliability standards should be put in place where they do not exist:**

The reliability standards language in the current U.S. House and Senate Bills allows for the creation of an international organization that properly reflects the multi-national nature of the grid.

- 3. The industry should continue to pursue the three part strategy of prevention, containment and minimization of impact.**
  
- 4. The industry should build on the strong institutional and regulatory foundations already in place:**

The strong and long tradition of international cooperation has served North America well. The institutions, agreements, and organizations already in place, supplemented by well-defined authorities as necessary, are fully sufficient, in our view, to take the industry forward.

I would like to thank the Committee for inviting the Independent Market Operator of Ontario to join this panel. My name is David Goulding, and I am the President and CEO of the IMO since its inception over four years ago.

There is strong tradition of cooperation and trade in electricity between Ontario and its U.S. neighbours. Our interconnections have yielded significant benefits to all parties over the years - benefits that can and should be preserved as we move forward. I say this even though Ontario was one of the jurisdictions hardest hit when this disturbance cascaded across our borders.

Today, I'll provide a quick background on how Ontario fits into the North American grid and markets, then proceed to address the six questions that were in the chairman's letter of invitation.

## 1. Ontario is Fully Integrated into the U.S. Grids and Markets

With a population of 11 million people, Ontario has an electricity system roughly equal in size to New England's. Annual use is about 150 TWh, valued at over CAD \$11 billion. The generation mix in Ontario is made up of nuclear, coal, hydroelectric and natural gas. Trade with our neighbouring jurisdictions is considerable, amounting to several hundred million dollars/year. For example, in the last twelve months, Ontario has traded the following volumes with its neighbouring states:

	<u>IMPORTS to Ontario GWh</u>	<u>EXPORTS from Ontario GWh</u>
New York	1, 572	3,149
Michigan	5,436	132
Minnesota	364	23
<b>TOTAL</b>	<b>7,372</b>	<b>3,304</b>

Ontario's electricity system has been fully integrated with neighbouring U.S. systems for many decades. There is significant import/export capability with the states of New York, Michigan and Minnesota that can total up to 2700 MW. This can supply up to 10% of Ontario's peak demand. We are active participants and members of international standards setting and development organizations such as North American Electric Reliability Council (NERC), Northeast Power Coordinating Council (NPCC), and of the recently formed Regional Transmission Organization (RTO) Council of all operating Regional Transmission Organizations in North America.

Electricity is predominately under provincial jurisdiction in Canada, with the federal National Energy Board (NEB) exercising a role limited to export permits and international facility approvals. The Ontario Energy Board (OEB) is the main regulatory agency for electricity in Ontario, although substantial regulatory functions, including reliability, are carried out by the IMO.

While Ontario utilities are not under the jurisdiction of FERC, the Commission, in a recent decision, found that the IMO operates markets that meet their criteria for providing non-discriminatory access to U.S. entities as well as to Ontario entities.

## 2. **Background on the Independent Market Operator in Ontario (IMO)**

The IMO was created in 1999 as part of Ontario's restructuring of its electricity sector, and is the functional equivalent of a U.S. based ISO or RTO such as NYISO, PJM, or ISO-NE. The objectives of the IMO are established by Ontario's *Electricity Act, 1998*. Our objectives are:

- (a) to exercise and perform the powers and duties assigned to the IMO under this Act, the market rules and its licence;
- (b) enter into agreements with transmitters giving the IMO authority to direct the operations of their transmission systems;
- (c) direct the operations and maintain the reliability of the IMO-controlled grid;
- (d) establish and operate the IMO-administered markets;
- (e) collect, and provide to the public, information relating to the current and future electricity needs of Ontario and the capacity of the integrated power system to meet those needs;
- (f) participate in the development by any standards authority of standards and criteria relating to the reliability of transmissions systems; and
- (g) work with responsible authorities outside Ontario to coordinate the IMO's activities with their activities.

Participation in and operation of the IMO-administered markets is governed by a comprehensive set of Market Rules. A Board of Directors, made up of independents as well as stakeholders, governs the IMO and approves the Market Rules. The IMO-administered markets have been in operation since May 1, 2002.

