# Market Rule Amendment Proposal Form

## Part 1 - Market Rule Information

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| Identification No.: | MR-00481-R04 |
| Subject: | Market Renewal Program - Final Alignment |
| Title: | Chapter 0.4 and Appendices – Grid Connection Requirements |
| Nature of Proposal: | ☐ Alteration ☐ Deletion ☒ Addition |
| Chapter: | 0.4 |
| Appendix: | Appendix 4.1 - 4.25 |
| Sections: | All |
| Sub-sections proposed for amending: | Various |
| Current Market Rules Baseline: | |

## Part 2 - Proposal History

| Version | Reason for Issuing | Version Date |
|---|---|---|
| 1.0 | Draft for Stakeholder Review | June 7, 2024 |
| 2.0 | Draft for Technical Panel Review | July 2, 2024 |
| 3.0 | Publish for Stakeholder Review and Comment | July 17, 2024 |
| 4.0 | Submitted for Technical Panel Vote | September 3, 2024 |
| 5.0 | Recommended by the Technical Panel; Submitted for IESO Board Review | September 10, 2024 |

## 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

The IESO proposes to amend the market rules to support the implementation of the Market Renewal Program (MRP), via the Final Alignment (FA) Batch.

The FA Batch consolidates all Technical Panel provisionally recommended/IESO Board provisionally approved market rule amendments, with three types of further modifications:

1. Updates or corrections to earlier batches resulting from the ongoing implementation and engagement processes;
2. Transitional market rules required to facilitate the mechanics of transitioning from the old market to the renewed market; and
3. Administrative "conforming change" – to reflect any updates or corrections, e.g. update to references and defined terms.

This proposal is based on input from various stakeholder engagement initiatives for the Market Renewal Program.

Further information on MRP can be found on the IESO's Market Renewal webpage.

## Background

Previous drafts of MRP market rule amendments have been provisionally approved by the IESO Board. The Final Alignment batch consolidates these provisionally approved amendments, with amendments where required, into a single batch that will follow the formal process for market rule amendments, including a formal vote by Technical Panel to recommend the market rules for IESO Board consideration, and formal approval by the IESO Board.

Given the scope of changes being proposed by MRP, each market rule chapter is impacted. The Final Alignment batch is structured such that there is a proposal for each chapter, with separate proposals for appendices 7 and 9.

The implementation of MRP will require two parallel sets of market rules to exist concurrently; the legacy market rules and the renewed market rules. The renewed market rules, which these proposals will create, will be labelled with unique chapter numbers to delineate them from the legacy market rules. A new section A, and in some chapters a section B, details the transitional nature of the two sets of market rules. As the renewed market rules are new chapters, there are no changes tracked. For a tracked changes view compared against the current market rules baseline, please refer to the MRP Final Alignment page.

### Discussion

The accompanying "Summary of Changes - Final Alignment (Readers Guide)" provides a summary of the market rule amendments to the market rules.

## Part 4 - Proposed Amendment

# Introduction

A.1.1 This Chapter is part of the *renewed market rules,* which pertain to:

A.1.1.1 the period prior to a *market transition* insofar as the provisions are relevant and applicable to the rights and obligations of the *IESO* and *market participants* relating to preparation for operation in the *IESO administered markets* following commencement of *market transition;* and

A.1.1.2 the period following commencement of *market transition* in respect of all the rights and obligations of the *IESO* and *market participants.*

A.1.2 All references herein to chapters or provisions of the *market rules* will be interpreted as, and deemed to be references to chapters and provisions of the *renewed market rules.*

A.1.3 Upon commencement of the *market transition*, the *legacy market rules* will be immediately revoked and only the *renewed market rules* will remain in force.

A.1.4 For certainty, the revocation of the *legacy market rules* upon commencement of *market transition* does not:

A.1.4.1 affect the previous operation of any *market rule* or *market manual* in effect prior to the *market transition*;

A.1.4.2 affect any right, privilege, obligation or liability that came into existence under the *market rules* or *market manuals* in effect prior to the *market transition*;

A.1.4.3 affect any breach, non-compliance, offense or violation committed under or relating to the *market rules* or *market manuals* in effect prior to the *market transition*, or any sanction or penalty incurred in connection with such breach, non-compliance, offense or violation; or

A.1.4.4 affect an investigation, proceeding or remedy in respect of:

(a) a right, privilege, obligation or liability described in subsection A.1.4.2; or

(b) a sanction or penalty described in subsection A.1.4.3.

A.1.5. An investigation, proceeding or remedy pertaining to any matter described in subsection A.1.4.3 may be commenced, continued or enforced, and any sanction or penalty may be imposed, as if the *legacy market rules* had not been revoked.

# 1. Introduction

1.1.1 This Chapter sets forth rules to assist the *IESO* in maintaining the *reliability* of the *IESO-controlled grid* by:

1.1.1.1 requiring all *market participants* to adhere to established standards for all equipment *connected* to the *IESO-controlled grid* and to comply with certain other obligations relating generally to *connection* to the *IESO-controlled grid* and to participation in the *IESO-administered markets*; and

1.1.1.2 setting forth certain *reliability*-related obligations of *embedded generators* and *embedded electricity storage participants* that may not be *market participants*.

1.1.2 MR Ch.1 s.7.5 does not apply to this Chapter and any action or event that is required to occur on or by a stipulated time or day under this Chapter or pursuant to a direction, instruction, or order made by the *IESO* under this Chapter shall occur on or by that time, whether or not a business hour, or on or by that day, whether or not a *business day*, unless otherwise specified in this Chapter or in the direction, instruction or order of the *IESO*.

1.1.3 [Intentionally left blank]

1.1.4 Nothing in this Chapter is intended to prevent *market participants* from acting to ensure the safety of any person, prevent the damage of equipment, or prevent the violation of any *applicable law*, provided that the *market participants* coordinate any such actions that may affect the *reliability* of the *IESO-controlled grid* with the *IESO* to the fullest extent practicable.

# 2. Equipment Standards

2.1.1 All *market participants* shall ensure that their equipment and *facilities* connected to the *IESO-controlled grid* adhere to all applicable *reliability standards*.

2.1.2 All *market participants* shall maintain and operate their equipment and *facilities* in accordance with *applicable law*, *good utility practice* and all applicable *reliability standards*.

2.1.3 The standards described in this Chapter shall be implemented through compliance with the requirements of this Chapter, through *connection agreements* between *transmitters* and *market participants* that are *connected* or seek to *connect* to the *IESO-controlled grid* and through *operating agreements* between the *IESO* and *transmitters*.

2.1.4 [Intentionally left blank]

2.1.5 No *transmitter* or *market participant* shall place into service a new or modified *connection facility* until the *IESO* has determined that the *connection facility* complies with this Chapter.

2.1.6 Nothing in this Chapter shall be deemed to interfere with the right of each *transmitter* and *distributor* to establish standards and criteria for the design, construction, and operation of equipment connected to their systems, provided that such standards and criteria:

2.1.6.1 are applied in a non-discriminatory manner to all *market participants* and *connection applicants connecting* or seeking to *connect* to the *IESO-controlled grid*;

2.1.6.2 satisfy *reliability standards* and any minimum general performance standards set forth in MR Ch.4 App.4.1; and

2.1.6.3 shall be subject to review by the *IESO* in the event there is a dispute regarding compliance with this section 2.1.6 and to the right of the *IESO* to override the application of such standards and criteria in the event it determines that they do not so comply.

2.1.7 Subject to compliance with the standards set forth in this Chapter and to sections 6.1.6 and 6.1.7, each *market participant* and *connection applicant* shall have the right to *connect* to the *IESO-controlled grid* or to modify its existing *connection facilities* to the *IESO-controlled grid* without undue delay.

# 3. Performance Standards and Obligations of Market Participants

## 3.1 General Requirement

3.1.1 The minimum general performance standards for all equipment *connected* to the *IESO-controlled grid* are set forth in Appendix 4.1. Specific performance standards applicable to the equipment of *generators*, *electricity storage participants, connected wholesale customers, distributors connected* to the *IESO-controlled grid* and *transmitters* are set forth in Appendices 4.2 to 4.4, respectively.

3.1.2 Each *market participant* shall ensure that its equipment connected to the *IESO-controlled grid* meets all applicable performance standards in Appendix 4.1 and each *generator*, *electricity storage participant, connected wholesale customer, distributor* connected to the *IESO-controlled grid* and *transmitter* shall ensure that its equipment connected to or forming part of the *IESO-controlled grid* meets all applicable performance standards in Appendices 4.2 to 4.4, respectively.

3.1.3 Each *embedded generator* or *embedded electricity storage participant* shall ensure that its equipment meets all applicable performance requirements in Appendix 4.3.

## 3.2 Development of Rules for Waivers of Standards

3.2.1 [Intentionally left blank]

3.2.2 [Intentionally left blank]

3.2.3 A *generator* or *electricity storage participant* may comply with its requirement to provide reactive power either by modifying any of its *generation units* or *electricity storage units* that do not comply with any standard with respect to the provision of reactive power, or by obtaining reactive power from other appropriate *generation units, electricity storage units* or *market participants.* The *IESO* shall determine whether these other *generation units, electricity storage units* or *market participants* are in sufficiently close electrical proximity to the non-compliant *generation unit* or *electricity storage unit* so as to provide the comparable or equivalent reactive power.

## 3.3 Obligations of Transmitters

3.3.1 Each *transmitter* shall:

3.3.1.1 [Intentionally left blank]

3.3.1.2 coordinate the design of equipment proposed to be *connected* to the *IESO-controlled grid* to achieve compliance with this Chapter;

3.3.1.3 permit and participate in any commissioning, inspection, and testing that the *IESO* requires of equipment that is or is to be *connected* to the *IESO-controlled grid*;

3.3.1.4 [Intentionally left blank]

3.3.1.5 satisfy the data requirements set forth in this Chapter to model the static and dynamic performance of the *IESO-controlled grid*;

3.3.1.6 obtain the prior approval of the *IESO* for all changes in or removals of equipment or *facilities connected* to the *IESO-controlled grid* that could impact on the *reliable* operation of the *IESO-controlled grid*;

3.3.1.7 operate its portion of the *IESO-controlled grid* such that, during a *normal operating state*, electricity may be transferred continuously at a *connection point*;

3.3.1.8 operate its portion of the *IESO-controlled grid* such that the fault level at any *connection point* does not exceed the limits specified in the relevant *connection agreement*;

3.3.1.9 operate its portion of the *IESO-controlled grid* to minimize the number and duration of interruptions at a *connection point*;

3.3.1.9A follow *good utility practice* to promptly return *transmission facilities* and equipment to service after an interruption;

3.3.1.10 [Intentionally left blank]

3.3.1.11 [Intentionally left blank]

3.3.1.12 complete and return to the *IESO* those portions of the *IESO catalogue of reliability-related information* relevant to its *facilities*; and

3.3.1.13 upon the request of the *IESO*, enter into an *operating agreement* with the *IESO*.

## 3.4 Obligations of Generators

3.4.1 Each *generator* that participates in the *IESO-administered markets* or that causes or permits electricity to be conveyed into, through or out of the *IESO-controlled grid* shall:

3.4.1.1 [Intentionally left blank]

3.4.1.2 [Intentionally left blank]

3.4.1.3 permit and participate in any commissioning, inspection, and testing that the *IESO* requires of its equipment that is or is to be *connected* to the *IESO-controlled grid*;

3.4.1.4 [Intentionally left blank]

3.4.1.5 [Intentionally left blank]

3.4.1.6 operate its equipment in accordance with its *connection agreement*;

3.4.1.7 [Intentionally left blank]

3.4.1.8 complete and return to the *IESO* those portions of the *IESO catalogue of reliability-related information* relevant to its *facilities*; and

3.4.1.9 notify the *IESO* upon the submission of a *connection request* to a *transmitter*.

## 3.5 Obligations of Connected Wholesale Customers and Distributors Connected to the IESO-Controlled Grid

3.5.1 Each *connected wholesale customer* and each *distributor connected* to the *IESO-controlled grid* shall:

3.5.1.1 [Intentionally left blank]

3.5.1.2 [Intentionally left blank]

3.5.1.3 permit and participate in any commissioning, inspection, and testing that the *IESO* requires of its equipment that is or is to be *connected* to the *IESO-controlled grid*;

3.5.1.4 [Intentionally left blank]

3.5.1.5 [Intentionally left blank]

3.5.1.6 operate its equipment in accordance with its *connection agreement*;

3.5.1.7 [Intentionally left blank]

3.5.1.8 complete and return to the *IESO* those portions of the *IESO catalogue of reliability-related information* relevant to its *facilities*; and

3.5.1.9 notify the *IESO* of the submission of a *connection request* to a *transmitter* pursuant to section 3.5.1.1.

