Market Rule Amendment Proposal Form

Part 1 - Market Rule Information

Identification No.:	MR-00497-R00
Subject:	Large Computational Loads
Title:	
Nature of Proposal:	☒ Alteration ☐ Deletion ☒ Addition
Chapter:	4, 7 and 11
Appendix:	Appendix 4.3 and 4.17
Sections:	Chapter 4: section 7 Chapter 7: section 2.2 Chapter 11
Sub-sections proposed for amending:	
Current Market Rules Baseline:	

Part 2 - Proposal History

Version	Reason for Issuing	Version Date
1.0	Draft for Stakeholder review	November 12, 2026

Version	Reason for Issuing	Version Date

Approved Amendment Publication Date:

Approved Amendment Effective Date:

Part 3 - Explanation for Proposed Amendment

Provide a brief description that includes some or all of the following points:

- The reason for the proposed amendment and the impact on the *IESO-administered markets* if the amendment is not made.
- Alternative solutions considered.
- The proposed amendment, how the amendment addresses the above reason and impact of the proposed amendment on the *IESO-administered markets*.

Summary

Background

Discussion

Part 4 - Proposed Amendment

Chapter 4

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7. Provision of Connection-Related Information

7.2 Synchrophasor Data Requirements

7.2.1 Each *generator, transmitter, wholesale customer* and *electricity storage participant* identified in Appendices 4.15, 4.16, 4.17 and 4.24 respectively, shall install and maintain at their own expense, *synchrophasor* data generating devices and associated infrastructure, including transformers and communications channels and provide *synchrophasor* data in accordance with the applicable *market manual* and the applicable Appendix.

Appendix 4.3 – Requirements for Connected Wholesale Customers and Distributors Connected to the IESO-Controlled Grid

The performance requirements set out below shall apply to *connected wholesale customers* and *distributors* that are connecting equipment or *facilities* to the *IESO-controlled grid* or to their *distribution systems* after January 18, 2021.

Equipment connected within a *connected wholesale customer's* or *distributor's facilities* or *distribution systems* that was authorized to *connect* prior to January 18, 2021 shall remain subject to the performance requirements in effect at the time its authorization to *connect* was granted (i.e. the "original performance requirements"). These original performance requirements shall prevail until the main elements of an associated system are replaced or substantially modified. At that time, the associated system that is replaced or substantially modified shall meet the applicable performance requirements detailed below. All other systems not affected by replacement or substantial modification, shall remain subject to the original performance requirements.

Requirements solely applicable to *large computational load facilities* do not apply to connected *wholesale customers* and *distributors* whose final System Impact Assessment (SIA) report and Notification of Conditional Approval (NoCA) was issued before June 30th, 2026.

Category	***Requirement***
1. Power Factor	*Connected wholesale customers* and *distributors* connected to the *IESO-controlled grid* shall operate at a power factor within the range of 0.9 lagging to 0.9 leading as measured at the *defined meter point*.
2. Under Frequency Load Shedding	*Connected wholesale customers* and *distributors connected* to the *IESO-controlled grid* may be required to participate in under frequency load shedding

Category	***Requirement***
3. Remedial Action Schemes	*Connected wholesale customers* and *distributors connected* to the *IESO-controlled grid* may be required to participate in *remedial action schemes*.
4. Voltage Reduction	*Distributors* connected to the *IESO-controlled grid* with directly *connected load facilities* of aggregated rating above 20 MVA and with the capability to regulate *distribution* voltages under load, shall install and maintain *facilities* and equipment to provide *voltage reduction capability*.
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7. [Intentionally left blank]	
8. [Intentionally left blank]	
9. Testing and Compliance Monitoring	*Connected wholesale customers* and *distributors connected* to the *IESO-controlled grid* shall test and maintain their equipment in accordance with all applicable *reliability standards*.
10. Metering	*Connected wholesale customers* and *distributors connected* to the *IESO-controlled grid* shall comply with metering codes and standards set by the *IESO*.
11. Voltage Ride-Through	Equipment connected within a *connected wholesale customer's* or a *distributor's facility* or *distribution system* that is connected to the *IESO-controlled grid* shall ride through routine switching events and design criteria contingencies on the *transmission system* assuming standard fault detection, auxiliary relaying, communication, and rated breaker interrupting times unless either disconnected by configuration or a failure to do so has been assessed and confirmed by the *IESO* as having no material adverse effect on the operation of the *IESO-controlled grid*. A *large computational load facility* that is directly connected to the *IESO-controlled grid* shall have the capability to ride-through voltage disturbances of the magnitude and duration specified in the following table except that the *large computational load facility* may disconnect from the *IESO controlled grid* if the Volts per Hz (V/Hz) at the *connection point* exceeds 1.21 per unit for longer than 45 seconds or exceeds 1.3 per unit for longer than 2 seconds.

