



Market Suspension Issue Identification Paper

July 30, 2009

Table of Contents

1.0 Introduction	3
2.0 Purpose.....	3
3.0 Rule History.....	3
3.2 Current Rule 6.9.....	4
3.3 Conditions for suspending the market under the current rule	4
3.3.1 Blackout	5
3.3.2 The AIES breaks up into two or more electrical islands.....	5
3.3.3 System Controller is unable to access or utilize the market management tools such as the energy market merit order.....	5
Table 4 – Summary for loss of market management tool(s)	6
3.3.4 The AIES is not in a secure operating state and in the judgment of the SC is on the verge of a system emergency	6
3.3.5 SC forced to abandon the workplace	7
3.3.6 An order is received from the Commission to suspend market operations	7
3.4 Current Pricing Methodology.....	7
4.0 Rationale for changing the rule	8
4.1 Inability to operate multiple markets during the loss of market management tools for an extended period of time.....	8
4.2 Inability for the market to operate competitively as a result of transmission constraints.....	9
4.3 Need for clarity for the System Controller	9
4.4 Need for clarity for Market Participants	10
4.5 Pricing during an Energy Market Suspension	10
4.6 Insufficient energy supply over an extended period of time	10
4.7 Supply surplus over an extended period of time	11
5.0 Other Markets	11
6.0 AESO Requests Stakeholder Input.....	11
7.0 Policy Coherence	12
8.0 Next Steps.....	13
Appendix 1 - Other Market Research.....	14
Table 3 – Market Suspension in other Markets.....	14
Appendix 2 – Current Rule 6.9.....	22
Appendix 3 – Pricing Data from 1996-2008	25
Graph 1 – Annual Average Hourly Pool Price 1996-2008.....	25
Graph 2 – Annual Average AECO “C” Natural Gas Price 1996-2008	25
Graph 3 – Annual Average Heat Rate 1996-2008	26

1.0 Introduction

The Alberta wholesale market has had a market suspension rule in place since 1999 to address how the market would be operated in certain circumstances. In the AESO's view, the rule is dated in some applications and as such warrants a review. At present, ISO Rule 6.9, Energy Market Suspension ("the Rule") outlines the conditions under which the energy market may be suspended, the process to be used by the system controller to suspend the energy market, and the pre-determined system marginal price during such time. This paper discusses the requirement to review the Rule, and describes the Rule history.

The AESO requests stakeholder feedback on the areas of improvement, as described in Section 4 of this paper, and any other aspects of the Rule that stakeholders feel should be addressed within this review.

2.0 Purpose

The intent of this paper is to identify reasons for changing the Rule and to consider new market conditions that may warrant an expanded role for the rule. This paper is intended to initiate discussions and solicit feedback from stakeholders.

As the wholesale energy market in Alberta evolves, it is the AESO's responsibility to ensure that the rules in place continue to be relevant and current within the market structure. ISO Rule 6.9, in its present form (Appendix 2), is still applicable within the current market structure; however, the Rule may benefit from updates and clarifications.

3.0 Rule History

The original version of the Market suspension rules were made effective by the Power Pool Council¹ December 23, 1999. This original version is very similar to the version in the current rule 6.9 today. The Power Pool of Alberta² (PPoA) initiated the rule development at that time in preparation for Y2K³, to provide a contingency price setting mechanism should circumstances render the normal price setting mechanism inoperative.

Although participants and stakeholders at that time felt that such a rule was prudent, they did have different views on circumstances that would trigger a market suspension. Consequently, the market suspension rule effective December 23, 1999 was approved as an interim rule, to expire March 31, 2000. The PPoA committed to re-examine the rule with stakeholders in February 2000, as it was not possible to extend the consultation period given the approach of the millennium. Upon re-examination of the rule in early

¹ Power Pool Council as described in the Electric Utilities Act, RSA 2000 cE-5

² Power Pool of Alberta and Transmission Administrator formed the Independent System Operator in 2003

³ Year 2000

2000, the PPOA and stakeholders determined that the rule was relevant, and only required minor changes to the rule language.

The majority of changes to the Rule since 1999 have been administrative, e.g. reference to the Ancillary Service merit order, minor changes to the wording, and a change in the rule number. Also included since 1999 were changes to the language on communication protocols to participants when declaring an energy market suspension and reporting to the market on the details of the market suspension when an energy market suspension has ended.

The PPOA reviewed the market suspension rules internally in 2002. At that time, the appropriateness of the price during an energy market suspension was evaluated. No action was taken given other priorities.

Section 4 of this paper discusses the rationale for initiating a review of the rule today.

3.2 Current Rule 6.9

ISO Rule 6.9 states that the “purpose of this rule is to prescribe the conditions under which the energy market may be suspended and the process to be used by the system controller to suspend the energy market”. The Rule objective also states that “the suspension of the energy market means that the system controller is not obliged to follow the energy market merit order nor the ancillary services merit order in issuing dispatches and that the system marginal price will be predefined and set in accordance with 6.9.4.”⁴

The current rule includes the following sections; the specific rule language for these sections is stated within Appendix 2 of this paper.

- 6.9.1 Objective
- 6.9.2 Initiating an Energy Market Suspension
- 6.9.3 Declaration of Energy Market Suspension
- 6.9.4 Pricing of Energy During Energy Market Suspension
- 6.9.5 Ending of Energy Market Suspension

3.3 Conditions for suspending the market under the current rule

Rule 6.9.2 describes the specific events or conditions in which the system controller may suspend the energy market. The duration of a suspension may vary depending on the condition or situation at that time. This section outlines the key components of the Rule with an assessment of whether each component remains relevant in today’s market.

⁴ ISO Rules, 6.9 Energy Market Suspension, 6.9.1 Objective

3.3.1 Blackout

The ISO Rules define blackout as a condition where a major portion or all of the AIES is de-energized.