## 3.6 Obligations of Electricity Storage Participants

3.6.1 Each *electricity storage participant* that participates in the *IESO-administered markets* or that causes or permits electricity to be conveyed into, through or out of the *IESO-controlled grid* shall:

3.6.1.1 permit and participate in any commissioning, inspection, and testing that the *IESO* requires of its equipment that is or is to be *connected* to the *IESO-controlled grid*;

3.6.1.2 operate its equipment in accordance with its *connection agreement*;

3.6.1.3 complete and return to the *IESO* those portions of the *IESO catalogue of reliability-related information* relevant to its *facilities*; and

3.6.1.4 notify the *IESO* upon the submission of a *connection request* to a *transmitter.*

# 4. Connection Agreements

4.1.1 Each *connected wholesale customer* and each *distributor*, *generator* and *electricity storage participant* connected to the *IESO-controlled grid* shall have a signed *connection agreement*, in such form as may be prescribed by the *OEB*, with the applicable *transmitter* with whom it is *connected.*

4.1.2 *Market participants* shall have signed connection agreements for each embedded *facility*, in such form as may be prescribed by the *OEB*, with the applicable *distributor* with whom it is *connected.*

# 5. Compliance, Inspection, Testing, and Monitoring

## 5.1 General Requirements

5.1.1 Each *transmitter*, *generator, electricity storage participant, connected wholesale customer* or *distributor connected* to the *IESO-controlled grid* shall have the obligation to test and monitor its equipment to ensure and maintain compliance with all applicable *reliability standards* required by these *market rules*. The requirement to conduct and pay for such activities shall be specified in each *connection agreement*. If any *transmitter*, *generator, electricity storage participant, distributor* or *connected wholesale customer connected* to the *IESO-controlled grid* in respect of which no relevant waiver has been granted by the *IESO* fails to comply with the provisions of this Chapter, the *IESO* shall notify the *transmitter* and the *connecting* party of such non-compliance and shall ask that the parties achieve prompt compliance with this Chapter, subject to the imposition of such penalties for failure to comply as may be specified in these *market rules*. Pending such compliance, the *IESO* may direct the *transmitter* and the *connecting* party to operate their respective equipment and *facilities* so as to maintain the *reliability* of the *IESO-controlled grid*.

5.1.2 The results of all compliance monitoring and performance testing required by this Chapter to be performed shall be made available to the *IESO* upon request.

5.1.3 Each *transmitter, generator, electricity storage participant, distributor* and *connected wholesale customer connected* to the *IESO-controlled grid* shall maintain records that set forth the results of all performance testing and monitoring conducted to demonstrate compliance with this Chapter in each case for 7 years from the date of the testing or monitoring activity. Each *transmitter, generator, electricity storage participant, distributor* and *connected wholesale customer* shall make such records available to the *IESO* upon request.

5.1.4 Parties to a *connection agreement* shall bear the cost of monitoring and testing their equipment and *facilities* for compliance with this Chapter. The *IESO* may request a *transmitter, generator, electricity storage participant, distributor* or *connected wholesale customer connected* to the *IESO-controlled grid* to attach to its equipment or *facilities* such test or monitoring equipment as the *IESO* determines appropriate and that is not required by the relevant *connection*

*agreement* to be so attached, provided that such test or monitoring equipment does not adversely affect the performance of the connecting party's equipment or *facilities*. If the test or monitoring equipment required by the *IESO* is intended to provide a general benefit to the *IESO-controlled grid*, and is not otherwise required to ensure compliance of the specific *market participant's* equipment, the *IESO* shall bear the costs of such additional test or monitoring equipment and the costs of operating and attaching such equipment to the *transmitter's, generator's, electricity storage participant's, distributor's* or *connected wholesale customer's* equipment or *facilities*. All such costs shall be subject to verification and audit by the *IESO*.

5.1.5 Parties to a *connection agreement* that propose to perform a test on equipment that requires a change to the normal operation of such equipment shall give such prior notice to the *IESO* as the *IESO* shall require if such test could have an adverse impact on the *reliable* operation of the *IESO-controlled grid*. If the *IESO* determines that the proposed test could adversely affect the *reliability* of the *IESO-controlled grid*, the *IESO* may direct that the parties modify the testing procedure or the time scheduled for the test to avoid any threat to *reliability*. If such activities cannot avoid a threat to *reliability* to a degree acceptable to the *IESO*, the *IESO* shall not permit the test.

5.1.6 Where the *IESO* believes that the equipment of a *transmitter*, *generator*, *electricity storage participant, distributor* or *connected wholesale customer connected* to the *IESO-controlled grid* does not comply with the requirements of this Chapter, and that such non-compliance poses a threat to the *reliable* operation of the *IESO-controlled grid*, the *IESO* may direct the *transmitter, generator, electricity storage participant, distributor* or *connected wholesale customer* to modify such equipment to comply with this Chapter.

5.1.7 Section 5.1.6 applies regardless of whether a waiver has been granted to the relevant *transmitter, generator, electricity storage participant, distributor* or *connected wholesale customer* by the *IESO* in respect of the non-complying equipment.

## 5.2 IESO-Required Tests of Generators and Electricity Storage Participants

5.2.1 In addition to any tests required by a *connection agreement*, the *IESO* may require a *generator* or *electricity storage participant* to test any *generation facility* or *electricity storage facility* connected to the *IESO-controlled grid* in order to determine whether such *facility* meets the requirements of this Chapter. The relevant *generator* or *electricity storage participant* shall comply with such request. If possible, the *IESO* shall permit such tests to be performed during the next scheduled *planned outage* of the *facility*. If the *IESO* determines that a test

is required for *reliability* reasons prior to the next scheduled *planned outage* of the *facility*, the *IESO* shall cooperate with the *generator* or *electricity storage participant* to ensure that the test is conducted in a manner designed to create the minimum impact on the operation of that *facility*.

5.2.2 Tests conducted under this section 5.2 shall be conducted in accordance with procedures that have been agreed upon by the *IESO* and the relevant *generator* or *electricity storage participant*. The *IESO* shall provide the relevant *generator* or *electricity storage participant* with the parameters of the model derived from such tests.

5.2.3 Section 5.1.4 shall apply to determine the allocation to and the recovery by the *IESO* of any costs incurred by a *generator* or *electricity storage participant* to assist in the performance of the tests required under this section 5.2.

## 5.3 IESO-Required Tests of Interconnections

5.3.1 The *IESO* may perform or require *transmitters* to perform tests to verify the magnitude of the power transfer capability of *interconnections* whenever:

5.3.1.1 a new *interconnection* between the *IESO-controlled grid* and a *neighbouring electricity system* is placed into operation, augmented or substantially modified; or

5.3.1.2 the *IESO* has reasonable grounds to believe that power transfer capability across that *interconnection* has materially changed.

5.3.2 Prior to performing or directing the performance of the tests referred to in section 5.3.1, the *IESO* shall provide as much advance notice as practicable to *market participants* and other *interconnected transmitters* whose systems, equipment or *facilities* could be materially affected by the tests. All *market participants* shall cooperate with the *IESO* and/or the relevant *transmitter* in planning, preparing for and conducting tests to assess the technical performance of *interconnections* on the *IESO-controlled grid*.

5.3.3 The *IESO* may temporarily direct the operation of *generation facilities* or *electricity storage facilities* during the testing of *interconnections* if and to the extent necessary to obtain operational conditions on the *IESO-controlled grid* that are required in order to achieve valid test results. The *IESO* shall plan the timing of tests so that the duration of the tests and the variation in the *dispatch* of any associated *generation resource* or *electricity storage resource* relative to its *dispatch* under non-test conditions are minimized to the extent possible.

5.3.4 Any costs that are incurred by a *generator* or *electricity storage participant* to assist in the performance of the tests required under section 5.3 that are

otherwise unrecoverable shall be recovered from *market participants* in accordance with MR Ch.9 s.4.14.12. All such costs shall be subject to verification and audit by the *IESO* before being so recovered.

# 6. Establishing or Modifying IESO-Controlled Grid Facilities and Connections

## 6.1 General Requirements

6.1.1 Subject to the *reliability standards* required by these *market rules* and to sections 6.1.7, 6.1.22 and 6.1.23, the requirements associated with the design and construction of *connections* to the *IESO-controlled grid* shall be established between the *connecting market participant* or *connection applicant* and the *transmitter* with whom the *market participant* or *connection applicant* seeks to *connect*.

6.1.2 [Intentionally left blank]

6.1.3 [Intentionally left blank]

6.1.4 [Intentionally left blank]

6.1.5 The *IESO* shall, upon receipt of a *request for connection assessment* referred to in section 6.1.6, assess the impact of a new or modified *connection* to the *IESO-controlled grid* on the *reliability* of the *integrated power system* by means of a *connection assessment* conducted in accordance with the provisions of sections 6.1.14 to 6.1.18.

6.1.6 A *connection applicant* shall:

6.1.6.1 file a *request for connection assessment* to obtain the assessment referred to in section 6.1.5 and the approval of the *IESO* in accordance with the provisions of sections 6.1.14 to 6.1.18; and

6.1.6.2 where applicable, obtain the approval of the *IESO* pursuant to section 6.1.22.

Without limiting the generality of sections 6.1.14 and 6.1.15, the *IESO* shall define the form and content of information required for a *request for connection*

*assessment*. The *connection applicant* shall notify the *transmitter* of the filing of such request for *connection assessment.*

6.1.7 If the *IESO* determines as part of a *connection assessment* that a new or modified *connection* will have an adverse effect on the *reliability* of the *integrated power system,* the *IESO* shall describe such adverse effects in its report on the *connection assessment* and of the system upgrades required to mitigate such adverse effects. No *market participant, connection applicant* or *transmitter* shall establish such new or modified *connection* unless the required system upgrades described in the *connection assessment* are designed and implemented to the satisfaction of the *IESO*.

6.1.8 [Intentionally left blank]

6.1.9 Each *transmitter* shall, subject to obtaining any required approvals therefor and to the completion by the *IESO* of a *connection assessment* in accordance with section 6.1.5 and sections 6.1.14 to 6.1.18, and, if applicable, such further assessment and resulting approval as contemplated by sections 6.1.22 and 6.1.23, undertake the design and construction of any upgrades to its portion of the *IESO-controlled grid* that are required by the *IESO* to ensure the *reliability* of the *IESO-controlled grid*.

6.1.10 Each *transmitter* shall, if required by its *licence*, or an order of the *OEB* or by an agreement between the *transmitter* and the *connection applicant*, use its best efforts to undertake the design and construction of any *connection facilities* that are necessary to bring about any new or modified *connections* to the *IESO-controlled grid* that have been the subject of a *connection assessment* completed in accordance with sections 6.1.14 to 6.1.18 and, if applicable, sections 6.1.22 and 6.1.23 on a timely basis and in accordance with the requirements of this Chapter.

6.1.11 [Intentionally left blank]

6.1.12 [Intentionally left blank]

6.1.13 [Intentionally left blank]

6.1.14 The *IESO* shall establish procedures describing the manner and timing for the processing of *requests for connection assessment.*

6.1.15 A *connection applicant* shall file with the *IESO*:

6.1.15.1 a *request for connection assessment*, the supporting documentation referred to in section 6.1.6 and such other supporting documentation

that meets the requirements of the procedures referred to in section 6.1.14;

6.1.15.2 a deposit in such amount as may be specified in the procedures referred to in section 6.1.14; and

6.1.15.3 an executed agreement in the form set forth in the procedures referred to in section 6.1.14 pursuant to which the *connection applicant* agrees, subject to section 6.1.17, to pay to the *IESO* an amount equal to all of the costs and expenses incurred by the *IESO* in completing the *connection assessment* associated with the *request for connection assessment* subject to section 6.1.17.

6.1.16 The *IESO* shall process each *request for connection assessment* in accordance with the procedures referred to in section 6.1.14 and as follows:

6.1.16.1 the *IESO* shall, unless the *request for connection assessment* is withdrawn or deemed to have been withdrawn pursuant to the procedures referred to in section 6.1.14, conduct a *connection assessment* in respect of the subject-matter of the *request for connection assessment* in accordance with the procedures referred to in section 6.1.14;

6.1.16.2 the *IESO* shall provide to the *connection applicant* and to the applicable *transmitter* a copy of the report of the results of the completed *connection assessment* referred to in section 6.1.16.1;

6.1.16.3 provided that the *connection applicant* has met the requirements of section 6.1.15, within such time as may be specified in the procedures referred to in section 6.1.14, the *IESO* shall conduct a *connection assessment* in respect of the subject-matter of the *request for connection assessment* in accordance with the procedures referred to in section 6.1.14;

6.1.16.4 the *IESO* shall provide to the *connection applicant* and the applicable *transmitter* a copy of the report of the results of the completed *connection assessment* referred to in section 6.1.16.3, together with notice of its approval or disapproval of the new or modified *connection* that is the subject-matter of the *connection assessment*;

6.1.16.5 the *IESO* shall advise the *Ontario Energy Board* of the results of the *connection assessment* referred to in section 6.1.16.3; and

6.1.16.6 provided that the *connection applicant* has, within such time or times following the date of completion of the *connection assessment* that

relates to its *request for connection assessment* as may be specified in the procedures referred to in section 6.1.14, filed with the *IESO* such confirmation or evidence, as the case may be and as may be specified in such procedures, of its intention to proceed with the new or modified *connection* that is the subject-matter of its *request for connection assessment*:

a. the *connection applicant* shall retain the priority allocated to its *request for connection assessment*; and

b. the *IESO* shall include the results of such *connection assessment* in such subsequent *connection assessment*, conducted within the times specified in the procedures referred to in section 6.1.14, as may be appropriate.

