NYSRC Procedure for Application of IEEE 2800-2022 Standard for Large IBR Generating Facilities for the New York Control Area

All normative mandatory requirements[1] specified in IEEE 2800-2022 (the *Standard*) shall be mandatory for ~~NYISO's *Interconnection Studies*~~[2] interconnection of *Large IBR Generating* ~~*Facilities*~~[2] *Facilities* in the New York Control Area with the exceptions, modifications, clarifications, and additional requirements as specified in this document. Additionally, all procedures or specifications indicated as "should" in IEEE 2800.2-2026 (the *Recommended Practice*) shall be considered mandatory unless it is established that alternative procedures or specifications are used which are equivalent in determining the conformance of the Facility with the performance requirements of the *Standard* as modified by this document.[3]

All other italicized words in this procedure document are terms specifically defined in IEEE 2800 and these definitions shall apply.

IEEE 2800-2022 Requirements as amended by NYSRC

CLAUSE 1 – OVERVIEW

1. Clause 1.4 – General Remarks and Limitations

Application of the Standard is specified by New York State Reliability Council's Reliability Rule B.5 - NYISO's Interconnection Studies for Large ~~(~~>(>=20 MW) IBR Generating Facilities shall be based on IBR Plants compliant with the IEEE 2800-2022 Standard as amended for NYCA application, and their associated IBR models and data.

CLAUSE 2 – NORMATIVE REFERENCES

Adopted in full.

CLAUSE 3 –DEFINITIONS, ACRONYMS, AND ABBREVIATIONS

Adopted in full.

CLAUSE 4 – GENERAL INTERCONNECTION TECHNICAL SPECIFICATIONS AND PERFORMANCE REQUIREMENTS

[1] IEEE standards use "shall" as the operative verb for mandatory requirements. Standards may include recommendations, using the verb "should" or guidelines using the verb "may" which are not mandatory.

[2] ~~NYSRC Glossary definitions~~

[3] Because Large IBR Facility testing and verification practices are not fully mature at this time, the IEEE Standards Association determined that the testing and verification standard associated with IEEE 2800-2022 (IEEE 2800.2-2026) would be a "Recommended Practice". IEEE Standards Association rules do not permit the use of "shall" in a Recommended Practice type of standard.

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NYSRC Procedure for Application of IEEE 2800-2022 Standard for Large IBR Generating Facilities for the New York Control Area, continued

1. Clause 4.2 – Reference Point of Applicability (RPA location)

The *Reference Point of Applicability (RPA*) shall be the *Point of Interconnection* (*POI*) with the exception of requirements specified in Clauses 7.2.2.3.4 and 7.2.2.3.5 of the Standard ~~to have~~for which the *RPA* shall be at the *Point of Connection (POC),* or at the Point of Measurement (POM) by mutual agreement between the NYISO, interconnection Transmission Owner and the IBR Plant ~~developer~~Developer.

CLAUSE 5 – REACTIVE POWER-VOLTAGE CONTROL REQUIREMENTS WITHIN THE CONTINUOUS OPERATION REGION

1. Clause 5.1 – Reactive Power Capability (Supply of reactive power support)

Reactive power support shall be supplied to the *Transmission System*, within the defined range of reactive power capability specified in Clause 5 of the Standard whenever active power is delivered to the *Transmission System,* or absorbed from the *Transmission System* at a level greater than electrical losses within the *IBR plant* and the *Interconnection System* between the *POI* and *POM*. Supply of reactive power and voltage support, and related voltage setpoint and regulation droop parameters, shall be as directed by the *Transmission System Operator* (NYISO).[4]

~~**2. Clause 5.1 – Reactive Power Capability (reactive power support at or near zero active power)**~~

~~Plant capability for reactive power at all active power levels between zero and *ICR*, or *ICAR* and *ICR* in the case of bidirectional *IBR plants* having energy storage capability, is required as specified in Clause 5 of the Standard. Except for *IBR plants* having energy storage capability, supply of reactive power support at net active power export levels less than or equal to zero shall not be required unless agreed to by the NYISO and *IBR owner* as an Ancillary Service. For *IBR plants* containing energy storage capability, supply of reactive power support shall not be required at levels of power import required to meet plant standby loss (i.e., provide power to plant auxiliary loads). Reactive power supply may be required when the plant is in standby mode if agreed to by the NYISO and IBR owner as an Ancillary Service. In that case, reactive power support within the ranges defined by Clause 5 of the Standard shall be continuously maintained during transitions from power export to import and import to export. Supply of reactive power support at net power levels within these exclusions is optional.~~

2. ~~3.~~ Clause 5.1 – Reactive Power Capability (dynamic reactive power)

The definition of dynamic reactive power is further defined to mean that the net reactive power flow of the *IBR plant* can move between any points within the reactive power capability plot shown in Figure 8 of the Standard, while active power flow is held constant, with time response characteristics as specified in Table 5 of the Standard. The time response shall not be degraded

[4] The Standard only requires that the IBR be designed to have the capability to provide reactive power. This additional requirement mandates that this reactive capability be provided (supplied) to the transmission system in order to hold voltage schedule or as otherwise directed by NYISO operations.

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by repetition of voltage change events or changes of required reactive power. Dynamic reactive power is further defined to mean net reactive power that is continuously variable, without discrete steps greater than 1% of the required reactive capability.