During a system blackout, generators are required to deliver energy to the system to meet a directive from the System Controller. In these circumstances, the market cannot function based on submitted bids and offers, and therefore an alternative pricing mechanism is required.

Rule assessment: This rule remains relevant as a market price or proper compensation is required during system re-energization.

3.3.2 The AIES breaks up into two or more electrical islands

The ISO Rules define electrical islands as a condition in the electrical system where geographical areas of the AIES electrically separate from the AIES, resulting from system disturbances, such that there exists both generation and load in these separated areas.

Rule assessment: This rule remains relevant. Amendments to the rule to determine definition of thresholds, such as the level at which the market becomes non-competitive, should be considered as part of the Rule review as this may be an example of system “islanding”.

3.3.3 System Controller is unable to access or utilize the market management tools such as the energy market merit order

The operation of the wholesale market for electricity relies heavily on the operation of market management tools such as the Energy Trading System (ETS), Dispatch Tool (DT)/Energy Management System (EMS), and Automated Dispatch and Messaging System (ADaMS). The loss of one or more of these tools may result in the inability to operate the market. The AESO’s current practice during the loss of critical tools for market operation is summarized in Table 4 below. The ISO Rules and OPPs document these protocols. It should be noted that not all practices are publicly documented. For example, the suspension of the DDS market during a DT outage is communicated to participants in real-time for unplanned outages and prior to a planned outage; however, the rules and OPPs do not account for such an interruption at this time. Section 4 of this paper further discusses the operation of the DDS market during IT system outages.

Rule assessment: This rule remains relevant. An update is necessary to provide further clarity to pool participants and the system controller with respect to the length of time the system controller is able to proficiently operate the market and provide transparency to participants when faced with the loss of one or more market management tools.

The Rule should determine the threshold and actions during IT outages.

Table 4 – Summary for loss of market management tool(s)

Loss of:	System required for:	Current process during outage of system:
ETS	Participants enter offers and restatements through ETS	Participants inform the SC immediately by phone, and also follow up with a fax if they experience de-rates or forced outages (ISO Rule 3.4)
DT/EMS	Managing the Energy Market, Ancillary Service, and DDS merit orders	The SC will dispatch assets using the last merit order in place prior to the outage. If ETS is available, participants should restate in ETS, and inform the SC immediately by phone. Restatements entered in ETS will not be transferred to DT until the DT outage is complete (ISO Rule 3.4) The Dispatch Down Service (DDS) market is not functional during DT outages. Therefore, the SC will be dispatching assets off DDS, and releasing the MW back into the energy market.
ADaMS	Communication mechanism between the SC and participants, primarily through dispatch instructions by the SC	SC will communicate dispatch information to participants via telephone (as per the OPPs).

3.3.4 The AIES is not in a secure operating state and in the judgment of the SC is on the verge of a system emergency

“Secure operating state” is not defined in the ISO Rules, though is part of the rule language.

The ISO Rules define “system emergency” as a situation in which there is systemic equipment malfunctions, including widespread transmission or generation outages and derates, a complete loss of communication with the system controller, or a loss of system controller’s market management tools.

It is difficult to anticipate all the situations that may contribute to an operating state in the AIES that is not secure, which is why the current rule 6.9 includes: “The AIES is not in a secure operating state and in the judgement of the system controller is on the verge of a system emergency”.

Rule assessment: This rule remains relevant. It may be appropriate to consider supply adequacy issues over extended periods as a system emergency. It may also be appropriate to include an escalation procedure within the OPP prior to suspending the market, to further tighten the rule.

3.3.5 SC forced to abandon the workplace

There may be a number of reasons the SC is forced to abandon the System Coordination Center, and move to the Back-up Control Center. Process, protocols and procedures in these situations are considered within the AESO's crisis management plan.

Rule assessment: This rule remains relevant. From an IT systems perspective, the probability of such an occurrence is minimal given back-up systems.

3.3.6 An order is received from the Commission to suspend market operations

This event could occur as a result of an investigation into the functioning of the market and a subsequent determination that the market is dysfunctional. In this case, the AUC could order the market suspended and establish a SMP for the duration of the suspension. If the AUC orders a market suspension and does not establish a price, the price will be set based on the AESO's pricing methodology.

Rule assessment: This rule remains relevant.

3.4 Current Pricing Methodology

Under the current Rule 6.9.4, the determination of price following a system emergency can fall into one of three categories:

- In the event of a system blackout, the system marginal price will be set at \$50/MWh
- Price will be set by the last unit dispatched prior to the market suspension in all other circumstances
- If the AUC suspends the market, the AUC may define a price, otherwise the price will be set by the last unit dispatched prior to the market suspension

Rule assessment: The \$50/MWh blanket price may not always appropriately reflect market conditions or cost recovery in order to motivate behavior and/or provide appropriate compensation during blackouts. In the case where the price will be set by the last unit dispatched prior to the market suspension, the rule may need to be updated to determine the length of time over which it is appropriate to set price based on the last dispatched unit before the information is no longer relevant or reflective of market economics. It may also be appropriate to consider a price methodology during an extended Supply Adequacy issue, such as congestion management.

In addition, administrative changes for updating the rule language to reflect changes in legislation (EUB to AUC) should be incorporated as part of this review.

4.0 Rationale for changing the rule

It is the AESO's view that the market suspension rules need to be updated and possibly extended in their applications to account for current market conditions and changes in the market since the Rule was originally written in 1999. This section identifies reasons for changes to the Rule, which have been brought forward by the AESO through this review, and by participants in stakeholder sessions or working committees such as the Power System Restoration Committee. Each item is summarized noting the issues with any rule components and where change may be required.