6.1.17 Where the *IESO* conducts a *connection assessment* that relates to two or more *requests for connection assessment*, the *IESO* shall apportion the costs relating to the *connection assessment* amongst the applicable *connection applicants* in accordance with the procedures referred to in section 6.1.14 and shall reflect such apportionment in the agreement referred to in section 6.1.15.3.

6.1.18 Where:

6.1.18.1 the *IESO* conducts a *connection assessment* that relates to two or more *requests for connection assessment*; and

6.1.18.2 one or more of the *connection applicants* withdraws or is deemed to have withdrawn its *request for connection assessment*,

the *IESO* shall apportion the costs relating to the *connection assessment* amongst applicable *connection applicants* in accordance with the procedures referred to in section 6.1.14.

6.1.19 [Intentionally left blank]

6.1.20 The *IESO* shall submit an *invoice* to each *connection applicant* upon completion of the *connection assessment* which relates to the *connection applicant's request for connection assessment* in an amount equal to:

6.1.20.1 all of the *IESO's* costs and expenses relating to the processing of the *connection applicant's request for connection assessment* and to the conduct of the *connection assessment;* or

6.1.20.2 where section 6.1.17 or 6.1.18 applies, the portion of the costs and expenses referred to in section 6.1.20.1 apportioned to the *connection applicant*;

minus

6.1.20.3 the amount of any deposit paid pursuant to section 6.1.15.2.

6.1.21 A *connection applicant* shall, within ten *business days* of receipt of an *invoice* referred to in section 6.1.20, pay to the *IESO* the amount owing thereunder. Such *invoice* shall be considered to create an obligation under the *market rules* to pay the amount specified therein and such amount may, without prejudice to any other manner of recovery available at law, be recovered accordingly.

6.1.22 No *connection applicant* shall establish a new or modify an existing *connection* to the *IESO-controlled grid* in a manner that differs materially from the configuration or technical parameters that were used by the *IESO* as the basis upon which it approved such new or modified *connection* in accordance with section 6.1.14 to 6.1.18 unless the applicable *connection applicant* has obtained the approval of the *IESO* for the change in configuration or technical parameter.

6.1.23 The *IESO* shall approve a change in configuration or technical parameter referred to in section 6.1.22 unless the *IESO* determines that such change will have an adverse effect on the *reliability* of the *integrated power system*. Where the *IESO* does not approve such change, no *connection applicant* shall establish the applicable new or modify the applicable existing *connection* to the *IESO-controlled grid* unless the required system upgrades described in the *connection assessment* are designed and implemented to the satisfaction of the *IESO*.

## 6.1A Upgrades to Ensure Reliability

6.1A.1 Each *transmitter* shall, subject to obtaining any required approvals therefor, undertake the design and construction of any upgrades to its portion of the *IESO-controlled grid* that are required by the *IESO* to ensure the *reliability* of the *IESO-controlled grid*.

## 6.2 Voluntary Disconnection

6.2.1 A *connected market participant* may *disconnect* from the *IESO-controlled grid* any *facility* that has been de-registered in accordance with section 2.4 of Chapter 7 following the completion of all applicable operating and decommissioning procedures referred to in the *connection agreement* applicable to the *facility*.

## 6.3 Disconnection by Transmitter, Distributor or Market Participant

6.3.1 A *transmitter* may *disconnect* from the *IESO-controlled grid* the *facilities* or equipment of a *market participant* in accordance with the *market rules* and *applicable law*.

6.3.1A Subject to section 6.4.3, a *transmitter* shall notify the *IESO* prior to *disconnecting* from the *IESO-controlled grid* the *facilities* or equipment of a *market participant* for any reason other than in response to a *disconnection order*.

6.3.2 Each *transmitter*, *distributor* and other *market participant* to whom a *disconnection order* is issued pursuant to section 6.4 shall, subject only to MR Ch.5 s.3.4.1.5 or s.3.7.1.5, as the case may be, on the date and at the time specified in the *disconnection order*, *disconnect* the *facilities* or equipment referred to in the *disconnection order*.

6.3.3 Without limiting the generality of MR Ch.1 s.8.3, a *disconnection order* may be issued by the *IESO* to a *transmitter*, *distributor* or other *market participant* pursuant to section 6.4 by voice communication.

## 6.4 Disconnection During an Emergency or For Safety or Reliability Reasons

6.4.1 During an *emergency*, the *IESO* may:

6.4.1.1 direct a connected *market participant* to reduce the power transferred at the *connection point* to zero in an orderly manner; and

6.4.1.2 issue a *disconnection order* to a *transmitter*, *distributor* or other *market participant* directing such *transmitter*, *distributor* or other *market participant* to *disconnect* a person's *facilities* or equipment from the *IESO-controlled grid*, its *transmission system*, its *distribution system* or from a host *market participant*, as the case may be.

6.4.2 Where the *IESO* becomes aware of a threat to the safety of any person, damage to equipment, or the environment or to the *reliability* of the *integrated power system* that requires urgent action, the *IESO* may issue a *disconnection order* directing the relevant *transmitter* or *distributor* to *disconnect* a person's *facilities* or equipment from the *IESO-controlled* grid, its *transmission system* or its *distribution* system, as the case may be.

6.4.2A Where the *IESO* becomes aware that a person has *connected facilities* or equipment to the *IESO-controlled grid*:

6.4.2A.1 without the approval of the *IESO* including, where applicable, but not limited to the approval referred to in section 6.1.22;

6.4.2A.2 in a manner that does not comply with the requirements of the *market rules* or *applicable law*;

6.4.2A.3 in a manner that does not comply with the requirements identified in a *connection assessment* associated with that person's *facilities* or equipment; or

6.4.2A.4 where applicable, in a manner other than that determined satisfactory by the *IESO* pursuant to section 6.1.7 or 6.1.23,

the *IESO* may issue a *disconnection order* directing the relevant *transmitter* to *disconnect* the person's *facilities* or equipment from the *IESO-controlled grid*.

6.4.2B Where the *IESO* becomes aware that a *generator* or *electricity storage participant* has synchronized (respectively) either a *generation resource,*or an *electricity storage resource* to the *IESO-controlled grid* other than in accordance with section 11.2 of Chapter 7, the *IESO* may issue a *disconnection order* directing the relevant *transmitter* to *disconnect* the *generation unit* or *electricity storage unit* from the *IESO-controlled grid*.

6.4.3 A *transmitter* may, in accordance with the provisions of its *licence,* any code issued by the *OEB* with which the *transmitter* is required to comply, or the *market rules*, immediately *disconnect* from the *IESO-controlled grid* the *facilities* or equipment of a person where:

6.4.3.1 such action is urgently required to ensure the safety of any person, prevent the damage of equipment, or the environment;

6.4.3.2 the urgency is such that there is insufficient time to notify the *IESO* prior to such action being taken; and

6.4.3.3 the *transmitter* is the operator of a *connection facility*.

A *transmitter* that *disconnects* a person's *facilities* or equipment pursuant to this section 6.4.3 shall promptly inform the *IESO* that such action has been taken.

## 6.5 Obligation to Reconnect After Disconnection

6.5.1 A *transmitter*, *distributor* or other *market participant* to whom a *disconnection order* was issued pursuant to section 6.4 shall, in accordance with the direction referred to in section 6.5.2, reconnect the relevant *facilities* or equipment to the

*IESO-controlled grid*, its *transmission system*, its *distribution system* or to the host *market participant*, as the case may be, once:

6.5.1.1 the *transmitter*, *distributor* or other *market participant*, as the case may be, and the *IESO* are satisfied that the *emergency* which prompted the *disconnection* no longer exists; or

6.5.1.2 where the *disconnection* occurred for reasons other than an *emergency,* the *transmitter*, *distributor* or other *market participant*, as the case may be, and the *IESO* are satisfied that the reason for the *disconnection* no longer exists.

6.5.2 A *transmitter*, *distributor* or other *market participant* to whom a *disconnection order* was issued pursuant to section 6.4 may reconnect the relevant *facilities* and equipment only under direction from the *IESO* provided that the person whose *facilities* or equipment were *disconnected* has carried out any demonstration required pursuant to section 6.5.3 to the reasonable satisfaction of the *transmitter*, the *distributor* or other *market participant*, as the case may be, and the *IESO*.

6.5.3 Prior to reconnection, the *transmitter*, *distributor* or other *market participant*, as the case may be, or the *IESO* may require the person whose *facilities* or equipment were *disconnected* to demonstrate that it has taken all necessary steps to prevent the recurrence of any event that prompted the *disconnection* that was within the control of the person.

6.5.3A A *transmitter* that has *disconnected* from the *IESO-controlled grid* the *facilities* or equipment of a person in circumstances other than where it has received from the *IESO* a *disconnection order* directing it to do so shall inform the *IESO* prior to reconnecting such *facilities* or equipment.

6.5.4 Any agreement between a *transmitter* and a *market participant* as to the payment of any costs associated with *disconnection* and reconnection shall be contained in their *connection agreement.*

# 7. Provision of Connection-Related Information

## 7.1 Provision of Information

7.1.1 [Intentionally left blank]

7.1.2 A *market participant* that becomes aware of any material change to or inconsistency with any information or data previously supplied to another *market participant* or to the *IESO* in accordance with a new or modified *connection* that could affect the *reliability* of the *IESO-controlled grid* shall promptly notify the *IESO* and such other *market participant* in writing of that change or inconsistency.

7.1.3 Each *generator* or *electricity storage participant* whose *facility* is *connected* to the *IESO-controlled grid*, *connected wholesale customer* and *distributor* connected to *the IESO-controlled grid*, and *transmitter* shall provide to the *IESO connection-related reliability information* as applicable prior to placing any *connected facility* into service.

7.1.4 Each *embedded generator* whose *embedded generation facility* includes a *generation unit* rated at greater than 10 MVA and that is designated by the *IESO* for the purposes of this section 7.1 shall provide to the *IESO connection-related reliability information* as may be requested by the *IESO*.

7.1.5 Each *embedded generator* that:

7.1.5.1 participates in the *IESO-administered markets* and whose *embedded generation facility* includes a *generation unit* rated at 1 MW or higher;

7.1.5.2 is not a *market participant* and whose *embedded generation facility* includes a *generation unit* rated at 10 MVA or higher,

and that is not required to provide data pursuant to section 7.1.4, shall provide the *IESO* with applicable *connection-related reliability information*.

7.1.6 Each *variable generator* shall provide data to the *IESO* in accordance with the applicable *market manual* for the purposes of deriving forecasts of the amount of *energy* that the *variable generator* is capable of producing.

7.1.7 Each *embedded electricity storage participant* whose *embedded electricity storage facility* includes an *electricity storage unit* with an *electricity storage unit size* greater than 10 MVA and that is designated by the *IESO* for the purposes of this section 7.1 shall provide to the *IESO connection-related reliability information* as may be requested by the *IESO*.

7.1.8 Each *embedded electricity storage participant* that:

7.1.8.1 participates in the *IESO-administered markets* and whose *embedded electricity storage facility* includes an *electricity storage unit* with an *electricity storage unit size* of 1 MW or higher;

7.1.8.2 is not a *market participant* and whose *embedded electricity storage facility* includes an *electricity storage unit* with a maximum *electricity storage unit size* of 10 MVA or higher,

and that is not required to provide data pursuant to section 7.1.7, shall provide the *IESO* with applicable *connection-related reliability information*.

## 7.2 [Intentionally left blank]

## 7.3 Monitoring Information Provided by Generators to the IESO

7.3.1 Subject to section 7.3.2, in order to permit the *IESO* to direct the operations of the *IESO-controlled grid*, each:

7.3.1.1 *generator* (i) whose *generation facility* is *connected* to the *IESO-controlled grid*, or (ii) that is participating in the *IESO-administered markets*; and

7.3.1.2 *embedded generator* (i) that is not a *market participant* or whose *embedded generation facility* is not associated with any *resources*; (ii) whose *embedded generation facility* includes a *generation unit* rated at greater than 20 MVA or that comprises *generation units* the ratings of which in the aggregate exceeds 20 MVA; and (iii) that is designated by the *IESO* for the purposes of this section 7.3.1 as being required to provide such data in order to enable the *IESO* to maintain the *reliability* of the *IESO-controlled grid*,

shall provide the *IESO* with the data listed in Appendix 4.15 on a continual basis. Such data shall not be modified by the *generator* and shall be provided:

7.3.1.3 with equipment that meets the requirements set forth in MR Ch.2 App 2.2; and

7.3.1.4 subject to section 7.6A, in accordance with the performance standards set forth in Appendix 4.19.

7.3.2 Section 7.3.1 does not apply to:

7.3.2.1 a *small generation facility*;

7.3.2.2 a *self-scheduling generation facility* that has a name-plate rating of less than 10 MW; or

7.3.2.3 an *intermittent generation resource* that is comprised solely of a *generation unit* rated at less than 20 MW or of *generation units* the ratings of which in the aggregate is less than 20 MW unless designated by the *IESO* at the time of registration as affecting the *reliability* of the *IESO-controlled grid*.