### 3. **Specific Accountabilities Regarding Reliability**

- The IMO's objects assigned to it by Provincial legislation include participating in the development of standards and criteria relating to the reliability of transmissions systems, as well as directing the operation and maintaining the reliability of the IMO-controlled grid.
- The IMO's licence, granted by the Ontario Energy Board (OEB), obligates the IMO to enter into agreements with Transmitters for purposes of directing the operation of the grid.
- An extensive set of Market Rules goes into considerable detail related to reliability obligations, authorities, monitoring and enforcement. A copy of these Market Rules is on the IMO website ([www.theimo.com](http://www.theimo.com)). A copy has been filed with FERC for information.
- The IMO has full statute-based authority for establishing, monitoring and enforcing reliability standards. In this regard, the IMO has been an active participant in NERC and NPCC and has adopted the standards developed through those organizations as the basis for reliability standards in Ontario.
- The IMO is Ontario's Control Area operator, and is party to the Northeast Power Coordinating Council (NPCC) agreement.
- The IMO is also the reliability coordinator for Ontario and was subject of a NERC reliability coordination audit in October, 2002.
- A 2002 reliability compliance audit by the NPCC concluded that the IMO's procedures and practices are exemplary in discharging its reliability authority functions. Its conclusion is that

“the Ontario Area compliance program is unique in that it is directly tied to the established market rules and licensing requirements. This structure makes compliance a binding obligation and facilitates in the administration and enforcement of compliance. NPCC’s Compliance Monitoring and Assessment Subcommittee (CMAS) encourages other Areas to consider such a compliance program model.”

## **Question 1**

**What exactly were the specific factors and series of events leading up and contributing to the blackouts of August 14?**

The Committee will hear from NERC on September 3<sup>rd</sup>, the day prior to this testimony.

The IMO, along with many other entities, is working with NERC to put a complete picture of events together. Our technical experts and our data are being made available for this purpose. This testimony expands on the Ontario perspective on the disturbance and how we worked with our neighbours to restore service to customers.

## Question 2a

**At what time did your company first become aware that the system was experiencing unscheduled, unplanned or uncontrollable power flows or other abnormal conditions?**

## Answer to 2a

Subsequent analysis of data indicates that the disturbance started at approximately 4:09 pm, and for the next several minutes, the following sequence occurred:

- The flow into Ontario from Michigan reversed, from a flow into Ontario of about 486 MW to a flow out of Ontario which increased over time, reaching over 2200 MW about 3 minutes into the disturbance period.
- Voltages across Southwestern Ontario declined.
- Flow into Ontario from New York first increased by 700 MW and stayed there for a minute or so and then increased further. Shortly after, the flow reversed to be from Ontario out to New York, settling at about 1,200 MW.
- During this time, voltage instability occurred in Ontario, and frequency declined causing automatic frequency protections to operate in Ontario in an attempt to arrest the decline by shedding load.
- Various generating units and transmission lines started tripping off-line to protect equipment.
- Separation of Ontario from Michigan occurred at around 4:12 pm.
- Ontario is largely blacked out by 4:12 pm.
- Small pockets of Ontario remained connected to New York and in Northwest Ontario to Minnesota and Manitoba.

## Question 2b

**What steps did you take to address the problem?**

### Answer to 2b

#### Steps taken to address the problem:

- Confirmed extent of the disturbance
- Activated the Ontario Power System Restoration Plan including:
  - Communication with other Control Areas (CAs)
  - Communication with Transmitters
  - Communication with market participants in Ontario
- In order to restore power reliability to customers throughout the Province, the priorities of the restoration plan are:
  - Restore Class IV AC power to all nuclear sites
  - Restore power to critical transmission and generating station service loads
  - Restore critical utility owned telecom facilities
  - Restore customer loads to the extent necessary to control voltages and secure generating units
  - Synchronize islands together and/or to adjacent power systems
- Suspended Ontario's IMO-administered Markets at 4:20 pm
- Activated the IMO's internal Emergency Response Team and our external Crisis Management Support Team (within minutes):
  - Focus on public health and safety
  - Early notification to provincial and federal government regarding scope and scale of the blackout
  - Early notification to telecommunications service providers to sustain critical telecom

- Identification of status of priority loads at several stages through restoration (e.g. hospitals, oil and gas refineries, and water treatment plants)
- Set up Decision Support and Communication Centre with Ontario government officials, including working with industry and government to assist in implementation of the Ontario government's voluntary conservation/curtailment program over the week following the disturbance.