The following issues are discussed within this section:

- Inability to operate multiple markets during the loss of market management tools for an extended period of time
- Inability for the market to operate competitively as a result of transmission constraints
- Need for clarity for the System Controller
- Need for clarity for market participants
- Pricing during an Energy Market Suspension
- Insufficient energy supply over an extended period of time
- Supply surplus over an extended period of time

4.1 Inability to operate multiple markets during the loss of market management tools for an extended period of time

Problem Identification: To determine the appropriateness of operating the Energy, Ancillary Service, and DDS markets using a paper merit order for an extended period of time, where the period of time needs to be determined.

The loss of one or more market management tools, such as DT, does not necessarily mean the loss of all market functionality. As discussed in section 3.3.3 of this paper, the SC has the ability to manage the fair, efficient and openly competitive operation of the market using a modified approach without full functionality. This means that the SC may not be dispatching using the most up to date information. During the loss of market management tools, such as DT, it may be difficult to manage changes within the Energy, Ancillary Service, and DDS markets using a paper merit order.

When manual methods such as the use of a paper merit order to dispatch the energy market merit order are in effect, restatements are not accepted; however, participants are required to communicate with the SC if a dispatch cannot be met⁵ due to an acceptable operational reason. Assets dispatched in the AS market continue to operate

⁵ Rule 3.4 b)

at the same level they were at before the system outage until the system is restored, and the DDS market is not operational due to the complexity in applying changes manually.

The question then arises, how long is it appropriate to operate the market using a paper merit order, considering that real-time changes will not be incorporated as restatements are not accepted? Further, how should the market be operated during a suspension such as described?

The cost of AS may also increase if assets continue to operate as the time changes from off peak to on peak hours, and the cost of payment to suppliers on the margin may increase for the affected hours if ETS continues to function, while DT is not functional (This may occur since the calculation for payments to suppliers on the margin is applied at settlement, and includes offer information in ETS and metered volumes such as actual generator performance, in comparison to dispatch information).

Currently, the DDS market is not functional if the DT is not functional. This is communicated to participants in real-time, and/or prior during planned outages. The rules do not account for this practice.

4.2 Inability for the market to operate competitively as a result of transmission constraints

Problem Identification: To determine the point at which competitive becomes non-competitive as a result of transmission constraints and consider a market suspension solution to market pricing during such an event.

The current market suspension rules establish conditions for a blackout and the separation of the AIES into two or more electrical islands as market suspension. In a blackout, it may be clear that a market suspension is appropriate due to the lack of competition. However, if a partial blackout or general congestion occurs due to transmission problems, it is not clear whether the remaining system may be large enough that it will still operate as a competitive market. Considerations for situations where a portion of the market is setting the price for the whole market, and the point in which the market switches from competitive to non-competitive due to constraints on the system, contribute to the need to review the current rule 6.9 and the potential need for a new threshold for triggering market suspension.

4.3 Need for clarity for the System Controller

Problem Identification: The system controller requires clear direction in defining thresholds.

As part of the AESO's internal review of the rule, it was noted that clear direction for the SC in certain areas of the rule such as defining thresholds for the situations outlined in 4.1 and 4.2 of this paper should be considered. It was also noted that it is not feasible to document every situation that may lead to a market suspension; therefore it may be appropriate to maintain the rule language in 6.9.2 f), which states "...the energy market may be suspended if.....circumstances that, in the judgment of the system controller,

warrant the suspension of the energy market.....” Regardless, some discretion is required when the market is suspended formally or simply relies on current available data.

4.4 Need for clarity for Market Participants

Problem Identification: To ensure that market participants are clear of the implications caused by certain situations.

The AESO recognizes the importance of maintaining transparency within the rules and operating policies and procedures, where possible. The AESO will continue to communicate system and market disturbances through the various communication mechanisms available. There may be an opportunity to document certain procedures to allow for further clarity to market participants, such as specifically stating that a paper merit order will be used when the dispatch tool is not operational.

4.5 Pricing during an Energy Market Suspension

Problem Identification: The pricing mechanism within the current rule 6.9.4 requires an update to reflect the economics of the market at present.

The pricing mechanism during an energy market suspension should generate an appropriate price or compensation mechanism in lieu of the market price that would have been generated by a proper functioning market. The pricing mechanism in the current rule 6.9.4 is reflective of the market 10 years ago. The market, market conditions, as well as the cost of doing business within the market, have changed since this time. Appendix 3 of this paper provides further information on changes in Pool Price, Gas price, and heat rates from 1996-2008.

In the event of a market suspension, the SC will issue directives that require a generator to comply. The blanket price to be set in the event of a market suspension may not always appropriately reflect market conditions or enable all suppliers to recover their operating costs, and there may be reluctance on the part of some suppliers to provide a resource without any assurance of cost recovery.

Rule 6.9.4 appears to require an update to reflect a pricing mechanism that is fair to both suppliers and consumers and/or requires a mechanism for prices to be set dynamically or for generators to dispute out of market price levels when directives occur.

4.6 Insufficient energy supply over an extended period of time

Problem Identification: The current rule 6.9 does not specifically address or outline insufficient energy supply over an extended period of time as a reason to suspend market operations, where the period of time needs to be determined.

Insufficient energy supply may result in certain non-competitive, inefficient or unfair situations that may warrant an energy market suspension. At what point does insufficient energy supply become non-competitive, considering the length of time there

is insufficient energy, the amount of MW's that would qualify as insufficient energy, and the cost impact during such time. Is this a relevant factor to consider as a condition for suspending the energy market? The AESO has worked with participants to determine a Long Term Adequacy (LTA) trigger and questions whether a Short Term Adequacy (STA) trigger is warranted as well in the context of this rule design.