7.3.2A Each *variable generator* not otherwise subject to any communication requirements specified in this chapter shall at a minimum, meet the medium performance standards set forth in Appendix 4.19 for the purposes of providing data in accordance with section 7.1.6.

7.3.3 [Intentionally left blank – section deleted]

7.3.4 The *IESO* shall *publish,* as soon as practicable following each *dispatch hour*, the actual *generation capacity* (in MW) and hourly *energy* production (in MWh) for each *generation unit* based on information provided to it by *market participants. Generation capacity* and *energy* production for *generation units* with rating less than 20 MVA can be aggregated by station.

7.3.5 The *IESO* shall, as soon as practicable prior to each *dispatch hour*, use reasonable efforts to provide a confidential forecast produced by the *forecasting entity* to each *registered market participant* for each of their *variable generation facilities* as specified in the applicable *market manual*.

7.3.6 The *IESO* shall, as soon as practicable following each *dispatch hour,* provide the confidential forecast produced by the *forecasting entity* for each *dispatch interval* in the preceding *dispatch hour,* to each *registered market participant* for each of their *variable generation facilities* as specified in the applicable *market manual.*

## 7.3A Monitoring Information Provided by Electricity Storage Participants to the IESO

7.3A.1 Subject to section 7.3A.2, in order to permit the *IESO* to direct the operations of the *IESO-controlled grid*, each:

7.3A.1.1 *electricity storage participant* (i) whose *electricity storage facility* is *connected* to the *IESO-controlled grid*, or (ii) that is participating in the *IESO-administered markets*; and

7.3A.1.2 *embedded electricity storage participant* (i) that is not a *market participant* or whose *embedded electricity storage facility* is not associated with any *resources*; (ii) whose *embedded electricity storage facility* includes an *electricity storage unit* with a rated *electricity storage unit size* greater than 20 MVA or that comprises multiple *electricity storage units*, the aggregated *electricity storage*

*unit size* ratings of which exceed 20 MVA; and (iii) that is designated by the *IESO* for the purposes of this section 7.3A.1 as being required to provide such data in order to enable the *IESO* to maintain the reliability of the *IESO-controlled grid*,

shall provide the *IESO* with the data listed in Appendix 4.24 on a continual basis. Such data shall not be modified by the *electricity storage participant* and shall be provided:

7.3A.1.3 with equipment that meets the requirements set forth in MR Ch.2 App.2.2; and

7.3A.1.4 subject to section 7.6A, in accordance with the performance standards set forth in Appendix 4.25.

7.3A.2 Section 7.3A.1 does not apply to:

7.3A.2.1 a *small electricity storage facility*

7.3A.3 The *IESO* shall *publish,* as soon as practicable following each *dispatch hour*, the actual *electricity storage capacity* (in MW) and hourly injections of *energy* (in MWh) for each *electricity storage unit* based on information provided to it by *market participants. Electricity storage capacity* and *energy* production for *electricity storage units* with a rated *electricity storage unit size* of less than 20 MVA can be aggregated by station.

## 7.4 Monitoring Information Provided by Transmitters to the IESO

7.4.1 In order to permit the *IESO* to direct the operations of the *IESO-controlled grid*, each *transmitter* shall provide the *IESO* with the data listed in Appendix 4.16 on a continual basis. Such data shall not be modified by the *transmitter* and shall be provided:

7.4.1.1 with equipment that meets the requirements set forth in MR Ch.2 App2.2; and

7.4.1.2 in accordance with the performance standards set forth in Appendix 4.20 and, subject to section 7.6A, Appendix 4.21.

## 7.5 Monitoring Information Provided to the IESO by Connected Wholesale Customers and Distributors Connected to the IESO-Controlled Grid

7.5.1 In order to permit the *IESO* to direct the operations of the *IESO-controlled grid*, each *connected wholesale customer* and each *distributor connected* to the *IESO-controlled grid* shall provide the *IESO* with the data listed in Appendix 4.17 on a continual basis. Such data shall not be modified by the *connected wholesale customer* or *distributor connected* to the *IESO-controlled grid*, as the case may be, and shall be provided:

7.5.1.1 with equipment that meets the requirements set forth in MR Ch.2 App.2.2; and

7.5.1.2 subject to section 7.6A, in accordance with the performance standards set forth in Appendix 4.22.

7.5.2 A *distributor* that is not *connected* to the *IESO-controlled grid* and that is designated by the *IESO* for the purposes of this section 7.5.2 as being required to provide the data listed in Appendix 4.17 in order to enable the *IESO* to maintain the *reliability* of the *IESO-controlled grid* shall comply with the obligations set forth in section 7.5.1.

## 7.6 Monitoring Information Provided by Embedded Load Customers to the IESO

7.6.1 In order to permit the *IESO* to direct the operations of the *IESO-controlled grid*, each *embedded load consumer* that is designated by the *IESO* for the purposes of this section 7.6.1 as being required to provide such data in order to enable the *IESO* to maintain the *reliability* of the *IESO-controlled grid* shall provide the *IESO* with the data listed in Appendix 4.18 on a continual basis. Such data shall not be modified by the *embedded load consumer* and shall be provided:

7.6.1.1 with equipment that meets the requirements set forth in MR Ch.2 App2.2; and

7.6.1.2 subject to section 7.6A, in accordance with the performance standards set forth in Appendix 4.23.

## 7.6A Alternative Arrangements for Submission of Data Measurements

7.6A.1 *Market participants* may propose to the *IESO* an alternative arrangement to make data measurements or equipment status changes available to the *IESO* communications interface within times different than those specified in Appendix 4.19, 4.21, 4.22, 4.23, or 4.25.

7.6A.2 Where an alternative arrangement proposed pursuant to section 7.6A.1 relates to the requirement to make data measurements or equipment status changes available at the *IESO* communications interface within less than 2 seconds from the change in field monitored quantity or field status change, as the case may be, the *IESO* shall approve the alternative arrangement if:

7.6A.2.1 the proposed alternative arrangement demonstrates to the satisfaction of the *IESO* that the *market participant's facilities* and equipment are capable of providing the data measurements or equipment status changes in such a manner that such data will be displayed on the communications terminals located at the *IESO's* principal and back-up control centres within less than 8 seconds from the change in field monitored quantity or field status change; and

7.6A.2.2 the proposed alternative arrangement demonstrates to the satisfaction of the *IESO* that the *market participant's facilities* and equipment are capable of meeting such other *reliability*-related performance standards and other requirements as may be specified by the *IESO*, including but not limited to time consistency of data, and loss of data from electrically adjacent stations.

7.6A.3 Where an alternative arrangement proposed pursuant to section 7.6A.1 relates to the requirement to make data measurements or equipment status changes available at the *IESO* communications interface within less than 10 seconds from the change in field monitored quantity or field status change, as the case may be, the *IESO* shall approve the alternative arrangement if:

7.6A.3.1 the proposed alternative arrangement demonstrates to the satisfaction of the *IESO* that the *market participant's facilities* and equipment are capable of providing the data measurements or equipment status changes in such a manner that such data will be displayed on the communications terminals located at the *IESO's* principal and back-up control centres within less than 20 seconds from the change in field monitored quantity or field status change; and

7.6A.3.2 the proposed alternative arrangement demonstrates to the satisfaction of the *IESO* that the *market participant's facilities* and equipment are capable of meeting such other *reliability*-related performance standards and other requirements as may be specified by the *IESO,* including but not limited to time consistency of data, and loss of data from electrically adjacent stations*.*

7.6A.4 Upon approval of an alternative arrangement proposed and reviewed under this section, the *IESO* may incorporate the alternative arrangement as an alternative standard in the *market rules*.

## 7.7 Reliability, Maintenance and Repair of Monitoring and Control Equipment

7.7.1 Each person referred to in section 7.3.1, 7.4.1, 7.5.1, 7.5.2 or 7.6.1, as the case may be, shall maintain the monitoring and control equipment referred to in Appendices 4.15 to 4.18 as applicable, in accordance with *good utility practice* and shall ensure that such equipment:

7.7.1.1 has an overall mean time between failures of:

a. no less than three years; or

b. no less than five years, if the equipment is designated by the *IESO* as significant for purposes of enabling the *IESO* to maintain the *reliability* of the *IESO-controlled grid*;

7.7.1.1A each person referred to in section 7.7.1 shall report and schedule with the *IESO* all planned changes to monitoring equipment referred to in section 7.7.1.1 and associated potential and current transformers and other devices affecting the accuracy or the reliability of such equipment;

7.7.1.2 is secure from the effects of interruptions in power supply for a period of at least eight hours.

7.7.2 Each person referred to in section 7.7.1 and 7.3.2A shall respond to an *outage* of or defect in the equipment referred to in section 7.7.1 or the applicable *market manual*:

7.7.2.1 immediately, in the case of equipment relating to *facilities* to which the high performance information monitoring standard applies pursuant to Appendices 4.19 to 4.23 and Appendix 4.25 other than *significant generation facilities, significant dispatchable load facilities* and *significant electricity storage facilities*.

7.7.2.2 no later than the next day following the day on which the *outage* or defect is discovered, in the case of equipment relating to *significant generation facilities, significant electricity storage facilities, significant dispatchable load facilities*, *variable generation,* and *facilities* to which the medium performance information monitoring standard applies pursuant to Appendices 4.19 to 4.23 and Appendix 4.25.

7.7.3 Each person referred to in section 7.7.1 and 7.3.2A shall ensure that the equipment referred to in section 7.7.1 or the applicable *market manual* is restored to a fully operational state following an *outage* of or defect in such equipment as follows:

7.7.3.1 in the case of equipment relating to the *facilities* referred to in section 7.7.2.1, within 24 hours of the time at which the *outage* or defect is discovered;

7.7.3.2 in the case of equipment relating to the *facilities* referred to in section 7.7.2.2, within 48 hours of the time at which the *outage* or defect is discovered; and

7.7.3.3 in all other cases, within 14 days of the time at which the *outage* or defect is discovered.

7.7.4 The *IESO* may direct a person referred to in section 7.7.1 and 7.3.2A to respond and restore the equipment referred to in section 7.7.1 or the applicable *market manual* to a fully operational state following an *outage* of or defect in such equipment within such longer or shorter time periods than those referred to in sections 7.7.2 and 7.7.3 based on the immediate or short-term impact of the unavailability of the equipment on the *reliable* operation of the *IESO-controlled grid*, provided that where a person is directed to respond and restore any such equipment in less than 24 hours, the person shall use commercial best efforts to achieve such direction.

7.7.5 Each person referred to in section 7.7.1 shall notify the *IESO* of any *planned outage* of the equipment referred to in section 7.7.1 no less than four days prior to the *planned outage*.

## 7.8 Re-Classification of Facilities

7.8.1 The *IESO* may, for the purposes of sections 7.3 to 7.6:

7.8.1.1 re-classify a *small generation facility* as a *minor generation facility*, a *significant generation facility* or a *major generation facility*;

7.8.1.2 re-classify a *minor generation facility* as a *significant generation facility* or a *major generation facility*;

7.8.1.3 re-classify a *significant generation facility* as a *major generation facility*;

7.8.1.4 re-classify a *minor dispatchable load facility* as a *significant dispatchable load facility* or a *major dispatchable load facility*; and

7.8.1.5 re-classify a *significant dispatchable load facility* as a *major dispatchable load facility*,

where the *IESO* determines that such re-classification is required to enable the *IESO* to maintain the *reliability* of the *IESO-controlled grid*.

7.8.2 The *IESO* may, for the purposes of sections 7.3 to 7.6:

7.8.2.1 re-classify a *major generation facility* as a *significant generation facility*, a *minor generation facility* or a *small generation facility*;

7.8.2.2 re-classify a *significant generation facility* as a *minor generation facility* or a *small generation facility*;

7.8.2.3 re-classify a *minor generation facility* as a *small generation facility*;

7.8.2.4 re-classify a *major dispatchable load facility* as a *significant dispatchable load facility* or a *minor dispatchable load facility*; and

7.8.2.5 re-classify a *significant dispatchable load facility* as a *minor dispatchable load facility*,

where the *IESO* determines that such re-classification will not adversely affect the ability of the *IESO* to maintain *reliability* of the *IESO-controlled grid*.

7.8.2A The *IESO* may, for the purposes of sections 7.3A:

7.8.2A.1 re-classify a *small electricity storage facility* as a *minor electricity storage facility*, a *significant electricity storage facility* or a *major electricity storage facility*;

7.8.2A.2 re-classify a *minor electricity storage facility* as a *significant electricity storage facility* or a *major electricity storage facility*;

7.8.2A.3 re-classify a *significant electricity storage facility* as a *major electricity storage facility*;

where the *IESO* determines that such re-classification is required to enable the *IESO* to maintain the *reliability* of the *IESO-controlled grid*.