Category	*Requirement*
	Table: Voltage Ride-Through Capability Requirement for Transmission-Connected Load Facility

Connection Point Voltage	Minimum Ride-Through Time (sec)
> 1.2 V_{max}	May trip
≤ 1.2 V_{max} and > 1.05V_{max}	2
≤ 1.05V_{max} and > V_{max}	1800
≤ V_{max} and ≥ V_{min}	Continuous
< V_{min} and ≥ 0.8 V_{nom}	2
< 0.8 V_{nom} and ≥ 0.5 V_{nom}	0.5
< 0.5 V_{nom} and ≥ 0.2 V_{nom}	0.25
< 0.2 V_{nom}	0.16

Notes:-: (i) Vmax and Vmin are post-contingency maximum and minimum system voltages, respectively, specified in applicable reliability standards. (ii) Vnom is nominal transmission voltage specified in Appendix 4.1.

A *large computational load facility* that is an *embedded load facility* shall have the capability to ride-through voltage disturbances of the magnitude and duration specified in the following table except that the Volts per Hz (V/Hz) at the embedded connection point exceed 1.21 per unit for longer than 45 seconds or exceed 1.3 per unit for longer than 2 seconds.

Table: Voltage Ride-Through Capability Requirement for Distribution-Connected Load Facility

Embedded Connection Point Voltage	Minimum Ride-Through Time (sec)
> 1.2 V_{nom}	May trip
≤ 1.2 V_{nom} and > 1.1 V_{nom}	1
≤ 1.1 V_{nom} and ≥ 0.88 V_{nom}	Continuous
≤ 0.88 V_{nom} and > 0.65 V_{nom}	0.5
< 0.65 V_{nom} and ≥ 0.45 V_{nom}	0.25
< 0.45 V_{nom}	0.16

Notes: Vnom is nominal RMS voltage, which is 44 kV, 27.6 kV, or 13.8 kV for various voltage levels in Ontario power system.

All *large computational load facilities* shall have the capability to ride-through two consecutive voltage disturbances occurring within a 30 second interval.

Category	***Requirement***
	Large computational load facilities equipped with Uninterruptible Power Supplies (UPS) may switch to that UPS supply in accordance with the applicable *market manual*.
12. *Generation Units* and *Electricity Storage Units*	Any *generation unit* or *electricity storage unit* connected within a *connected wholesale customer's* or a *distributor's facility* or *distribution system* that is connected to the *IESO-controlled grid* shall meet, at a minimum, the performance requirements for Off-Nominal Frequency Operation (category 1), Speed/Frequency Regulation (category 2), and Voltage Ride-Through (category 3) specified in Appendix 4.2. If a *connected wholesale customer* injects active power into the *IESO-controlled grid*, all performance requirements specified in Appendix 4.2 are applicable to the *generation units* and *electricity storage units* installed within their *facility*. Note: These performance requirements shall apply to *electricity storage units* and *generation units* at all times while connected within a *connected wholesale customer's* or *distributor's facilities* or *distribution system* that is connected to the *IESO-controlled grid*, unless the *IESO* identifies specific performance requirements that are not applicable to an *electricity storage unit* or *generation unit* for those with a *connection assessment* finalized after January 18, 2021. Due consideration will be given to inherent limitations.
13. Damping	A *large computational load facility* shall not introduce any net negative damping to system oscillations within the sub-synchronous frequency range.
14. Periodic Oscillation	A *large computational load facility* shall ensure the power consumption at the *connection point* of the *facility* has no periodic power oscillation within the sub-synchronous frequency band exceeding the lesser of +/-2.5 MW or +/-0.25 % of the nominal power of the *facility* and as measured according to the applicable *market manual*.