4.7 Supply surplus over an extended period of time

Problem Identification: The current rule 6.9 does not specifically address or outline supply surplus over an extended period of time as a reason to suspend market operations, where the period of time needs to be determined.

If there are supply surplus conditions in which the market results in \$0 prices over a period of time, the market may become non-competitive. Is this a relevant factor to consider as a condition for suspending the energy market? This discussion will also occur in the supply surplus consultation.

5.0 Other Markets

Research on other markets is attached in Appendix 1. Appendix 1 includes information on market suspension in other markets, and an assessment of whether it could be relevant in Alberta. A high level summary of the market structure within these markets is also included. Other market research is provided on an information only basis.

6.0 AESO Requests Stakeholder Input

Section 4.0 discusses a number of issues/reasons to suspend the market. The AESO would like to get industry input into the issues identified by this paper. The questions below summarize areas the AESO requests stakeholder input.

- Section 4.1 – How should the market be operated during the failure of an IT system? Is there a point where it is appropriate to declare a market suspension due to outdated information in the absence of critical market management tools?
- Section 4.1 - Is it appropriate to suspend the DDS market during a DT outage? Should the rule consider partial market suspension in such conditions?
- Section 4.2 - When does the market switch from competitive to non-competitive due to constraints on the Alberta Interconnected Electric System?
- Section 4.5 – What is a fair pricing mechanism during an energy market suspension?
- Section 4.6 – At what point does insufficient energy supply become non-competitive?
- Section 4.7- At what point does a supply surplus condition become non-competitive?
- Section 5.0 - What information from other market designs is pertinent to the design consideration in Alberta? Are the pricing alternatives appropriate during a suspension and how should they be addressed?

7.0 Policy Coherence

The AESO recognizes that precautions and contingency plans are required in order to mitigate the possibility of situations or conditions that may affect system reliability or the operation of a fair, efficient and openly competitive market.

The AESO supports market based solutions, where possible and applicable.

The AESO expects that the ISO Rules resulting from the market suspension rules review will be Fair, Efficient, Openly Competitive, in the public interest, and technically sound.

The following includes relevant policy references for the market suspension review:

Alberta's Electricity Policy Framework: Competitive – Reliable – Sustainable, June 6, 2005, Section 4.2 Short Term Adequacy, pg 20 of 51

During the wholesale market review process, the following design principles were established.....to ensure an efficient electricity market, the market structure should be stable enough to provide system reliability through market signals, with minimal market interference.

Electric Utilities Act, Section 5 (b)

The purposes of this Act are.....to provide for a competitive power pool so that an efficient market for electricity based on fair and open competition can develop, where all persons wishing to exchange electric energy through the power pool may do so on non-discriminatory terms and may make financial arrangements to manage financial risk associated with the pool price.

Electric Utilities Act, Section 5 (c)

The purposes of this Act are....to provide for rules so that an efficient market for electricity based on fair and open competition can develop in which neither the market nor the structure of the Alberta electric industry is distorted by unfair advantages of government-owned participants or any other participant;

Electric Utilities Act, Section 16

The Independent System Operator must exercise its powers and carry out its duties, responsibilities and functions in a timely manner that is fair and responsible to provide for the safe, reliable and economic operation of the interconnected electric system and to promote a fair, efficient and openly competitive market for electricity.

Electric Utilities Act, Section 17 (a)

The Independent System Operator has the following duties.....to operate the power pool in a manner that promotes the fair, efficient and openly competitive exchange of electric energy.

Electric Utilities Act, Section 17 (h)

The Independent System Operator has the following duties.....to direct the safe, reliable and economic operation of the interconnected electric system

8.0 Next Steps

The AESO is interested on feedback on this issue identification paper.

- Stakeholder comments are due by August 5th, 2009 as per the normal consultation process. Please submit the comments to Ruppa Minhas at ruppa.minhas@aeso.ca.
- It is likely this work will result in market research and design work. In due course, a discussion paper and recommendation paper will be developed with input from stakeholders and impacted internal AESO parties as per the normal consultation process.

Appendix 1 - Other Market Research

The complexity and design of electricity markets worldwide vary based on the requirements of their jurisdiction. Some include a number of different regions, while some are confined within their specific state or province.

Alberta's market suspension rules review included an analysis of various markets around the world. These included, in no particular order, a review of the Ontario, New York, Australia, PJM, Midwest, and Philippine markets. Some markets provided relevant information that may be incorporated within Alberta's unique market, and others did not apply due to the significant differences in market design. A summary of the results of the analysis is described in Table 3.

Markets chosen as part of the review were chosen based on the following considerations:

- a) ISO or RTO?
- b) Does the jurisdiction include market suspension protocols (processes, procedures, rules)?
- c) Comparison to Alberta's market design – are there similarities?
- d) Despite similarities or differences in market design, are there aspects of market suspension protocols that may be implemented within Alberta, or changed to fit within Alberta's market design?
- e) Does the jurisdiction include detailed information on these protocols? If there are little or no details, are there resources available within the reviewed jurisdiction to answer questions?