7.8.2B The *IESO* may, for the purposes of sections 7.3A:

7.8.2B.1 re-classify a *major electricity storage facility* as a *significant electricity storage facility*, a *minor electricity storage facility* or a *small electricity storage facility*;

7.8.2B.2 re-classify a *significant electricity storage facility* as *a minor electricity storage facility* or a *small electricity storage facility*;

7.8.2B.3 re-classify a *minor electricity storage facility* as a *small electricity storage facility*;

where the *IESO* determines that such re-classification will not adversely affect the ability of the *IESO* to maintain *reliability* of the *IESO-controlled grid.*

7.8.3 A person whose *facility* has been re-classified pursuant to section 7.8.1, 7.8.2, 7.8.2A or 7.8.2B shall:

7.8.3.1 ensure that its *facilities* and equipment meet the requirements set forth in section 7.3, 7.4, 7.5 or 7.6, as the case may be; and

7.8.3.2 comply with the requirements of section 7.7,

applicable to the class of *facility* in which its *facility* has been re-classified*.*

# Appendix 4.1 – IESO-Controlled Grid Performance Standards

| Ref | Item | Requirement |
|---|---|---|
| | **Transmission System** | |
| 1 | Frequency variations | All *equipment* shall be capable of continuously operating in the range between 59.5 Hz and 60.5 Hz. |
| 2 | Voltage variations | Under normal conditions voltages are maintained within the range below.<br><br>Transmission Voltage:<br>Nominal (kV) 500 230 115<br>Maximum Continuous (kV) 550 250* 127*<br>Minimum Continuous (kV) 490 220 113<br><br>*In northern Ontario, the maximum continuous voltage for the 230 and 115 kV systems can be as high as 260 kV and 132 kV respectively |
| 3 | [Intentionally left blank] | |
| 4 | [Intentionally left blank] | |
| 5 | [Intentionally left blank] | |
| 6 | [Intentionally left blank] | |
| 7 | [Intentionally left blank] | |
| 8 | [Intentionally left blank] | |

# Appendix 4.2 – Requirements for Generation and Electricity Storage Facilities Connected to the IESO-Controlled Grid

The performance requirements set out below shall apply to *generation facilities* subject to a *connection assessment* finalized after September 21, 2020. Performance of alternative technologies shall be comparable with that of conforming conventional synchronous generation with an equal apparent power rating.

These performance requirements shall also apply to *electricity storage units* at all times while connected to the *IESO-controlled grid*, unless the *IESO* identifies specific performance requirements that are not applicable to an *electricity storage unit* for those with a *connection assessment* finalized after January 18, 2021. Due consideration will be given to inherent limitations.

Each *facility* that was authorized to *connect* to the *IESO-controlled grid* prior to September 21, 2020 shall remain subject to the performance requirements in effect for each associated system at the time its authorization to *connect* to the *IESO-controlled grid* was granted or agreed to by the *market participant* and the *IESO* (i.e. the "original performance requirements"). These original performance requirements shall prevail until the main elements of an associated system (e.g. governor control mechanism, main exciter, power inverter) 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.

| **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 |

| **Category** | *Generation facilities* or *electricity storage facilities* directly connected to the *IESO-controlled grid* shall have the capability to: |
|---|---|
| | 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. |

[1] A main output transformer steps up the voltage from the *generation unit/facility* to the transmission voltage level.

| **Category** | *Generation facilities* or *electricity storage facilities* directly connected to the *IESO-controlled grid* shall have the capability to: |
|---|---|
| 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.<br>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 | 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 |

| **Category** | *Generation facilities* or *electricity storage facilities* directly connected to the *IESO-controlled grid* shall have the capability to: |
|---|---|
| Changes of Inverter-Based Units | 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. |

# 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.

| **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] | |

| **Category** | *Requirement* |
|---|---|
| 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.<br><br>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*.<br><br>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. |

# Appendix 4.4 – Transmitter Requirements

| *Ref* | *Item* | *Requirement* |
|---|---|---|
| 1 | Abrupt Voltage Changes | Voltage changes shall not normally exceed 4% of steady state rms for capacitor switching operations. Voltage changes shall not normally exceed 10% of steady state rms for line switching operations |
| 2 | Frequency Variations | All equipment shall be capable of continuous operation within the range of 59.5 to 60.5 Hz and have the capability to operate for 10 minutes in the range 58 to 61.5 Hz. |
| 3 | Load Shedding Facilities | Each *transmitter* shall comply with *IESO* requirements for automatic under-frequency load shedding in accordance with its *operating agreement.* Each *transmitter* shall be able to manually drop up to 50% of its load within 10 minutes. |
| 4 | Automatic Reclosure | Transmission circuits shall be equipped with timed, single-shot automatic re-closing facilities. Reclosure shall only be initiated by protections that operate when it is highly likely that the fault is not permanent. Reclosure within 5 seconds of fault detection is allowed only in exceptional circumstances. Angle supervision shall be provided on all breakers rated at 230 kV and above. Automatic reclosure shall remain enabled only for a limited period of time, usually about 40 seconds, following initiation. |
| 5 | Thermal Ratings | • *Market participants* that own and operate transmission equipment shall provide the *IESO* with the continuous and limited time thermal ratings for their transmission circuits and transformers.<br>• *Market participants* shall provide this information to the *IESO* via a data link with a minimum update rate of 5 minutes or as agreed to by the *IESO*. For backup and pre-dispatch purposes, *market participants* shall provide a thermal rating table in a suitable format to facilitate *IESO* applications to perform thermal rating interpolation.<br>• Where other equipment (e.g. wavetraps) is more limiting, *market participants* shall provide the *IESO* with the thermal rating of the most restrictive element.<br>• *Generators* and *connected wholesale customers* that own and operate transmission equipment that is part of the *IESO-controlled grid* shall provide the *IESO* with the continuous and limited time thermal ratings for their transmission circuits and transformers only if required by the *IESO* to maintain *reliable* operation of the *IESO-controlled grid*.<br>• Limited time thermal ratings shall be 15-minute ratings, unless mutually agreed by the *IESO* and *market participant.* |

| *Ref* | *Item* | *Requirement* |
|---|---|---|
| 6 | Protective System Requirements | Protection systems shall be constructed and maintained in accordance with all applicable *reliability standards*. |
| 7 | *IESO* Information Requirements | The *transmitter* shall provide any information that the *IESO* deems necessary to direct the operation of the *IESO-controlled grid*. This Information, including, but not limited to, voltages, flows, and equipment status shall be telemetered continually to the *IESO*. |
| 8 | Voltage Reduction | *Transmitters* with the ability to regulate *distribution* voltages under load shall install and maintain facilities and equipment to provide *voltage reduction capability*. |
| 9 | Telecommunications | Communication channels shall have a level of reliability that is consistent with the required performance of the associated protection system. Telecommunications shall be designed to assure adequate signal transmission during transmission disturbances and may be provided with means to verify proper signal performance. Equipment may be monitored to assess its readiness and be powered by batteries or other sources independent of the *IESO*. |
| 10 | Testing and Compliance Monitoring | *Transmitters* shall test and maintain their equipment in accordance with all applicable *reliability standards.* |
| 11 | Metering | *Transmitters* shall comply with the metering codes and standards set by the *IESO*. |

# Appendix 4.5 – [Intentionally left blank]

# Appendix 4.5A – [Intentionally left blank]

# Appendix 4.6 – [Intentionally left blank]

# Appendix 4.7 – [Intentionally left blank]

# Appendix 4.8 – [Intentionally left blank]

# Appendix 4.9 – [Intentionally left blank]

# Appendix 4.10 – [Intentionally left blank]

# Appendix 4.11 – [Intentionally left blank]

# Appendix 4.12 – [Intentionally left blank]

# Appendix 4.13 – [Intentionally left blank]

# Appendix 4.14 – [Intentionally left blank]

# Appendix 4.15 – IESO Monitoring Requirements: Generators

The following information, as a minimum, shall be available on a continual basis to the *IESO* from:

(a) any *generator* (i) whose *generation facility* is connected to the *IESO-controlled grid*, or (ii) that is participating in the *IESO-administered markets*; and

(b) any *embedded generator* (i) that is not a *market participant* or whose *embedded generation facility* is not associated with any *resources*; (ii) whose *embedded generation facility* includes a *generation unit* rated at greater than 20 MVA or that comprises *generation units* the ratings of which in the aggregate exceeds 20 MVA; and (iii) that is designated by the *IESO* for the purposes of section 7.3.1 of this Chapter as being required to provide such data in order to enable the *IESO* to maintain the *reliability* of the *IESO-controlled grid*.

| TYPE | SCADA INFORMATION REQUIREMENTS |
|---|---|
| Major generation facility | Monitored Quantities<br>1. Active Power (MW) and Reactive Power (MX)<br>a) The standard requirement for active and reactive power is the provision of *net MW* and *net MX* or *gross MX*. *Gross MW* and *gross MX* or *net MX* are also to be provided, if designated by the *IESO* as required for:<br>(i) determination of operating *security limits*;<br>(ii) to maintain *reliable* operation of the *IESO-controlled grid*;<br>(iii) for compliance monitoring purposes; or<br>(iv) if provision of only the standard requirement values as defined above would have a negative impact on other *market participants* through reduced operating *security limits*.<br>b) For *generation units* rated greater than or equal to 100 MVA, the standard requirement as defined in part a) for each *generation unit* shall be provided, and *gross MW* and *gross MX* or *net MX* for each *generation unit* shall be provided if designated by the *IESO* as required using the criteria listed above in part a).<br>c) For *generation units* rated at less than 100 MVA:<br>(i) for a group of *generation units* if those *generation units* are similar in size and operating characteristics, the standard requirement as defined in part a) shall be provided as a total for these *generation units*, and total *gross MW* and *gross MX* or *net MX* shall be provided if designated by the *IESO* as required using the criteria listed above in part a); or<br>(ii) if designated by the *IESO* as required for determination of operating *security limits* or to maintain reliable operation of the *IESO-controlled grid* or for compliance monitoring purposes, the standard requirement as |

| TYPE | SCADA INFORMATION REQUIREMENTS |
|---|---|
| | defined in part a) for each *generating unit* shall be provided, and *gross MW* and *gross MX* or *net MX* for each *generation unit* shall be provided if designated by the *IESO* as required using the criteria listed above in part a).<br>d) For *generation facilities* that have been aggregated pursuant to Chapter 7 section 2.3:<br>(i) the standard requirement as defined in part a) shall be provided as an aggregated total, and an aggregated total *gross MW* and *gross MX* or *net MX* shall be provided if designated by the *IESO* as required using the criteria listed above in part a); or<br>(ii) if so designated by the *IESO* as required for determination of operating *security limits* or to maintain *reliable* operation of the *IESO-controlled grid* or for dispatch compliance monitoring purposes, the standard requirement as defined in part a) for each *generating unit* shall be provided, and *gross MW* and *gross MX* or *net MX* for each *generation unit* shall be provided if designated by the *IESO* as required using the criteria listed above in part a).<br>e) For frequency changers:<br>(i) total MW and MX at either frequency; or<br>(ii) if so designated by the *IESO* as required for determination of operating *security limits*, total MW and MX at both frequencies.<br>f) For synchronous condensers:<br>(i) total MX.<br>2. Voltage:<br>a) For each *generation unit*, unit terminal voltage, except if *generation units* are connected to a common low voltage bus section, then the bus section voltage is adequate for those *generation units*.<br>3. Frequency:<br>a) For each *generation unit* or *generation facility* providing *black start capability*, frequency of the applicable *generation unit* or *generation facility*.<br>4. Equipment Status<br>a) Unit mode (i.e. generator, condenser, pump) for each *generation unit* capable of different modes of operation.<br>b) *AGC* status for each *generation unit* associated with a *resource* providing *regulation*.<br>c) AVR and Stabilizer Status for each *generating unit* with a rated capacity $\geq$ 100 MVA. Stabilizer status reporting is only required if it can be switched off by *generation facility* personnel remotely or at the *facility*.<br>d) AVR and Stabilizer status for each *generation unit* with a rated capacity $\leq$ 100 MVA if the status of this equipment is designated by the *IESO* as required for determination of operating *security limits* or to maintain *reliable* operation of the *IESO-controlled grid*. Stabilizer status reporting is only |

