Market Rule Amendment Proposal Form

Part 1 - Market Rule Information

Identification No.:	MR-00501-R00
Subject:	Ramp Rates for Battery Energy Storage Facilities
Title:	Ramp Rates for Battery Energy Storage Facilities
Nature of Proposal:	☒ Alteration ☐ Deletion ☒ Addition
Chapter:	Chapter 7, Chapter 4
Appendix:	Appendices 4.2 and 4.3
Sections:	Chapter 7: sections 3.5.7 and 7.5
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 18, 2027

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 7

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3. Data Submissions for the Day-Ahead Market and the Real-Time Market

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3.5 Energy Offers and Energy Bids

Hourly Dispatch Data Parameters

3.5.7 Each *energy offer* or *energy bid*, other than an *energy offer* or *energy bid* on a *price responsive load*, a *boundary entity resource*, a *self-scheduling electricity storage resource* that intends to withdraw, or a *virtual zonal resource*, shall contain at least one and up to five sets of hourly ramp quantities and its corresponding ramp up and ramp down values for each *dispatch hour*. Ramp quantities and corresponding ramp up and ramp down values shall be submitted in accordance with this section:

3.5.7.1 The hourly ramp quantity shall be expressed in MW to one decimal place, be greater than 0.0 MW and increase monotonically;

3.5.7.2 The hourly ramp quantity shall constitute the maximum MW quantity at which the corresponding ramp up and ramp down values apply;

3.5.7.3 The last hourly ramp quantity shall be greater than or equal to the maximum quantity of the *price-quantity pairs* submitted in an hour*;* and

3.5.7.4 The hourly ramp up and ramp down values in each such set shall be expressed in MW/minute to one decimal place, be greater than 0.0 MW/min and be less than or equal to the maximum *offer* or *bid* ramp rate, as applicable, specified during the registration process determined by the *IESO* in accordance with section 2.2.

3.5.7.4A In the case of dispatchable *electricity storage resources* with a fuel type of electricity submitting *dispatch data* pursuant to section 3.5.7.4:

3.5.7.4A1 the total submitted ramp up value of all associated *resources* that make up an *electricity storage facility* must be no greater than 100 MW/min for every ramp quantity; and

3.5.7.4A2 the total submitted ramp down value of all associated resources that make up an *electricity storage facility* must be no greater than 100 MW/min for every ramp quantity.

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7. IESO Dispatch Instructions

7.5 Compliance with Dispatch Instructions

7.5.1 Each *registered market participant* shall ensure that each of its *resources* complies with *dispatch instructions* issued to it under these *market rules*. Without limiting the generality of MR Ch.3 s.6.2, non-compliance with *dispatch instructions* other than for the reasons referred to in section 7.5.3 shall be a breach of the *market rules* and may be sanctioned in accordance with MR Ch.3 s.6.2 and with this section 7.5.

7.5.1.1 When complying with *dispatch instructions* under section 7.5.1, all *electricity storage resources* with a fuel type of electricity associated with an *electricity storage facility* must ramp up or ramp down at an aggregate rate of no greater than 6.7 MWs per four seconds.

7.5.2 A registered market participant that expects its resource specified in section 7.1.1A, to operate in a manner that, for any reason, differs materially from the dispatch instructions issued to it in accordance with these market rules shall so notify the IESO as soon as possible. The IESO shall publish guidelines defining when a difference is material and how notice shall be provided for the purposes of this section 7.5.2 and of section 7.5.3.

7.5.3 Compliance with a dispatch instruction for a resource specified in section 7.1.1A, is not required if such compliance would endanger the safety of any person, damage equipment, or violate any applicable law. A market participant that departs from dispatch instructions for any such reason shall so notify the IESO in accordance with section 7.5.2. I

7.5.4 If failure by a resource specified in section 7.1.1A, to comply with a dispatch instruction endangers electricity system reliability, the IESO shall declare the resource to be non-conforming and shall take any actions allowed by sections 7.5.6 to 7.5.7 or any other provisions of these market rules which the IESO determines appropriate.

Appendix 4.2 – Requirements for Generation and Electricity Storage

Facilities Connected to the IESO-Controlled Grid

Category	*Generation facilities* or *electricity storage facilities* directly connected to the *IESO-controlled grid* shall have the capability to:
1. Off-Nominal Frequency Operation	Operate continuously between 59.4 Hz and 60.6 Hz and for a limited period of time in the region bounded by straight lines on a log-linear scale defined by the points (0.0 s, 57.0 Hz), (3.3 s, 57.0 Hz), and (300 s, 59.0 Hz) and the straight lines on a log-linear scale defined by the points (0.0 s, 61.8 Hz), (8 s, 61.8 Hz), and (600 s, 60.6 Hz).
2. Speed/Frequency Regulation	Regulate speed/frequency with an average droop based on maximum active power adjustable between 3% and 7% and set at 4% unless otherwise specified by the *IESO*. Regulation deadband shall not be wider than ±0.06%. Speed/frequency shall be controlled in a stable fashion in both interconnected and island operation. A sustained 9% change of applicable rated active power as defined in category 4 after 10 s in response to a step change of speed of 0.5% during interconnected operation shall be achievable. Due consideration will be given to inherent limitations such as mill points and gate limits when evaluating active power changes. Control systems that inhibit primary frequency response shall not be enabled without *IESO* approval.
3. Voltage Ride-Through	Ride through routine switching events and design criteria contingencies assuming standard fault detection, auxiliary relaying, communication, and rated breaker interrupting times unless disconnected by configuration. For Inverter-based units, momentary current cessation or reduction of output current during system disturbances is not permitted without *IESO* approval.
4. Active Power	Continuously supply all levels of active power output within a +/- 5% range of its rated terminal voltage. Rated active power is the smaller output at either rated ambient conditions (e.g. temperature, head, wind speed, solar radiation) or 90% of rated apparent power. For *electricity storage facilities*, rated active power values shall be separately specified for both injection and withdrawal operations. To satisfy steady-state reactive power requirements, active power reductions to rated active power are permitted.
5. Reactive Power	Continuously (i.e., dynamically) inject or withdraw reactive power at the high-voltage terminal of the main output transformer[1] up to 33% of the applicable rated active power at all levels of active power, and at the typical *transmission system* voltage, except where a lesser continually available capability is permitted with the *IESO's approval*. A conventional synchronous