Table 3 – Market Suspension in other Markets

Market	What constitutes a Market Suspension within the specified jurisdiction	Market Suspension Actions	Relevant in Alberta (Yes/No)
Ontario (IESO)	<ul style="list-style-type: none"> - a failure in the software, hardware, or communications systems that support market operations, rendering it physically impossible to continue market operations in a normal manner - a major blackout - an emergency situation requiring the IESO to evacuate its principle control center; or - a declaration of an emergency situation by the premier of Ontario or 	Administrative pricing, which compares demand patterns from similar days, taking conservation and demand reduction efforts into account. Conservation efforts include: -Request of commercial and retail businesses to reduce their consumption to 50% of normal usage. -Request that all market participants do their	Yes

⁶ http://www.ieso.ca/imoweb/pubs/marketOps/mo_MktSuspResum.pdf

	direction from the minister to implement an emergency plan ⁶	part.	
New York	- blackout	- NYISO establishes prices as close to what they would have been under normal operation, participants enter offers as per normal operations - Prices are determined using Day Ahead Market prices, and assuming normal scheduled outages.	No. There is no day ahead market in Alberta
Australia	- the power system has collapsed to a black system ⁷ - AEMO ⁸ has been directed by a participating jurisdiction to suspend the market or operate all or part of the power system in a manner contrary to the provisions of the rules following the formal declaration by that participating jurisdiction of a state of emergency under its emergency services or equivalent legislation ⁹ ; or - AEMO determines that it is necessary to suspend the spot market in a region because it has become impossible to operate the spot market in accordance with the provision of the Rules. ¹⁰	-The spot price is determined by application of an appropriate inter-regional loss factor to the spot price in the adjacent region. -If a current pre-dispatch schedule exists, the schedule supersedes the preceding pricing mechanism	No. The market design is different from Alberta (ie. inclusion of other regions in the Australian market)
PJM	No protocol, tariff language, or provision to cease or stop the energy market	N/A	Yes
Midwest ISO	No protocol, tariff language, or provision to cease or stop the energy market	N/A	Yes

⁷ Australian National Electricity Rules, Version 30, 3.14.3 (a) (1)

⁸ Australian Energy Market Operator

⁹ Australian National Electricity Rules, Version 30, 3.14.3 (a) (2)

¹⁰ Australian National Electricity Rules, Version 30, 3.14.3 (a) (3)

Philippines	<p>When the grid is in extreme state condition arising from a) an emergency b) threat to system security c) an event of force majeure</p> <p>Emergency events include:</p> <ul style="list-style-type: none"> -a significant supply capacity shortfall, -a power system disturbance due to an outage in the transmission network or generating system for which market processes are inadequate for recovery -a significant environmental phenomenon -a system blackout or significant power system under voltage condition -material damage to a distribution system which has or is likely to adversely affect the operation of the transmission system or to render the spot market ineffective -a situation in which the government proclaims or declares an emergency¹¹ 	<p>Generator Administered Prices – Average Ex-Post Nodal Energy Price. For each generator node, the administered price will be computed as the load weighted average of the ex-post nodal energy prices of the four most recent same-day (i.e., Monday to Sunday, , Holidays) same-hour trading intervals that have not been administered.</p> <p>-In case any of the prices covered by the four preceding same days have been administered, said prices shall be excluded and replaced with the prices that have not been administered from the most recent earlier same or similar day.</p> <p>- In cases where any of the prices in the four preceding same days reflect constraint violation coefficient prices, the market prices derived from the market re-run¹² performed by the Market Operator will be used.¹³</p>	Yes, although in another form (Alberta does not have nodal prices)
-------------	---	--	--

For background on each reviewed market, a summary of the market design is included below. The summary includes the following: the type of market, and how price is determined within the stated jurisdiction. It should be noted that all markets reviewed include Ancillary Service markets; however, details on the Ancillary Service market are not included within each summary.

¹¹ WESM Manual (WESM-AP-000) Administered Price Determination Methodology, Issue 2.0, Section 3.1

¹² If the ex-post prices are believed to be in error or reflect non-congestion related CVC prices, the WESM Rules require the Market Operator to perform a re-run for the relevant trading interval. The re-run involves the retrieval of the original ex-post market run and this is re-run offline using validated and corrected real-time information. Reference: <http://www.wesm.ph/market.results.php?p=116>

¹³ WESM Manual (WESM-AP-000) Administered Price Determination Methodology, Issue 2.0, Section 4.2

Independent Electricity System Operator (IESO) - Ontario¹⁴

The IESO operates a real-time energy market.

The wholesale market price for electricity is based on supply and demand. Suppliers submit offers to sell electricity and wholesale buyers submit bids to buy electricity. The IESO collects bids and offers until two hours before the energy is needed, so "pre-dispatch" prices, or the price of electricity before the bidding window has closed, can fluctuate as new bids come in. In the market, generators can submit offers for electric power in different quantities and prices for each hour of the day. Every five minutes, the IESO calculates a new spot market price by balancing the supply of electricity with demand. As demand increases, more expensive offers from generators are accepted, and as demand drops only the less expensive offers are accepted. Wholesale customers are able to respond to changes in prices by shifting some of their demand to off-peak periods.

The five-minute prices are averaged to create the hourly Ontario Energy Price, or HOEP. The five-minute market clearing price is uniform across Ontario for an initial period after market commencement. Dispatchable facilities will be settled at this five-minute price, non-dispatchable wholesale consumers will be settled using a weighted hourly average of these five-minute prices.

New York Independent System Operator (NYISO) – New York¹⁵

The NYISO energy market includes a Day Ahead Market (DAM), the Hour Ahead Market (HAM), and the Real-time market.

The DAM sets prices as of 11:00 AM the previous day based on generation and energy transaction bids that were offered in advance to the NYISO. DAM prices are determined on an hourly basis for each of the state's eleven zones and for the four neighboring areas (New England, Hydro Quebec, Ontario Hydro and PJM). Typically more than 90% of energy transactions processed by NYISO occur in the DAM. A software program called Security Constrained Unit Commitment (SCUC) determines the amount of energy expected to be needed within the state for each day. NYISO will schedule the generating units that can most economically satisfy the energy needed to supply customers' demand and allow a sufficient reserve for contingencies.

HAM - The Power Supplier Balancing Market Energy settlement (\$) is intended to credit or charge Market Participants acting as Power Suppliers for Balancing Market energy sold or purchased in the NYISO Balancing Energy Market. This settlement accounts for energy variations in a generator's real-time dispatch from what is sold in the NYISO DAM and/or via DAM Transaction Schedules.