Category	***Requirement***
15. Common point failure	A *large computational load facility shall have* no internal single point failure that results in a load loss: (i) above 600 MW or (ii) a different value that has been assessed and confirmed by the *IESO* as having no material adverse impact on the operation of the *IESO-controlled grid*.
16. Automatic Load Transfer	For a *large computational load facility* directly connected to the *IESO-controlled grid* with multiple *connection points*, automatic load transfer between different *connection points* is not acceptable. For an *embedded load facility* that is a *large computational load facility* and has multiple *embedded connection points*, automatic load transfer between *embedded connection points* from different supplying stations is not acceptable. Automatic load transfer from the *IESO-controlled grid* to a backup generation supply is permitted.
17. Load Ramping	*Large computational load facilities* shall have the capability to control ramp rates to less than 20 MW per minute (maximum 5 MW over any 15-second period) during self-initiated load changes or *dispatch* signal responses. The ramp rate of the *facility* shall be set to 20 MW per minute or less by default unless the IESO approves a higher value. This maximum ramp rate applies for both ramping up and ramping down of active power consumption, unless a different ramp rate has been specified by the *IESO*. For a group of *large computational load facilities* in the *IESO-controlled grid* whose load ramping is synchronized with each other, the *IESO* may specify a lower ramp rate for these *facilities* or require staggering load ramping at these *facilities*. These ramp rate limitations are not intended to restrict the *facility's* response rate during system events, including but not limited to load reduction programs, frequency excursions, voltage changes, switching loads to and from UPS supply during and after a system disturbance, or *remedial action scheme (RAS)* runbacks, unless explicitly stated as part of such programs. The IESO reserves the right to require further adjustments to *facility* ramp rates in accordance with evolving power system operating conditions.

<table>
<tr><th>Category</th><th>Requirement</th></tr>
<tr><td>18. Frequency Ride-Through</td><td>A large computational load facility shall have the capability to ride-through a frequency disturbance of the magnitude and duration specified in the following table unless the absolute rate of change of frequency (RoCoF) magnitude is more than 5 Hz/second. RoCoF shall be calculated as outlined in the applicable market manual.

Table: Frequency Ride-Through Capability Requirement
<table>
<tr><th>System Frequency (Hz)</th><th>Minimum Ride-Through Time (sec)</th></tr>
<tr><td>> 61.8</td><td>May trip</td></tr>
<tr><td>>61.2</td><td>299</td></tr>
<tr><td>≤ 61.2 and ≥ 58.8</td><td>Continuous</td></tr>
<tr><td><58.8</td><td>10</td></tr>
<tr><td><57</td><td>0</td></tr>
</table>
During the frequency disturbance, the load facility shall maintain its active power consumption at the level prior to the disturbance. A large computational load facility shall not switch to UPS during the ride-through period.</td></tr>
<tr><td>19. Voltage Phase Angle Jump Ride-Through</td><td>A large computational load facility shall have the capability to ride-through positive-sequence phase angle jump initiated by no-fault switching events within a sub-cycle time frame of the voltage at the connection point, or the embedded connection point, of less than or equal to 25 electrical degrees. The facility shall maintain pre-disturbance active power consumption and shall not switch to UPS following the voltage phase angle jump.</td></tr>
<tr><td>20. Failure to meet interconnection requirements</td><td>A wholesale customer or embedded load consumer that operates a large computational load facility shall take corrective actions that could include upgrades to their load facility, if such facility is not able to meet the applicable interconnection requirements, and/or the performance of their facility becomes inadequate or causes any adverse impact on the IESO-controlled grid after the facility is in-service. If such upgrades are needed, the IESO may direct the transmitter or the distributor to disconnect the large computational load facility, and the facility may not reconnect until performance can be corrected to the satisfaction of the IESO.</td></tr>
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Appendix 4.17 – IESO Monitoring Requirements: Connected Wholesale Customers and Distributors

The following information, as a minimum, shall be available on a continual basis to the *IESO* from all *distributors connected* to the *IESO-controlled grid*, *distributors* designated pursuant to section 7.5.2 and *connected wholesale customer*s. Needs of the state estimation process or other reasons may result in additional requirements. The direction of all real and reactive power flows shall be indicated measurements. A *connected wholesale customer* that is also a *generator* shall also comply with the applicable requirements of Appendix 4.15.