| TYPE | SCADA INFORMATION REQUIREMENTS |
|---|---|
| | required if it can be switched on or off by *market participant* operating personnel remotely or at the *facility*.<br>e) Synchronizing Breaker status for each *generation unit*. Where a *generation facility* is designed such that no low voltage synchronizing breaker is installed for each *generation unit*, the status of the appropriate HV breaker(s) and disconnect switch(es) normally used to isolate the *generation unit* must be provided. Where this results in access to the majority of breakers on a bus, the status of the remainder of the breakers shall be provided to complete the bus configuration.<br>Where a *generation facility* is designed such that there are disconnect switches in parallel, or directly in series, with the synchronizing breaker, the status of those switches is also required.<br>f) *Remedial Action Scheme* status for each applicable *generation unit*. |
| Significant generation facility and minor generation facility connected to IESO-controlled grid | Monitored Quantities<br>1. Active Power (MW) and Reactive Power (MX):<br>a) The standard requirement for active and reactive power is the provision of *net MW* and *net MX* or *gross MX*. *Gross MW* and *gross MX* or *net MX* are also to be provided, if designated by the *IESO* as required for:<br>(i) determination of operating *security limits*;<br>(ii) to maintain *reliable* operation of the *IESO-controlled grid*;<br>(iii) for compliance monitoring purposes; or<br>(iv) if provision of only the standard requirement values as defined above would have a negative impact on other *market participants* through reduced operating *security limits*.<br>b) For *generation facilities* that have not been aggregated pursuant to Chapter 7 section 2.3:<br>(i) for a group of *generation units* if those *generation units* are similar in size and operating characteristics, the standard requirement as defined in part a) shall be provided as a total for these *generation units*, and total *gross MW* and *gross MX* or *net MX* shall be provided if designated by the *IESO* as required using the criteria listed above in part a);<br>(ii) if designated by the *IESO* as required for determination of operating *security limits* or to maintain *reliable* operation of the *IESO-controlled grid* or for compliance monitoring purposes, the standard requirement as defined in part a) for each *generating unit* shall be provided, and *gross MW* and *gross MX* or *net MX* for each *generation unit* shall be provided if designated by the *IESO* as required using the criteria listed above in part a).<br>c) For *generation facilities* that have been aggregated pursuant to Chapter 7 section 2.3:<br>(i) the standard requirement as defined in part a) shall be provided as an aggregated total, and an aggregated total *gross MW and gross MX* or *net* |

| TYPE | SCADA INFORMATION REQUIREMENTS |
|---|---|
| | *MX* shall be provided if designated by the *IESO* as required using the criteria listed above in part a); or<br>(ii) if so designated by the *IESO* as required for determination of operating *security limits* or to maintain *reliable* operation of the *IESO-controlled grid* or for dispatch compliance monitoring purposes, the standard requirement as defined in part a) for each *generating unit* shall be provided, and *gross MW* and *gross MX* or *net MX* for each *generation unit* shall be provided if designated by the *IESO* as required using the criteria listed above in part a).<br>d) For frequency changers:<br>(i) total MW and MX at either frequency; or<br>(ii) if so designated by the *IESO* as required for determination of operating *security limits*, total MW and MX at both frequencies.<br>e) For Synchronous Condensers:<br>(i) Total MX.<br>2. Voltage:<br>a) For *generation units* that are VAR *dispatchable*, unit terminal voltage, except if the *generation units* are connected to a common low voltage bus section, then the bus section voltage is adequate for those *generation units*.<br>3. Frequency:<br>a) For each *generation unit* or *generation facility* providing *black start capability*, frequency of the applicable *generation unit* or *facility.*<br>4. Equipment Status<br>a) Unit mode (i.e. generator, condenser, pump) for each *generation unit* capable of different modes of operation.<br>b) AVR and Stabilizer Status for each *generation unit* if the status of this equipment is designated by the *IESO* as required for determination of operating *security limits* or to maintain *reliable* operation of the *IESO-controlled grid*. Stabilizer status reporting is only required if it can be switched on or off by *market participant* operating personnel remotely or at the *facility*.<br>c) Synchronizing Breaker Status for each *generation unit*. Where a *generation facility* is designed such that no low voltage synchronizing breaker is installed for each *generation unit*, the status of the appropriate HV breaker(s) and disconnect switch(es) normally used to isolate the *generation unit* must be provided. Where this results in access to the majority of breakers on a bus, the status of the remainder of the breakers shall be provided to complete the bus configuration.<br>Where a *generation facility* is designed such that there are disconnect switches in parallel, or directly in series, with the synchronizing breaker, the status of those switches is also required.<br>d) *Remedial Action Scheme* status for each applicable *generation unit*. |

| TYPE | SCADA INFORMATION REQUIREMENTS |
|---|---|
| *Self-scheduling generation facility* with a name-plate rating of less than 10 MW | None |
| Intermittent *generation resource* | • if a major generation facility, as described above for a major generation facility<br>• if a significant generation facility, as described above for a significant generation facility<br>• if a *minor generation facility*, as described above for a *minor generation facility* if designated by the *IESO* at the time of registration as affecting the *reliability* of the *IESO-controlled grid*<br>• if a small generation facility, none |
| Small generation facility | None |
| Minor generation facility that is embedded in a distribution system and registered as a dispatchable generator | • Total active power (MW) output of the individual *generation unit* or of the aggregated resource.<br>• Unit status if the *facility* is comprised of a single *generation unit*.<br>• Aggregated resource status if the *facility* is comprised of aggregated resources, i.e. if at least one unit of the aggregated resource is synchronized, the aggregated resource is synchronized or if no unit in the aggregated resource is synchronized, the aggregated resource is not synchronized.<br>• Reactive Power (MX) output, if requested by the *IESO* for reliable operation of the *IESO-controlled grid*, of individual *generation units* or of the aggregated resource. |

| Type | Synchrophasor Data Requirements |
|---|---|
| *Generation facility* | The following are required unless otherwise specified by the IESO:<br>(1) For *generation units* rated greater than or equal to 100 MVA (name-plate rating), each *generation unit* shall provide positive sequence voltage phasor, positive sequence current phasor and frequency from generator terminal.<br>(2) For *generation units* connected to the IESO-controlled grid through a common connection point, whose aggregated rated size is greater than or equal to 100 MVA (aggregate nameplate rating), positive sequence voltage phasor, aggregated positive sequence current phasor and frequency shall be provided from the generation facility side of the connection point to the grid.<br>(3) For *generation units*, regardless of rated size, whose output power flow is a part of an Interconnection Reliability Operating Limit (IROL) definition, positive sequence voltage phasor, positive sequence current |

| Type | Synchrophasor Data Requirements |
|---|---|
| | phasor and frequency shall be provided at the terminals defining the IROL. |

Unless otherwise specified by the IESO, synchrophasor data requirements shall comply with the corresponding Market Manual.

# Appendix 4.16 – IESO Monitoring Requirements: Transmitters

The following information regarding the *IESO-controlled grid*, as a minimum, shall be available on a continual basis to the *IESO* from *transmitters*. 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.

| Equipment Type | Voltage Level | Monitored Status | Monitored SCADA Quantities |
|---|---|---|---|
| Station Bus | | | |
| Bus Voltage | 50 kV and higher | | Specified phase-phase and phase to ground voltages measured at different buses.<br>Note: a line voltage may be used if bus PTs are not available. |
| Frequency | 50 kV and higher | | As directed by the *IESO* for points on the *IESO-controlled grid* that are significant for reliability purposes. High accuracy PTs & measurements of frequency are required at a number of stations at the discretion of the *IESO*. |
| TRANSFORMATION | | | |
| Autotransformers | 50 kV and above | Isolating switches<br>As described in the "Reactive Devices" section below for ancillary equipment associated with the transformer | Megawatts and Megavars for the high voltage winding for each transformer<br>Megawatts and Megavars for the low voltage winding for each transformer, if other than station service is connected to the tertiary winding.<br>ULTC tap positions for the transformer<br>The *IESO* may require the monitoring of any Off-Load Tap Changer positions. |
| Phase Shifting Transformers | 50 kV and higher | Bypass and isolating switches | Voltage, MW and MVAR may be required as directed by the *IESO* |

| Equipment Type | Voltage Level | Monitored Status | Monitored SCADA Quantities |
|---|---|---|---|
| | | | All transformer tap positions |
| Step Down Transformers | 50 kV and higher | Bypass and isolating switches | MW and MVAR<br>Phase to ground Voltage, for each winding measured on the high voltage side. Where only LV PTs are available: MW and phase to phase voltages for each LV winding<br>ULTC tap positions. |
| Voltage Regulating Transformers | 50 kV and higher | Bypass and isolating switches | MW and MVAR may be required as directed by the *IESO*<br>ULTC tap positions for the transformer<br>The *IESO* may require the monitoring of any Off-Load Tap Changers. |
| Isolating Devices | | | |
| Breakers and Switches | 50 kV and higher including connected tertiaries | All Circuit breakers, including bus tie breakers<br>All breakers connecting loads for each tertiary winding of autotransformer other than that for Station Service<br>Each capacitor breaker<br>All line disconnect switches<br>All transformer disconnect and by-pass switches<br>All bus sectionalizing switches<br>All isolating switches for reactors and capacitors where circuit breakers are not provided<br>All in line switches as specified<br>Note: The status of breaker isolating switches is not required | |

| Equipment Type | Voltage Level | Monitored Status | Monitored SCADA Quantities |
|---|---|---|---|
| | Below 50 kV | Breakers of Low Voltage Capacitors, Reactors, Transformers that are part of or have an impact on the *IESO-controlled grid* or that are subject to a contracted ancillary services contract including by means or within the scope of an *operating agreement*<br>Each reactor or condensor breaker. | |
| Isolating and by-pass switches | 50 kV and higher | Isolating and bypass switches for each transformer<br>Bus sectionalizing switches<br>Reactor and capacitor isolation | |
| Circuits | | | |
| Circuit forming part of the *IESO-controlled grid* | 50 kV and higher | | MW and MVAR line flow at each terminal |
| Circuit that is an interconnection with another control area | 50 kV and higher | | • MW and MVAR line flow<br>• (MW from the billing meter point) where practical |
| Special Protection Schemes | | | |
| *Remedial Action Schemes (RAS)* | 50 kV and higher | As directed by the *IESO* on a case-by-case basis. Where so directed, must include all associated capacitors and reactors breaker status. | As directed by the *IESO* on a case-by-case basis. |
| Reactive Devices | | | |
| Capacitors, Synchronous Condensors, Reactors, Static Var | All levels designated by the *IESO* as affecting the *reliability* of | Breaker Status | MVARs where output is variable. |

| Equipment Type | Voltage Level | Monitored Status | Monitored SCADA Quantities |
|---|---|---|---|
| Compensators, FACTS | the *IESO-controlled grid* | | |

| Equipment Type | Voltage Level | Monitored Syncrophasor Quantities |
|---|---|---|
| *Station Buses*<br>(a) 500 kV station<br>(b) *Bulk Power System (BPS)* Required to restore IESO-controlled grid from generating facilities providing *black-start capability*. | 50 kv and higher | Positive sequence voltage phasor magnitude Positive sequence voltage phasor angle |
| | | Frequency |
| Circuits defining Interconnection Reliability Operating Limits (IROL) and interties | 50 kv and higher | Positive sequence current phasor magnitude measured at terminals Positive sequence current angle magnitude measured at terminals |
| | | Positive sequence voltage phasor magnitude measured at terminals Positive sequence voltage phasor angle measured at terminals |
| | | Frequency |
| Static Var Compensators (SVCs), Synchronous condensers, and Static synchronous compensators (STATCOMs) | Below 50 kv | Positive sequence current phasor magnitude measured at terminals Positive sequence current angle magnitude measured at terminals |
| | | Positive sequence voltage phasor magnitude measured at terminals Positive sequence voltage phasor angle measured at terminals |
| | | Frequency |

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

# 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:<br>Circuits: (where applicable)<br>• Megawatt (MW), megavars (MVARs) and direction of power flow at each terminal connected to the *IESO-controlled grid*.<br>Transformers:<br>• MW, MVARS<br>• phase to ground voltages for each HV winding as specified by the *IESO*<br>• Where only low voltage PTs are available:<br>• MW, MVARs for each Low Voltage (LV) winding, and<br>• phase to phase voltage for each LV winding as specified by the *IESO*.<br>• Under Load Tap Changer (ULTC) tap positions.<br>• Off Load Tap Changer (OLTC) tap positions may be required, as directed by the *IESO*<br>• 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*<br>• Status of:<br>• All breakers 50 kV and above.<br>• All line disconnect switches 50 kV and above.<br>• All transformer disconnect and by-pass switches 50 kV and above.<br>• All bus sectionalising switches 50 kV and above.<br>• transformer LV winding breakers and bus tie breakers for DESN type step-down transformers connected to the *IESO-controlled grid*<br>The status of breaker isolating switches is not required.<br>• *Remedial Action Schemes* as directed by the *IESO* on a case by case basis. |

| TYPE | MONITORED QUANTITIES |
|---|---|
| Connected wholesale customers | For:<br>• All dispatchable loads; and<br>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:<br>Where high voltage PTs are available:<br>Circuits: (where applicable)<br>• Megawatts (MW), and Megavars (MVAR) and direction of power flow at each terminal connected to the *IESO-controlled grid*.<br>Transformers:<br>• Megawatts (MW), and Megavars (MVAR) and<br>• phase to ground voltages for each HV winding as specified by the *IESO*.<br>Where only low voltage PTs are available:<br>• MW, MVARs from each LV winding, and<br>• phase to phase voltages for each LV winding as specified by the *IESO*.<br>• Under Load Tap Changer (ULTC) tap positions.<br>• Off Load Tap Changer (OLTC) tap positions may be required, as directed by the *IESO*<br>• Status of:<br>• All breakers 50 kV and above.<br>• All line disconnect switches 50 kV and above.<br>• All transformer disconnect and by-pass switches 50 kV and above.<br>• All bus sectionalising switches 50 kV and above.<br>• Transformer LV winding breakers and bus tie breakers for DESN type step-down transformers connected to the *IESO-controlled grid*<br>• 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*<br>The status of breaker isolating switches is not required<br>• *Remedial Action Schemes (RAS)* as directed by the IESO |