Service was restored to all customers in Ontario by end of Friday, August 15<sup>th</sup>, with the voluntary curtailment request from government being lifted on Friday, August 22<sup>nd</sup>.

### **Question 2c**

**Were there any indications of system instability prior to that time?**

### **Answer to 2c**

There were no indications of system instability prior to that time.

Pre-disturbance conditions:

- All reserve requirements were being met (1,580 MW)
- Operating within all system limits
- System voltages were within required ranges
- No significant transmission outage
- Actual Ontario demand – 24,050 MW
- Schedules: from Michigan - 1, 074 MW, from New York - 373 MW
- Actual Flows: from Michigan – 486 MW, from New York – 1,089 MW

### **Question 3**

**Which systems operated as designed and which systems failed?**

#### **Power System Protections**

Protections intended to isolate equipment from damage worked as designed. These protections provided a safe and orderly shut down for generators, transformers, and transmission lines.

#### **Emergency Power Supply to Control Centre**

Back-up battery/diesel systems worked seamlessly at the IMO's Control Centre, providing electrical power to enable the IMO to direct the restoration of Ontario's power system.

#### **Public Telephone System**

With the exception of cell phones that were overloaded early in the event, the public telephone network was generally available to the Control Centre. Subsequently, the heavy traffic made arranging large conference calls difficult.

#### **System Restoration and Crisis Management Processes**

- Efficient and effective assignment of accountabilities within the control room
- Good cooperation from field staff of generators and transmitters
- Good cooperation with neighbouring area operators
- Successful restoration plan

Large-scale restoration is inherently complex, and our control room staff adapted to changing circumstances as the restoration proceeded, modifying approaches as necessary to achieve objectives. The overall restoration and crisis management processes proceeded in an orderly fashion and met their objectives.

### **IMO Help Centre**

The IMO Help Centre was immediately able to expand its operations from weekdays to 24x7, and successfully handled a 400% increase in call volumes over the ensuing 8 days. As a result there was always someone available to answer questions during the declared emergency, and all questions were handled quickly.

The IMO Help Centre typically answers calls from IMO customers. During this period significant volumes also came from large industrial consumers, small businesses and the general public. The overriding request was for information to help them ensure that they, as electricity users, were “doing the right thing,” such as implementing conservation measures.

The communication systems that the IMO Help Centre relies on to receive and reply to inquiries (i.e. phone and e-mail) functioned normally during the entire emergency.

### **Communication Centre / Provincial Decision Support**

A Communications Centre was set up to brief media on status of system restoration in Ontario and to provide information as to how customers can assist in the restoration effort. Press conferences, scheduled twice daily, were coordinated with Provincial officials.

Provincial government officials were continuously briefed on power restoration priorities to ensure coordination with other government agencies.

**Question 4a**

**If events similar to those that occurred on August 14, 2003 had happened a year ago, would the results have been the same?**

**Answer to 4a**

No comprehensive analysis of the initiating and subsequent events is yet available. This question can only be answered in a meaningful way once that analysis, now underway at NERC, is complete.

**Question 4b**

**If similar events occur a year from now, do you anticipate having in place equipment and processes sufficient to prevent a reoccurrence of the August 14 blackout?**

**Answer to 4b**

Ontario's intent is to incorporate lessons learned from this event, and to follow up on all recommendations designed to avoid a re-occurrence. But Ontario's actions, and those in our neighbouring jurisdictions, must be part of wider regional actions and solutions. It will not be sufficient if even a few entities fail to address the lessons learned. Actions must be taken by all interconnected jurisdictions.