TYPE	MONITORED QUANTITIES
Distributor connected to the *IESO-controlled grid* or designated pursuant to section 7.5.2	• Where high voltage (HV) Potential Transformers (PTs) are available: Circuits: (where applicable) • Megawatt (MW), megavars (MVARs) and direction of power flow at each terminal connected to the *IESO-controlled grid*. Transformers: • MW, MVARS • phase to ground voltages for each HV winding as specified by the *IESO* • Where only low voltage PTs are available: • MW, MVARs for each Low Voltage (LV) winding, and • phase to phase voltage for each LV winding as specified by the *IESO*. • Under Load Tap Changer (ULTC) tap positions. • Off Load Tap Changer (OLTC) tap positions may be required, as directed by the *IESO* • Status of breakers or isolating switches for low voltage capacitors that are part of the *IESO-controlled grid*, or that are subject to a contracted ancillary services contract including by means or within the scope of an agreement similar in nature to an *operating agreement* entered into with the connected *wholesale customer* • Status of: • All breakers 50 kV and above. • All line disconnect switches 50 kV and above. • All transformer disconnect and by-pass switches 50 kV and above.

TYPE	MONITORED QUANTITIES
	• All bus sectionalising switches 50 kV and above. • transformer LV winding breakers and bus tie breakers for DESN type step-down transformers connected to the *IESO-controlled grid* The status of breaker isolating switches is not required. • *Remedial Action Schemes* as directed by the *IESO* on a case by case basis.
Connected wholesale customers	For: • All dispatchable loads; and Each *load facility* that includes *load equipment* rated individually or in the aggregate at 20 MVA or higher associated exclusively with a *non-dispatchable load* or *price responsive load*, in each case where directed by the *IESO* if transmitter data is not adequate the following shall be monitored: Where high voltage PTs are available: Circuits: (where applicable) • Megawatts (MW), and Megavars (MVAR) and direction of power flow at each terminal connected to the *IESO-controlled grid*. Transformers: • Megawatts (MW), and Megavars (MVAR) and • phase to ground voltages for each HV winding as specified by the *IESO*. Where only low voltage PTs are available: • MW, MVARs from each LV winding, and • phase to phase voltages for each LV winding as specified by the *IESO*. • Under Load Tap Changer (ULTC) tap positions. • Off Load Tap Changer (OLTC) tap positions may be required, as directed by the *IESO* • Status of: • All breakers 50 kV and above. • All line disconnect switches 50 kV and above. • All transformer disconnect and by-pass switches 50 kV and above. • All bus sectionalising switches 50 kV and above. • Transformer LV winding breakers and bus tie breakers for DESN type step-down transformers connected to the *IESO-controlled grid* • Breakers or isolating switches for low voltage capacitors that are part of the *IESO-controlled grid* or that are subject to a

TYPE	MONITORED QUANTITIES
	contracted *ancillary services* contract including by means or within the scope of an agreement similar in nature to an *operating agreement* entered into with the *connected wholesale customer* The status of breaker isolating switches is not required • *Remedial Action Schemes (RAS)* as directed by the IESO

Type	Synchrophasor Data Requirements
Large Computational Load facility	For all three phases the voltage and current phasor measurements and frequency measurements, as further described in the applicable *market manual*, shall be required for the *large computational load facility* as outlined below: (1) For *large computational load facilities* having a *connection point* voltage equal to or greater than 100 kV and an aggregate greater than or equal to a 20 MVA nameplate rating (2) For *large computational load facilities*, regardless of rated size, whose output power flow is a part of an Interconnection Reliability Operating Limit-, measured from the terminals defining the Interconnection Reliability Operating Limit (3) Notwithstanding the foregoing, a *market participant* is not required to measure and provide such data when exempted from such requirement as determined in accordance with the applicable *market manual*.