	unit with a power factor range of 0.90 lagging and 0.95 leading at rated active power connected via a main output transformer impedance not greater than 13% based on *generation unit* rated apparent power is acceptable. Reactive power losses or charging between the high-voltage terminal of the main output transformer and the *connection point* shall be addressed in a manner permitted by *IESO* approval.
6. Automatic Voltage Regulator (AVR)	Regulate voltage automatically within ±0.5% of any setpoint within ±5% of rated voltage at the low-voltage terminal of the main output transformer if the transformer impedance is not more than 13% based on the rated apparent power of the *generation facility* or *electricity storage facility* or at a point approved by the *IESO*. Reactive power-voltage droop or AVR reference load current compensation shall not be enabled without *IESO* approval. The equivalent time constants shall not be longer than 20 ms for voltage sensing and 10 ms for the forward path to the exciter output.
7. Excitation System for Synchronous Machines Greater than 20 MVA or any Synchronous Machines *within Facilities* Greater than 75 MVA	Provide (a) Positive and negative ceilings not less than 200% and 140% of rated field voltage, respectively, while supplying the field winding of the *generation unit* or *electricity storage unit* operating at nominal voltage under open circuit conditions; (b) An excitation transformer impedance not greater than 10% on excitation system base; (c) A voltage response time to either ceiling not more than 50 ms for a 5% step change from rated voltage under open-circuit conditions; and (d) A linear response between ceilings.
8. Power System Stabilizer (PSS) for Synchronous Machines within Facilities Greater than 75 MVA	Provide (a) A change of power and speed input configuration; (b) Positive and negative output limits not less than ±5% of rated AVR voltage; (c) Phase compensation adjustable to limit angle error to within 30° between 0.2 Hz and 2.0 Hz under conditions specified by the *IESO*, and (d) Gain adjustable up to an amount that either increases damping ratio above 0.1 or elicits poorly damped exciter modes of oscillation at maximum active output unless otherwise specified by the *IESO*. Due consideration will be given to inherent limitations. For *electricity storage units, Power System Stabilizer shall be disabled while withdrawing*.
9. Phase Unbalance	Provide an open circuit phase voltage unbalance not more than 1% and operate continuously with a phase voltage unbalance as high as 2% at the high-voltage terminal of its main output transformer.
10. Armature and Field Limiters	Provide short-time capabilities specified in IEEE/ANSI 50.13 and continuous capability determined by either maximum field current, maximum stator current, core-end heating, or minimum field current. More restrictive limiting

	functions, such as steady state stability limiters, shall not be enabled without *IESO* approval.
11. Technical Characteristics	Exhibit, at the high-voltage terminal of its main output transformer, performance comparable to an equivalent synchronous *generation unit* with characteristic parameters within typical ranges. Inertia, unsaturated transient impedance, transient time constants, and saturation coefficients shall be within typical ranges (e.g. H > 1.2 Aero-derivative, H > 1.2 Hydroelectric units less than 20 MVA, H > 2.0 Hydroelectric units 20 MVA or larger, H > 4.0 Other synchronous units, X'd < 0.5, T'd0 > 2.0, and S1.2 < 0.5) except where permitted by *IESO* approval.
12. Reactive Power Response to Voltage Changes of Inverter-Based Units	For a constant voltage at the high-voltage terminal of the main output transformer, achieve a sustained reactive power change of 30% of *generation facility* or *electricity storage facility* rated apparent power at the low-voltage terminal of the main output transformer within 3s following a step change no larger than 4% to the AVR voltage reference. AVR response to the voltage error signal must be consistent over the entire operating range.
13. Ramping	For *electricity storage facilities* with a fuel type of electricity have the capability to operate with ramp rates not exceeding 6.7 MWs per four seconds. This maximum ramp rate applies for both ramping up and ramping down of active power, and injections and withdrawals of active power, unless a different ramp rate has been specified by the *IESO*.

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

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

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*.
5. [Intentionally left blank]	
6. [Intentionally left blank]	
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*.
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. Ramping	For *electricity storage facilities* with a fuel type of electricity that are connected within a *connected wholesale customer's* or a *distributor's facility* or *distribution system* that is connected to the *IESO-controlled grid* have the capability to operate with ramp rates not exceeding 6.7 MWs per 4 seconds. This maximum ramp rate applies for both ramping up and ramping down of active power, and injections and withdrawals of active power unless a different ramp rate has been specified by the *IESO*.