Since this settlement addresses energy variations from the DAM, it can be either a credit or a charge to the Power Supplier.

Real-Time Market Locational Based Marginal Pricing (LBMP) Prices are calculated at five-minute intervals throughout the day based on generation and energy transaction

¹⁴ Information from this section is from [www.ieso.ca/inside the market/markets and programs](http://www.ieso.ca/inside%20the%20market/markets%20and%20programs)

¹⁵ Information from this section is from http://www.nyiso.com/public/products/energy_market/index.jsp

bids that were offered to the NYISO. RT prices are determined for each of the state's eleven zones and for the four neighboring areas (New England, Hydro Quebec, Ontario Hydro and PJM). Typically less than 10 % of energy transactions processed by NYISO occur in the RT market. A software program called Security Constrained Dispatch (SCD) determines the amount of energy needed within the state on a continual basis. SCD makes adjustments (from the SCUC and BME values) to regulate generating units that can most economically satisfy the energy needed to supply customers' real-time demand and allow a sufficient reserve for contingencies.

Australian Energy Market Operator (AEMO) - Australia¹⁶

The National Electricity Market (NEM) is the wholesale market for electricity supply in the Australian Capital Territory and the states of Queensland, New South Wales, Victoria, Tasmania and South Australia.

AEMO is responsible for managing and operating the NEM in accordance with the National Electricity Rules. AEMO operates an energy only market which includes regional pricing, spot price, locational and nodal pricing. The Price cap within this market is \$10000/MWh, and the Market floor price is minus \$1000.

Supply and demand must be balanced in each of the NEM's regions simultaneously. AEMO's management of the market must take into account both the capacity and availability of generators to produce electricity in each of the six NEM regions, and the capacity and availability of the inter-regional transmission systems to transfer supply across region boundaries. All generators with a capacity of at least 30 MW are required to submit bids indicating their intended physical generation targets for each dispatch interval.

Regional pricing – the price at each network connection point is determined in relation to a common regional reference node price. When the network operates below the level of its maximum technical transfer capacity, electricity prices in different regions of the NEM are related to each other by real-time loss calculation. However, when an interconnector is operating at its maximum transfer capacity, and therefore physically prohibits the transfer of additional capacity between regions, the prices in different regions may vary.

Spot Price – Trading is based on a 30-minute trading interval. The spot price is used to settle the market, and is the average of the six dispatch price outcomes of generator bidding for the preceding half hour. That is, the spot price is the half-hourly clearing price to match supply and demand. A regional reference node has been identified at one specific connection point to the power system in each region of the NEM. A regional spot price is calculated for each trading interval at the regional reference point, and all trade in the region is based on the regional spot price. This means that for any one trading interval in the NEM, six separate spot prices for each of the six NEM regions are used to financially settle trades between registered generators and market customers. The spot price that applies to any one transaction depends on the region of the NEM in which the trade was transacted.

Locational Pricing – Locational pricing reflects the full costs of supplying electricity to a consumption point, and is based on the regional spot price plus the costs of transporting electricity to the consumption point.

¹⁶ Information within this section is from "An introduction to Australia's National Electricity Market, July 2009"

Nodal Pricing – a separate price is set for every connection point on the transmission system.

*Pennsylvania, Jersey, Maryland (PJM)*¹⁷

PJM Interconnection is a regional transmission organization (RTO) that coordinates the movement of wholesale electricity in all or parts of Delaware, Illinois, Indiana, Kentucky, Maryland, Michigan, New Jersey, North Carolina, Ohio, Pennsylvania, Tennessee, Virginia, West Virginia and the District of Columbia, in the United States of America.

The market uses locational marginal pricing that reflects the value of the energy at the specific location and the time it is delivered. If the lowest priced electricity can reach all locations, prices are the same across the entire grid. When there is transmission congestion, energy cannot flow freely to certain locations. In that case, more expensive electricity is ordered to meet that demand. As a result, the locational marginal price (LMP) is higher in those locations.

The energy market consists of day-ahead and real time markets. Price is established by matching supply and demand. The day-ahead market is a forward market in which hourly LMPs are calculated for the next operating day based on generation offers, demand bids, and scheduled bilateral transactions. The real-time market is a spot market in which current LMPs are calculated at 5-minute intervals based on actual grid operating conditions.

PJM also operates a market for financial transmission rights to assist market participants in hedging price risk when delivering energy on the grid, and a Capacity Credit market, which is intended to provide a transparent, market-based mechanism for load serving entities to acquire the capacity resources needed to meet their capacity obligations and to sell capacity resources when no longer needed to serve load.

*Midwest Independent System Operator (Midwest ISO)*¹⁸

The Midwest ISO is an independent, nonprofit organization that supports the constant availability of electricity in 15 U.S. states and the Canadian province of Manitoba.

Market operations include: a day-ahead market, a real time market, and a financial transmission rights market. These are operated and settled separately.

Locational marginal pricing or LMP is the market clearing price at a specific commercial pricing node (1,768 pricing nodes) in the Midwest market that is equal to the cost of supplying the next increment of load at that location. LMP provides price transparency for users of the wholesale bulk electric system. The price signals provided by LMP indicate the cost of conducting business based on current system conditions. LMP consists of three components - energy price, congestion, and losses.

¹⁷ Information within this section is from <http://www.pjm.com/markets-and-operations/energy.aspx>

¹⁸ Information within this section is from:
http://www.midwestmarket.org/publish/Document/20f443_ffd16ced4b_-7fa40a3207d2/Market%20Concepts%20Study%20Guide%20092304.pdf?action=download&_property=Attachment

Day-ahead market - supply offers, demand bids, virtual supply offers, virtual demand bids and implemented physical schedules must be entered by 1100 EST the day prior to the operating day. Market results for these activities will be available at 1700 EST that afternoon. Market participants can submit re-offers for the reliability assessment commitment period by 1800 EST, and at 2000 EST units will begin receiving commitment notifications for the operating day. If there are more demand bids than supply offers for the day-ahead market, the clearing process for the day-ahead market will clear only demand bids that can be met with supply offers. If there are more demand bids than can be met with supply offers, the additional demand bids will not be cleared in the day-ahead market.