Unless otherwise specified by the *IESO*, synchrophasor data requirements shall comply with the corresponding *market manual*.

Chapter 7

2. Registration for Physical Operations in the Day-Ahead Market and Real-Time Market

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2.2 Facility and Associated Resources Registration

2.2B Registration of Commissioning Large Computational Load Facilities

2.2B.1 A *market participant* may apply to register a *commissioning large computational load*, in accordance with section 2.2, for the purpose of being permitted to convey electricity or a *physical service* into, through or out of the *integrated power system* or of participating in the *day-ahead market* or *real-time market* during the period in which the *commissioning large computational load* is undergoing the commissioning tests referred to in section 2.2B.4.

2.2B.2 The *IESO* shall approve an application to register a *commissioning large computational load* if the *IESO* is satisfied that the *commissioning large computational load* meets the requirements provided by section 2.2 applicable to *load facilities*. Any such registration shall expire upon completion by the *commissioning large computational load* of the final commissioning test submitted to and approved by the *IESO* pursuant to section 2.2B.4.

2.2B.3 Upon expiry of the registration referred to in section 2.2B.2, a *market participant* shall not participate in the *day-ahead market* or *real-time market* nor cause or permit electricity or any *physical service* to be conveyed into, through or out of the *integrated power system* in respect of a former *commissioning large computational load* unless such former *commissioning large computational load* has been registered, other than pursuant to this section 2.2B, in accordance with section 2.2.

2.2B.4 Where a *commissioning large computational load* has been registered by the *IESO* pursuant to section 2.2B.2, the *market participant* for that *commissioning large computational load* shall, while such registration is in effect:

2.2B.4.1 ensure that the *commissioning large computational load*:

a. complies with all of the provisions of these *market rules* applicable to *non-dispatchable loads*; and

b. notwithstanding section 2.2B.4.1(a), where it will seek to be registered other than pursuant to this section 2.2B, in accordance with section 2.2 as other than a *non-dispatchable load*, complies with all of the applicable requirements of MR Ch.4 s.7.5 or MR Ch.4 s.7.6; and

2.2B.4.2 submit to the *IESO*, for approval and in accordance with section 2.2B.5, information detailing the commissioning test plans for the *commissioning large computational load*.

2.2B.5 The detailed commissioning test plans, referred to in section 2.2B.4.2 shall be submitted to the *IESO* for approval and shall be scheduled in accordance with the procedures applicable to the *outage* coordination process described in MR Ch.5 s.6 and with any applicable *market manual* and shall include, but not be limited to:

2.2B.5.1 the timing of and ramp rates associated with changes in *energy* and reactive output levels;

2.2B.5.2 the performance of any uninteruptible power supply, if applicable;

2.2B.5.3 run-back or trip tests for the *commissioning large computational load*; and

2.2B.5.4 validation tests for equipment models required by the *IESO* for *reliability* purposes.

2.2B.6 Except as otherwise provided in this section 2.2B, where a *commissioning large computational load* has been registered by the *IESO* pursuant to section 2.2B.2, the *IESO* shall, while such registration is in effect,

2.2B.6.1 For purposes of the *settlement process*, treat the *commissioning large computational load* as the type of *resource* for which it has sought registration; and

2.2B.6.2 For the purposes of the *day-ahead market*, *pre-dispatch process* and *real-time dispatch process,* treat the *resource* as the type of *resource* for which it has sought registration except it does not need to submit *bids* to withdraw *energy*.

Chapter 11 - Definitions

Commissioning large computational load means a *large computational load facility* located within the *IESO control area* that is either (i) newly constructed or (ii) significantly redesigned or rebuilt and is designated by the *IESO* as a *commissioning large computational load* and, in

either case, that has not yet completed the commissioning tests referred to in MR Ch.7 s.2.2B.4.2;

Large computational load facility means a *load facility* that is primarily used for; creating, executing and delivering software applications and services, artificial intelligence training, deployment and delivery, cryptocurrency mining or other computational activities at a data centre, and is over 10 MW and is either directly connected to the *IESO-controlled grid* or connected to a *distribution system*;