# Appendix 4.18 – IESO Monitoring Requirements: Embedded Load Consumers

The following information, as a minimum, shall be available on a continual basis to the *IESO* from all *embedded load consumers* designated by the *IESO* pursuant to section 7.6.1. 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. An *embedded load consumer* that is also a *generator* shall also comply with the applicable requirements of Appendix 4.15.

| TYPE | SIZE | MONITORED QUANTITIES |
|---|---|---|
| Dispatchable load | | • Megawatts (MW),<br>• megavars (MVAR) as designated by the *IESO* as required to maintain *reliable* operation of the *IESO-controlled grid*,<br>• phase to phase voltages as specified by the *IESO*, and<br>• 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 *embedded load consumer* |
| Non-dispatchable load or price responsive load | For a *load facility* that includes *load equipment* rated individually or in the aggregate at 20MVA or higher that is associated exclusively with a *non-dispatchable load* or *price responsive load* | Where directed by the *IESO* if *transmitter* or *distributor* data is not sufficient,<br>• MW, MVAR,<br>• phase to phase voltages as specified by the *IESO*; and<br>• 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 *embedded load consumer* |

# Appendix 4.19 – IESO Monitoring Requirements: Generator Performance Standards

The following performance standards, as a minimum, shall be achieved on a continual basis by all *generators* referred to in section 7.3.1 of this Chapter when monitored by the *IESO*. 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.

| FUNCTION | Major generation facility or significant generation facility<br>(High Performance) | Minor generation facility and intermittent *generation resource* designated pursuant to section 7.3.2.3<br>(Medium Performance) | Small generation facility |
|---|---|---|---|
| Data measurements available at the *IESO* communications interface | Less than 2 seconds from change in field monitored quantity | 1. Less than 10 seconds from change in field monitored quantity or<br>2. If the *minor generation facility* is embedded within a *distribution system,* less than one minute from change in field monitored quantity unless otherwise designated by the *IESO* to maintain the *reliability* of the *IESO-controlled grid*. | Not applicable |

| FUNCTION | Major generation facility or significant generation facility<br>(High Performance) | Minor generation facility and intermittent *generation resource* designated pursuant to section 7.3.2.3<br>(Medium Performance) | Small generation facility |
|---|---|---|---|
| Equipment status change available at the *IESO* communications interface | Less than 2 seconds from field status change | 1. Less than 10 seconds from field status change or<br>2. If the *minor generation facility* is embedded within a *distribution system*, less than one minute from change in equipment status unless otherwise designated by the *IESO* to maintain the *reliability* of the *IESO-controlled grid*. | Not applicable |
| *IESO* scan period for data measurements | Maximum:* 4 seconds | Minimum:** 4 seconds | Not applicable |
| *IESO* scan period for Equipment Status | Maximum:* 4 seconds | Minimum:** 4 seconds | Not applicable |
| Data Skew | Maximum: 4 seconds | Not applicable | Not applicable |
| [Intentionally left blank – section deleted] | | | |

| | | | |
|---|---|---|---|
| FUNCTION | Major generation facility or significant generation facility<br>(High Performance) | Minor generation facility and intermittent *generation resource* designated pursuant to section 7.3.2.3<br>(Medium Performance) | Small generation facility |
| [Intentionally left blank – section deleted] | | | |

* The *IESO* may scan more frequently than the maximum.

** The *IESO* may scan less frequently than the minimum.

# Appendix 4.20 – IESO Monitoring Requirements: Transmitter Performance Standards

The following performance levels, as a minimum, shall be achieved on a continual basis by all *transmitters* when monitored by the *IESO*. 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.

| PERFORMANCE LEVEL | FACILITIES |
|---|---|
| For transmission facilities or assets designated by the *IESO* as high performance at the time of registration, must meet the high performance levels in Appendix 4.21 | All facilities and assets at 50 kV and above which are monitored for system limits such as transformer or switching stations<br>All transformer and switching stations with interconnected ties<br>An RTU which collects information at several locations on the *electricity system*<br>Step-down transformer facilities that supply a *dispatchable load facility* that is required to meet high performance monitoring standard<br>All other facilities where medium performance is not specified below |
| For transmission facilities or assets designated by the *IESO* as medium performance at the time of registration, must meet the medium performance levels in Appendix 4.21 | Step-down transformer facilities that supply a *dispatchable load facility* that is required to meet medium performance monitoring standard<br>Step-down transformer facilities that supply a *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*<br>Facilities and assets at 50 kV and above designated by the *IESO* as requiring medium performance |

# Appendix 4.21 – IESO Monitoring Requirements: Transmitter Performance Standards

The following performance standards, as a minimum, shall be achieved on a continual basis by all *transmitters* when monitored by the *IESO*. 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.

| FUNCTION | Transmission facilities or assets identified as high performance in Appendix 4.20 | Transmission facilities or assets identified as medium performance in Appendix 4.20 |
|---|---|---|
| Data measurements available at the *IESO* communications interface | Less than 2 seconds from change in field monitored quantity | Less than 10 seconds from change in field monitored quantity |
| Equipment status change available at the *IESO* communications interface | Less than 2 seconds from field status change | Less than 10 seconds from field status change |
| Data Skew | Maximum: 4 seconds | N/A |
| *IESO* scan period for data measurements | Maximum: 4 seconds* | Minimum:** 4 seconds |
| *IESO* scan period for equipment status | Maximum: 4 seconds* | Minimum:** 4 seconds |

* The *IESO* may scan more frequently than the maximum.

** The *IESO* may scan less frequently than the minimum.

# Appendix 4.22 – IESO Monitoring Requirements: Distributors and Connected Wholesale Customer Performance Standards

The following performance standards, as a minimum, shall be achieved on a continual basis by all *distributors connected* to the *IESO-controlled grid*, *distributors* designated pursuant to section 7.5.2 and *connected wholesale customers* when monitored by the *IESO*. 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 requirements of Appendix 4.19.

| FUNCTION | Major Dispatchable Load Facility and Significant Dispatchable Load Facility<br>(High Performance) | *Minor Dispatchable Load Facility* and *Load Facilities**** 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*<br>(Medium Performance) |
|---|---|---|
| Data measurements available at the *IESO* communications interface | Less than 2 seconds from change in field monitored quantity | Less than 10 seconds from change in field monitored quantity |
| Equipment status change available at the *IESO* communications interface | Less than 2 seconds from field status change | Less than 10 seconds from field status change |
| Data skew | Maximum:* 4 seconds | Not applicable |
| *IESO* scan period for data measurements | Maximum:* 4 seconds | Minimum:** 4 seconds |
| *IESO* scan period for equipment status | Maximum:* 4 seconds | Minimum:** 4 seconds |

* The *IESO* may scan more frequently than the maximum.

** The *IESO* may scan less frequently than the minimum.

*** Where directed by the *IESO* if *transmitter* data is not adequate.

# Appendix 4.23 – IESO Monitoring Requirements: Embedded Load Consumers Performance Standards

The following performance standards, as a minimum, shall be achieved on a continual basis by all *embedded load consumers* designated pursuant to section 7.6.1 when monitored by the *IESO*. 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. An *embedded load consumer* that is also a *generator* shall also comply with the requirements of Appendix 4.19.

| FUNCTION | Major Dispatchable Load Facility and Significant Dispatchable Load Facility (High Performance) | *Minor Dispatchable Load Facility* and *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* (Medium Performance) |
|---|---|---|
| Data measurements available at the *IESO* communications interface | Less than 2 seconds from change in field monitored quantity | 1. Less than one minute from change in field monitored quantity; or<br>2. Less than 10 seconds from change in field monitored quantity if designated by the *IESO* as required to maintain *reliable* operation of the *IESO-controlled grid*. |
| Equipment status change available at the *IESO* communications interface | Less than 2 seconds from field status change | 1. Less than one minute from change in field monitored quantity; or<br>2. Less than 10 seconds from field status change if designated by the *IESO* as required to maintain *reliable* operation of the *IESO-controlled grid*. |
| Data skew | Maximum:* 4 seconds | Not applicable |
| *IESO* scan period for data measurements | Maximum:* 4 seconds | Minimum:** 4 seconds |
| *IESO* scan period for equipment status | Maximum:* 4 seconds | Minimum:** 4 seconds |

* The *IESO* may scan more frequently than the maximum.

** The *IESO* may scan less frequently than the minimum.

*** Where directed by *IESO* if *transmitter* or *distributor* data is not adequate.

# Appendix 4.24 – IESO Monitoring Requirements: Electricity Storage Participants

The following information, as a minimum, shall be available on a continual basis to the *IESO* from:

(a) any *electricity storage participant* (i) whose *electricity storage facility* is *connected* to the *IESO-controlled grid*, or (ii) that is participating in the *IESO-administered markets*; and

(b) any *embedded electricity storage participant* (i) that is not a *market participant* or whose *embedded electricity storage facility* is not associated with any *resources*; (ii) whose *embedded electricity storage facility* includes an *electricity storage unit* with an *electricity storage unit* size rated at greater than 20 MVA or that comprises multiple *electricity storage units*, the aggregated *electricity storage unit* size ratings of which exceeds 20 MVA; and (iii) that is designated by the *IESO* for the purposes of section 7.3.1 of this Chapter as being required to provide such data in order to enable the *IESO* to maintain the *reliability* of the *IESO-controlled grid*.

| TYPE | INFORMATION REQUIREMENTS |
|---|---|
| Major electricity storage facility | Monitored Quantities<br>1. Active Power (MW) and Reactive Power (MX) injected or withdrawn<br>a) The standard requirement for active and reactive power is the provision of *net MW* and *net MX* or *gross MX*. *Gross MW* and *gross MX* or *net MX* are also to be provided, if designated by the *IESO* as required for:<br>(i) determination of operating *security limits*;<br>(ii) to maintain *reliable* operation of the *IESO-controlled grid*;<br>(iii) for compliance monitoring purposes; or<br>(iv) if provision of only the standard requirement values as defined above would have a negative impact on other *market participants* through reduced operating *security limits*.<br>b) For *electricity storage units* with an *electricity storage unit size* greater than or equal to 100 MVA, the standard requirement as defined in part a) for each *electricity storage unit* shall be provided, and *gross MW* and *gross MX* or *net MX* for each *electricity storage unit* shall be provided if designated by the *IESO* as required using the criteria listed above in part a).<br>c) For *electricity storage units* with an *electricity storage unit size* of less than 100 MVA:<br>(i) for a group of *electricity storage units* if those *electricity storage units* are similar in size and operating characteristics, the standard requirement as defined in part a) shall be provided as a total for these *electricity storage units*, and total *gross MW* and *gross MX* shall be provided if designated by the *IESO* as required using the criteria listed above in part a); or<br>(ii) if designated by the *IESO* as required for determination of operating *security limits* or to maintain reliable operation of the *IESO-controlled grid* or for compliance monitoring purposes, the standard requirement as |

| TYPE | INFORMATION REQUIREMENTS |
|---|---|
| | defined in part a) for each *electricity storage unit* shall be provided, and *gross MW* and *gross MX* or *net MX* for each *electricity storage unit* shall be provided if designated by the *IESO* as required using the criteria listed above in part a).<br>d) For *electricity storage facilities* that have been aggregated pursuant to Chapter 7 section 2.3:<br>(i) the standard requirement as defined in part a) shall be provided as an aggregated total, and an aggregated total *gross MW* and *gross MX* or *net MX* shall be provided if designated by the *IESO* as required using the criteria listed above in part a); or<br>(ii) if so designated by the *IESO* as required for determination of operating *security limits* or to maintain *reliable* operation of the *IESO-controlled grid* or for dispatch compliance monitoring purposes, the standard requirement as defined in part a) for each *electricity storage unit* shall be provided, and *gross MW* and *gross MX* or *net MX* for each *electricity storage unit* shall be provided if designated by the *IESO* as required using the criteria listed above in part a).<br>2. State of Charge and Charge Limit<br>a) For each *electricity storage unit* or *electricity storage facility*, the *state of charge* of the applicable *electricity storage unit* or *electricity storage facility*<br>b) For each *electricity storage unit* or *electricity storage facility*, the economic maximum charge limit and the economic minimum charge limit expressed in MWh as per the applicable *market manual*.<br>3. Base point<br>a) For each *electricity storage unit* or *electricity storage facility* associated with a *resource* providing *regulation*, the basepoint, if applicable, of the *electricity storage unit* expressed in MW, according to the applicable *market manual*.<br>4. Dynamic Maximum and Minimum Power<br>a) For each *electricity storage unit* or *electricity storage facility*, the economic maximum power mode and economic minimum power mode, expressed in MW.<br>5. Voltage:<br>a) For each *electricity storage unit*, unit terminal voltage, except if *electricity storage units* are connected to a common low voltage bus section, then the bus section voltage is adequate for those *electricity storage units*.<br>6. Equipment Status<br>a) Voltage Control status and stabilizer status (if applicable) for each *electricity storage unit* with an *electricity storage unit size* > 100 MVA. When applicable, stabilizer status reporting is only required if it can be switched off by electricity storage participant personnel remotely or at the facility.<br>b) AGC status for each *electricity storage unit* associated with a *resource* providing *regulation*.<br>c) Voltage control status and stabilizer status (if applicable) for each *electricity storage unit* with an *electricity storage unit size* < 100 MVA if the status of this equipment is designated by the IESO as required for determination of operating security limits or to maintain reliable operation of the *IESO-* |