Real time market – market participants enter physical schedules and updates to real-time offers up to 30 minutes prior to the hour, Offers are locked in at this time. Spot market prices are calculated every five minutes.

Financial transmission rights markets (FTR) – annual auctions for this market are held prior to the start of each year (offer to sell and bid to buy FTRs). Monthly allocation occurs prior to the start of each month, and is the allocation of additional FTR capacity to participants who did not receive FTRs up to their full nominated entitlement in the annual auction.

Wholesale Electricity Spot Market (WESM) – Philippines¹⁹

The wholesale electricity spot market (WESM) serves as a clearing house to reflect the economic value of electricity for a particular period, as indicated by the "spot price". The wholesale electricity market uses the concept of a "pool" where all electricity output from generators is centrally coordinated.

The spot market involves:

- An hourly trading/dispatch/ settlement period;
- Ex-ante real-time prices based on the hour ahead load forecasts and dispatch;
- Ex-post real-time prices based on actual metered generation/load; and
- Nodal settlement prices based on the ex-ante prices applied to the ex ante (forecast/dispached) loads, supplemented by an "imbalance" settlement for the difference between ex ante quantities and metered quantities at the ex post prices.

A single optimization is performed with all of the system requirements included in the linear programming model, which is called the "market dispatch optimization model". At each dispatch event, the dispatch schedule and spot price are determined by accounting for: energy offers; demand-side bids or forecast load; reserve offers (when applicable); reserve requirements; transmission system parameters, modeled using DC load-flow equations; and most recently observed plant status.

The price determination process is based on and maintains consistency with the offer price/quantity preferences of Trading Participants, and provides a single market clearing price at any point in time and location in the network.

¹⁹ Information within this section is from: <https://www.wesm.ph/page.php?p=80>

Financial Transmission Rights provide the generator with a means of reducing the impact of any nodal price differences across the trading region through a difference contract secured with the network service provider or transmission facility owner

Appendix 2 – Current Rule 6.9

6.9 Energy Market Suspension

6.9.1 Objective

Under extraordinary circumstances, the system controller may suspend the normal operation of the energy market.

The purpose of this rule is to prescribe the conditions under which the energy market may be suspended and the process to be used by the **system controller** to suspend the energy market.

The suspension of the energy market means that the **system controller** is not obliged to follow the **energy market merit order** nor the **ancillary services merit order** in issuing **dispatches** and that the **system marginal price** will be predefined and set in accordance with **rule 6.9.4**.

6.9.2 Initiating an Energy Market Suspension

If deemed necessary, the system controller may suspend the energy market under specific events or conditions.

In the determination of the **system controller**, the energy market may be suspended if any of the following conditions apply:

- a) **AIES** has experienced a **blackout**;
- b) The **AIES** breaks up into two (2) or more **electrical islands**;
- c) The **AIES** is not in a secure operating state and in the judgement of the **system controller** is on the verge of a **system emergency**.
- d) The **system controller** is unable to issue **dispatches** under normal market operations because the:
 - i) **system controller** is forced to abandon the workplace;
 - ii) **system controller** is unable to access or utilize the market management tools such as the **energy market merit order**.

- e) An order is received from the **Commission** to suspend market operations;
- f) Circumstances that, in the judgement of the **system controller**, warrant the suspension of the energy market.

6.9.3 Declaration of Energy Market Suspension

The system controller will issue a notice that the market has been suspended, and will notify pool participants using certain methods of communication.

The **system controller** will issue a notice that the energy market has been suspended. As soon as possible the **system controller** will update the notice indicating the reason for the suspension and, if practical, an expected time of return to normal energy market operation. In the case of a **system emergency**, the **system controller** will issue **directives** to **market participants**, as required, to return the **AIES** to a safe and reliable state.

If the **system controller** suspends the energy market for any of the reasons listed in rule 6.9.2, the **system controller** will notify **pool participants**. Communication prioritization will be to use methods that attempt to contact **pool participants** simultaneously. The **system controller** will use one or more of the following methods, to notify the **pool participants** that the energy market has been suspended:

- a) **Alberta Electric System Operator** website through the **system controller** real time shift report and/or other message.
- b) Fax to all **pool participants**.
- c) Phone notifications via regular phone communication systems.
- d) Phone notifications via back up phone communication systems to **pool participants** with this capability.
- e) **Automated dispatch and messaging system**.

6.9.4 Pricing of Energy During Energy Market Suspension

During an energy market suspension, the ISO will follow certain protocol to set the system marginal price.

During periods of **energy market suspension** the **system marginal price** will be set at the following levels for the duration of the suspension, dependent upon the reason for the suspension:

- a) The **system marginal price** will be set at \$50/MWh in the event of a blackout;
- b) The **system marginal price** will be set at the price of the last **block** receiving an **energy market dispatch** that was eligible to set **pool price** using the last available **energy market merit order** prior to the **energy market suspension** in the event that:
 - i) The **system controller** suspends the energy market for reasons of **system security**;

- ii) The **system controller** is forced to abandon the workplace;
- iii) The **system controller** is unable to access or utilize market management tools such as the **energy market merit order** list;
- iv) The **AIES** breaks up into two (2) or more **electrical islands**
- v) In the judgement of the **system controller** circumstances warrant the suspension of the energy market.