## **Question 5**

### **What lessons were learned as a result of the blackouts?**

It is too early to know all the lessons learned at this time. Only by thoroughly studying the events of August 14<sup>th</sup> and getting to the root cause of the events will the lessons become apparent. We can, however, confirm the value of various plans and practices from Ontario's perspective:

1. We confirmed that the devices that are in place to protect equipment operated as planned.
2. We confirmed that maintaining a well-documented restoration plan, supported by training and rehearsals involving the IMO, market participants and government, was and will continue to be a key investment.
3. We confirmed that close cooperation amongst the IMO, and Ontario Transmitters, Generators, market participants and government is essential to achieving an orderly restoration.
4. The significance of communication protocols between different control areas and reliability coordinators became evident.
5. Maintaining a secure power system in a strongly interconnected network is difficult when there is imperfect knowledge about the extent of local disturbances that have the potential to spread regionally. The extreme speed at which events can cascade across the system increases the significance of timely information.

## Question 6

### How can similar incidents in the future be prevented?

While additional lessons will be identified as the event analysis proceeds, it is the submission of the IMO that the following principles should be adopted by the Committee, and acted on at the earliest possible date:

#### **1. Maintain and enhance the integration of systems and markets:**

The interconnections with our neighbours have yielded substantial reliability and trading benefits for all parties over the years. These benefits are significant and must be preserved.

#### **2. Mandatory enforceable reliability standards should be put in place where they do not exist:**

- Reliability standards for the interconnected North American grid should continue to be developed through the NERC international processes and the associated regional reliability councils but those standards should no longer be voluntary, they should be mandatory.

- A well-defined statute-based mandate should be established in the U.S. under which a responsible organization would have clear enforcement, compliance and sanctioning authority for reliability performance. This mandate should be compatible with the corresponding Ontario mandate with respect to Ontario entities.

- Ontario already has in place a statute-based authority to support the development and enforcement of reliability standards. Under Ontario law, the IMO establishes

reliability standards, and can and does enforce those standards. Ontario standards established and enforced by the IMO meet or exceed relevant NERC and NPCC guidelines and policies. The IMO has all necessary authorities to impose sanctions on asset owners for non-compliance.

- The U.S. reliability standards language in the current U.S. House and Senate Bills allows for the creation of an international organization that properly reflects the multi-national nature of the grid.

**3. The industry should continue to pursue the three part strategy of prevention, containment and minimization of impact:**

**prevention:** through good planning and operations, adequate investments and putting in place mandatory enforceable standards.

**containment:** through monitoring capabilities, communication protocols, as well as equipment and processes that are set to limit the scale of disturbances.

**minimization of impact:** through good restoration plans, practical training, education and communications.

**4. The industry should build on the strong institutional and regulatory foundations already in place:**

It is our view that the framework exists to provide for improvements and future prevention of similar incidents. The strong and long tradition of international cooperation has served North America well. The institutions, agreements, and

organizations already in place, supplemented by well-defined authorities as necessary, are fully sufficient, in our view, to take the industry forward.

This concludes my prepared remarks. I am prepared to answer questions at this time.

## **Background**

Mr. Goulding was appointed President and Chief Executive Officer of the Independent Electricity Market Operator in March 1999.

Under Mr. Goulding, the IMO is responsible for overseeing the safe and reliable operation of Ontario's bulk electrical system - one of the most diversified, reliable and efficient in the world. The organization also oversees the IMO-administered wholesale electricity markets.

Mr. Goulding is a member of the Stakeholder Committee of the North American Electric Reliability Council (NERC) and a former member of the executive committee of the Northeast Power Co-ordinating Council and Board of Trustees for NERC. He is also a member of the Ontario government's Electricity Conservation And Supply Task Force that is developing an action plan to attract new generation and identify mechanisms for demand side management.

Prior to his appointment to the IMO, Mr. Goulding was Senior Vice-President of Central Market Operations with Ontario Hydro.

Born in Yorkshire, United Kingdom, Mr. Goulding was educated at the University of Bradford, England, where he obtained a Bachelor of Technology Degree.