| TYPE | INFORMATION REQUIREMENTS |
|---|---|
| | *controlled grid*. When applicable, stabilizer status reporting is only required if it can be switched on or off by market participant operating personnel remotely or at the *facility*.<br>d) Synchronizing Breaker status for each *electricity storage unit*. Where a *electricity storage facility* is designed such that no low voltage synchronizing breaker is installed for each *electricity storage unit*, the status of the appropriate HV breaker(s) and disconnect switch(es) normally used to isolate the electricity storage unit must be provided. Where this results in access to the majority of breakers on a bus, the status of the remainder of the breakers shall be provided to complete the bus configuration.<br>e) Where a *electricity storage facility* is designed such that there are disconnect switches in parallel, or directly in series, with the synchronizing breaker, the status of those switches is also required.<br>f) *Remedial Action Scheme* status for each applicable *electricity storage unit*. |
| Significant electricity storage facility and minor electricity storage facility connected to IESO-controlled grid | Monitored Quantities<br>1. Active Power (MW) and Reactive Power (MX) injected or withdrawn:<br>a) The standard requirement for active and reactive power is the provision of *net MW* and *net MX* or *gross MX* facility. *Gross MW* and *gross MX* or *net MX* are also to be provided, if designated by the IESO as required for:<br>(i) determination of operating security limits;<br>(ii) to maintain reliable operation of the *IESO-controlled grid*;<br>(iii) for compliance monitoring purposes; or<br>(iv) if provision of only the standard requirement values as defined above would have a negative impact on other *market participants* through reduced operating security limits.<br>b) For *electricity storage facilities* that have not been aggregated pursuant to Chapter 7 section 2.3:<br>(i) for a group of *electricity storage units* if those *electricity storage units* are similar in size and operating characteristics, the standard requirement as defined in part a) shall be provided as a total for these electricity storage units, and total *gross MW* and *gross MX* or *net MX* shall be provided if designated by the IESO as required using the criteria listed above in part a);<br>(ii) if designated by the IESO as required for determination of operating security limits or to maintain reliable operation of the IESO-controlled grid or for compliance monitoring purposes, the standard requirement as defined in part a) for each electricity storage unit shall be provided, and gross MW and gross or net MX for each electricity storage unit shall be provided if designated by the IESO as required using the criteria listed above in part a).<br>c) For *electricity storage facilities* that have been aggregated pursuant to Chapter 7 section 2.3:<br>(i) the standard requirement as defined in part a) shall be provided as an aggregated total, and an aggregated total *gross MW* and *gross MX* or *net MX* shall be provided if designated by the IESO as required using the criteria listed above in part a); or<br>(ii) if so designated by the IESO as required for determination of operating security limits or to maintain reliable operation of the IESO-controlled grid or for dispatch compliance monitoring purposes, the standard requirement as |

| TYPE | INFORMATION REQUIREMENTS |
|---|---|
| | defined in part a) for each electricity storage unit shall be provided, and *gross MW* and *gross MX* or *net MX* for each *electricity storage unit* shall be provided if designated by the IESO as required using the criteria listed above in part a).<br>2. Voltage:<br>a) For *electricity storage units* that are VAR dispatchable, unit terminal voltage, except if the electricity storage units are connected to a common low voltage bus section, then the bus section voltage is adequate for those electricity storage units.<br>3. State of Charge and Charge Limit<br>a) For each *electricity storage unit* or *electricity storage facility*, the *state of charge* of the applicable *electricity storage unit* or *electricity storage facility*<br>b) For each *electricity storage unit* or *electricity storage facility*, the economic maximum charge limit and the economic minimum charge limit expressed in MWh as per the applicable *market manual*.<br>4. Dynamic Maximum and Minimum Power<br>a) For each *electricity storage unit* or *electricity storage facility*, the economic maximum power mode and economic minimum power mode, expressed in MW.<br>5. Base point<br>a) For each *electricity storage unit* or *electricity storage facility* associated with a *resource* providing *regulation*, the basepoint, if applicable, of the storage unit expressed in MW, according to the applicable *market manual*.<br>6. Equipment Status<br>a) Automatic Voltage Control and stabilizer status (if applicable) for each *electricity storage unit* if the status of this equipment is designated by the IESO as required for determination of operating security limits or to maintain reliable operation of the IESO-controlled grid. When applicable, stablizer status reporting is only required if it can be switched on or off by the *market participant* operating personnel remotely or at the facility.<br>b) Synchronizing Breaker Status for each *electricity storage unit*. Where an *electricity storage facility* is designed such that no low voltage synchronizing breaker is installed for each *electricity storage unit*, the status of the appropriate HV breaker(s) and disconnect switch(es) normally used to isolate the *electricity storage unit* must be provided. Where this results in access to the majority of breakers on a bus, the status of the remainder of the breakers shall be provided to complete the bus configuration.<br>Where an *electricity storage facility* is designed such that there are disconnect switches in parallel, or directly in series, with the synchronizing breaker, the status of those switches is also required.<br>c) *Remedial Action Scheme* status for each applicable *electricity storage unit*. |
| Self-scheduling electricity storage facility with a name-plate rating | Monitored Quantities<br>1. Active Power (MW) and Reactive Power (MX) injected or withdrawn: |

| TYPE | INFORMATION REQUIREMENTS |
|---|---|
| of less than 10 MW | a) The standard requirement for active and reactive power is the provision of *net MW* and *net MX* or *gross MX*. *Gross MW* and *gross MX* or *net MX* are also to be provided, if designated by the IESO as required for:<br>(i) determination of operating *security limits*;<br>(ii) to maintain reliable operation of the *IESO-controlled grid*;<br>(iii) for compliance monitoring purposes; or<br>(iv) if provision of only the standard requirement values as defined above would have a negative impact on other *market participants* through reduced operating *security limits*.<br>b) For *electricity storage facilities* that have not been aggregated pursuant to Chapter 7 section 2.3:<br>(i) for a group of *electricity storage units* if those *electricity storage units* are similar in size and operating characteristics, the standard requirement as defined in part a) shall be provided as a total for these *electricity storage units*, and total *gross MW* and *gross MX* or *net MX* shall be provided if designated by the *IESO* as required using the criteria listed above in part a);<br>(ii) if designated by the *IESO* as required for determination of operating *security limits* or to maintain reliable operation of the *IESO-controlled grid* or for compliance monitoring purposes, the standard requirement as defined in part a) for each *electricity storage unit* shall be provided, and *gross MW* and *gross MX* or *net MX* for each *electricity storage unit* shall be provided if designated by the *IESO* as required using the criteria listed above in part a).<br>c) For *electricity storage facilities* that have been aggregated pursuant to Chapter 7 section 2.3:<br>(i) the standard requirement as defined in part a) shall be provided as an aggregated total, and an aggregated total *gross MW* and *gross MX* or *net MX* shall be provided if designated by the IESO as required using the criteria listed above in part a); or<br>(ii) if so designated by the *IESO* as required for determination of operating *security limits* or to maintain reliable operation of the *IESO-controlled grid* or for *dispatch* compliance monitoring purposes, the standard requirement as defined in part a) for each *electricity storage unit* shall be provided, and *gross MW* and *gross MX* or *net MX* for each *electricity storage unit* shall be provided if designated by the *IESO* as required using the criteria listed above in part a).<br><br>2. Voltage:<br>a) For *electricity storage unit*s that are VAR dispatchable, unit terminal voltage, except if the *electricity storage units* are connected to a common low voltage bus section, then the bus section voltage is adequate for those *electricity storage units*.<br>3. State of Charge and Charge Limit<br>a) For each electricity storage unit or electricity storage facility, the state of charge of the applicable *electricity storage unit* or *electricity storage facility* |

| TYPE | INFORMATION REQUIREMENTS |
|---|---|
| | b) For each *electricity storage unit* or *electricity storage facility* the economic maximum charge limit, the economic minimum charge limit expressed in MWh<br>4. Dynamic Maximum and Minimum Power<br>a) For each *electricity storage unit*, the economic maximum power mode and economic minimum power mode, expressed in MW.<br>5. Base point<br>a) For each *electricity storage unit* associated with a *resource*, providing *regulation* the basepoint of the applicable *electricity storage unit* expressed in MW according to the applicable *market manual*.<br>6. Equipment Status<br>a) Automatic Voltage Control status and Stabilizer status (if applicable) for each *electricity storage unit* if the status of this equipment is designated by the *IESO* as required for determination of operating *security limits* or to maintain reliable operation of the *IESO-controlled grid*. When applicable, stablizer status reporting is only required if it can be switched on or off by *market participant* operating personnel remotely or at the *facility*.<br>b) Synchronizing Breaker Status for each *electricity storage unit*. Where an *electricity storage facility* is designed such that no low voltage synchronizing breaker is installed for each *electricity storage unit*, the status of the appropriate HV breaker(s) and disconnect switch(es) normally used to isolate the *electricity storage unit* must be provided. Where this results in access to the majority of breakers on a bus, the status of the remainder of the breakers shall be provided to complete the bus configuration.<br>Where an *electricity storage facility* is designed such that there are disconnect switches in parallel, or directly in series, with the synchronizing breaker, the status of those switches is also required.<br>c) *Remedial Action Scheme* status for each applicable *electricity storage unit*. |
| Small electricity storage facility | None |
| Minor electricity storage facility that is embedded in a distribution system and registered as a dispatchable electricity storage participant | Monitored Quantities<br>1. Total active power (MW) output of the individual *electricity storage unit* or of the aggregated resource.<br>a) Unit status if the *facility* is comprised of a single *electricity storage unit*.<br>b) Aggregated resource status if the *facility* is comprised of aggregated resources, i.e. if at least one unit of the aggregated resource is synchronized, the aggregated resource is synchronized or if no unit in the aggregated resource is synchronized, the aggregated resource is not synchronized.<br>c) Reactive Power (MX) output, if requested by the *IESO* for reliable operation of the *IESO-controlled grid*, of individual *electricity storage units* or of the aggregated resource.<br>d) Unit terminal voltage (kV) if requested by the IESO for reliable operation of the *IESO controlled grid* |

| TYPE | INFORMATION REQUIREMENTS |
|---|---|
| | 2. State of Charge and Charge Limit<br>a) For each electricity storage unit or electricity storage facility, the state of charge of the applicable electricity storage unit or electricity storage facility expressed as a percentage<br>b) For each *electricity storage unit* or *electricity storage facility*, the economic maximum charge limit, the economic minimum charge limit expressed in MWh<br>3. Dynamic Maximum and Minimum Power<br>a) For each *electricity storage unit* or *electricity storage facility*, the economic maximum power mode and economic minimum power mode, expressed in MW.<br>4. Base point<br>a) For each *electricity storage unit* or *electricity storage facility* associated with a *resource*, providing *regulation*, the basepoint, if applicable, of the *electricity storage unit* expressed in MW according to the applicable *market manual*. |

# Appendix 4.25 – IESO Monitoring Requirements: Electricity Storage Performance Standards

The following performance standards, as a minimum, shall be achieved on a continual basis by all *electricity storage participants* referred to in section 7.3.A of this Chapter when monitored by the *IESO*. 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.

| FUNCTION | *Major electricity storage facility* or *significant electricity storage facility* (High Performance) | *Minor electricity storage facility* and *self-scheduling electricity storage facility* (*electricity storage facility unit size* <10MW) (Medium Performance) | *Small electricity storage facility* |
|---|---|---|---|
| Data measurements available at the *IESO* communications interface | Less than 2 seconds from change in field monitored quantity | 1. Less than 10 seconds from change in field monitored quantity or<br>2. If the *minor electricity storage facility* is *embedded within a distribution system,* less than one minute from change in field monitored quantity unless otherwise designated by the *IESO* to maintain the *reliability* of the *IESO-controlled grid*. | Not applicable |

| FUNCTION | *Major electricity storage facility* or *significant electricity storage facility* (High Performance) | *Minor electricity storage facility* and *self-scheduling electricity storage facility* (*electricity storage facility unit size* <10MW) (Medium Performance) | *Small electricity storage facility* |
|---|---|---|---|
| Equipment status change available at the *IESO* communications interface | Less than 2 seconds from field status change | 1. Less than 10 seconds from field status change or<br>2. If the *minor electricity storage facility* is *embedded* within a *distribution system*, less than one minute from change in equipment status unless otherwise designated by the *IESO* to maintain the *reliability* of the *IESO-controlled grid*. | Not applicable |
| *IESO* scan period for data measurements | Maximum:* 4 seconds | Minimum:** 4 seconds | Not applicable |
| *IESO* scan period for Equipment Status | Maximum:* 4 seconds | Minimum:** 4 seconds | Not applicable |
| Data Skew | Maximum: 4 seconds | Not applicable | Not applicable |

* The *IESO* may scan more frequently than the maximum.

** The *IESO* may scan less frequently than the minimum.