If an order from the **EUB** to suspend market operations occurs, the **system marginal price** will be set at the price ordered by the **EUB**, or lacking this direction, at the price of the last **block** receiving an **energy market dispatch** that was eligible to set **pool price** using the last available **energy market merit order** prior to the **energy market suspension**.

6.9.5 Ending of Energy Market Suspension

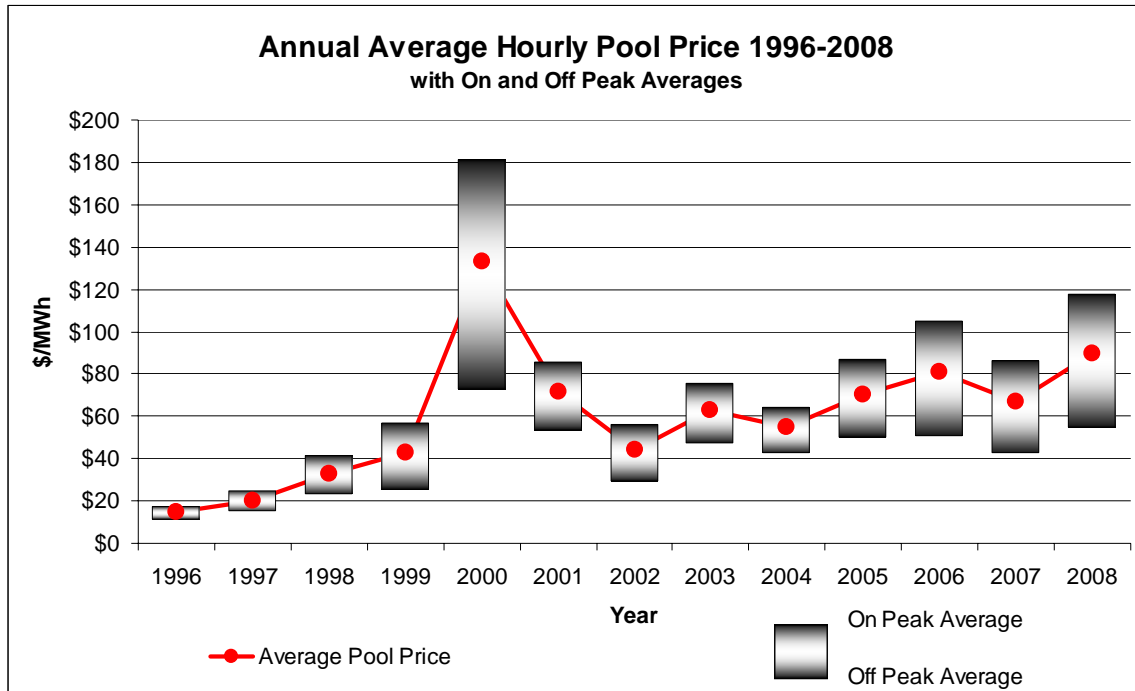
The system controller will notify pool participants when an energy market suspension has ended, and a report will be published.

The **energy market suspension** will end as soon as normal energy market operations are possible and the **AIES** can be operated reliably, as determined by the **system controller**. The **system controller** will issue a notice that the **energy market suspension** has ended and normal energy market operations have resumed. A report outlining the nature of the suspension and which may also include recommendations as to possible revisions to these **energy market suspension rules** would be made available to **pool participants** following such a suspension.

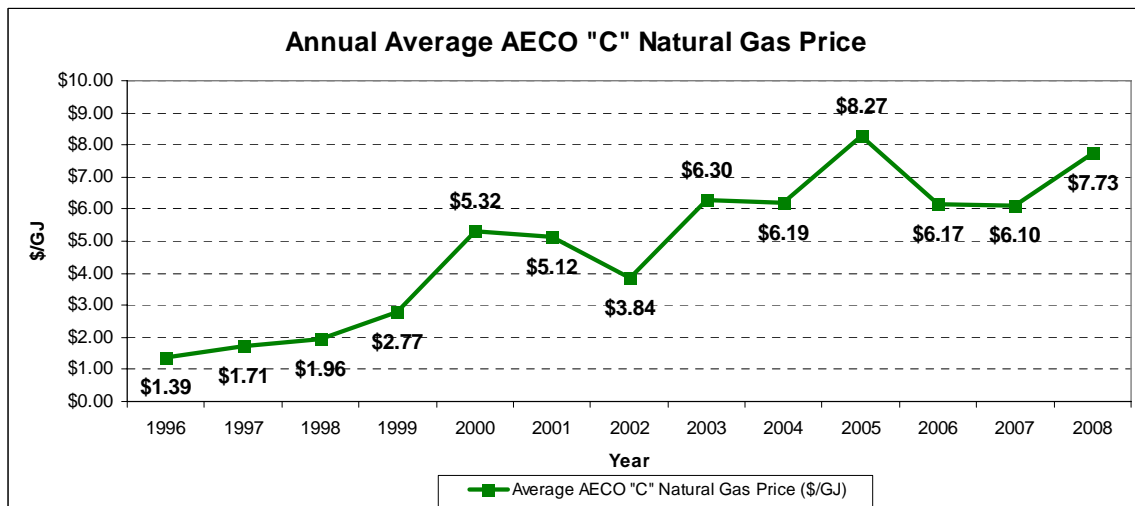
The **ISO** will publish a preliminary report, on the **ISO** website, within 5 **business days** following an **energy market suspension**. The **ISO** will publish a final report, on the **ISO** website, within 20 **business days** following an **energy market suspension**.

Appendix 3 – Pricing Data from 1996-2008

Graph 1 – Annual Average Hourly Pool Price 1996-2008



Graph 2 – Annual Average AECO "C" Natural Gas Price 1996-2008



Graph 3 – Annual Average Heat Rate 1996-2008