3. ~~4.~~ Clause 5.2.2 – Voltage Control (clarification of target voltage)

The first sentence Clause 5.2.2 of the Standard, for application in the New York Control Area, shall be modified to: "When in this mode, the *IBR plant* shall operate in closed-loop automatic voltage control mode to regulate the steady-state voltage at the *RPA* to the reference value, as adjusted by the droop function, to within ±0.01 p.u. of the adjusted voltage set point unless to do so requires reactive power exceeding the reactive power capability of the *IBR plant*."[5]

4. ~~5.~~ Clause 5.2.2 – Voltage Control (dynamic performance)

The voltage control small-signal dynamic performance specified in Table 5 of the Standard shall be applicable when the system short-circuit strength at the RPA is equal to or above the minimum short-circuit strength identified in cases provided by the NYISO for a minimum feasible generation scenario and NYSRC Reliability Rules, Table B-1, Category I, Item 2 contingencies (Opening of elements without fault) local to the POI. The maximum step response time for this condition shall be less than 15 seconds.

For any transmission system conditions within the planning design criteria defined by the New York State Reliability Council, voltage control performance shall be positively damped.

CLAUSE 6 – ACTIVE-POWER—FREQUENCY RESPONSE REQUIREMENTS

1. Clause 6.1.1 – PFR Capability (supply of primary frequency response)

Primary frequency response, for which the capability is defined in Clause 6.1.1, shall be supplied to the *Transmission System* as a mandatory requirement, within the constraints of the *available active power* and the *IBR plant's minimum active power capability,* and is not subject to *IBR owner* mutual agreement. Supply of primary frequency response and the relevant control frequency response control parameters (e.g., droop, dead band) shall be as directed by the *Transmission System Operator* (NYISO).[6] Pre-curtailment of active power to provide an underfrequency response is not required. If the *IBR plant* active power has been curtailed to less than the *available active power* for any reason, supply of underfrequency response, to the extent of the *available active power*, is mandatory. The IBR plant shall be designed such that

[5]As an example, consider an IBR plant rated 150 MW connected to a 230 kV system and with a 236 kV voltage reference value and 6% voltage droop (on ICR base, as defined in the Standard) specified by the NYISO system operator. The voltage control shall hold the RPA voltage to 236 kV ±2.3 kV ± the droop value. If the reactive power injection to hold voltage to the reference, as adjusted for droop, is 30 MVAR, the droop value is -30/150 ´ 0.06 ´ 230 = -2.76 kV. Therefore, the actual RPA voltage must be between 230.9 kV and 235.6 kV for compliance in this example.

[6]The Standard only requires that the IBR be designed to have the capability to provide primary frequency response. This additional requirement mandates that primary frequency response be provided (supplied) to the transmission system as directed by NYISO operations.

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there is capability for underfrequency response to override power curtailment limits. In operation, selection of whether the underfrequency response or the power curtailment limits have priority shall be at the discretion of the NYISO System Operator as indicated by the NYISO in its curtailment order.

CLAUSE 7 – RESPONSE TO TS ABNORMAL CONDITIONS

1. Clause 7.2.2.1 – General Requirements and Exceptions (RPA location)

The *Reference Point of Applicability* (*RPA*) for voltage *ride-through* requirements shall be the *Point of Interconnection* with the exception of requirements specified in the Standard to be applicable at the *IBR unit Points of Connection* (*POC*s).

2. Clause 7.2.2.2 – Voltage Disturbances Within Continuous Operating Region (temporary power deviations)

Active power changes, due to voltage deviations for which all *applicable voltages* at the *RPA* remain within the *continuous operating region*, shall not cause a change in active power greater, in per-unit of the *ICR* (or the *ICAR* for energy storage in the charging mode), ~~greater~~ than twice the magnitude of abrupt voltage change, in per-unit of the nominal voltage, for greater than or equal to 0.05 seconds. The active power output shall return to within ± 0.05 p.u. of the lesser of the pre-disturbance active power and the *available active power*, on the base of the *ICR* or *ICAR*, as applicable, within one second of the disturbance.

3. Clause 7.2.2.2 – Voltage Disturbances Within Continuous Operating Region (extended voltage imbalance)

In addition to the exceptions to requirements for *continuous operation* stated in this clause of the Standard, the *IBR plant* may also trip for negative sequence component of the *applicable voltage* exceeding 6.7% of the *nominal voltage* for a duration exceeding two seconds.

4. Clause 7.2.2.3.2 – Low and High-Voltage Ride-Through Capability (reactive power priority in mandatory operation range)

The *IBR plant* shall operate in *reactive current priority mode* during high- and low-voltage *ride-through* events within the *mandatory operating range*. The relationships between voltage deviation at the *POCs* of *IBR units* and the reactive components of current from these units shall be determined by NYISO based on interconnection studies with consideration of the characteristics of the *IBR units*, with default relationships as proposed by the *IBR owner*. The *IBR plant* shall perform according to these specifications determined by NYISO, which may differ for voltage deviations above and below the *continuous operating range*.

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5. **Clause 7.2.2.3.4 – Current Injection During *Ride-Through* Mode (negative sequence current injection during *ride-through*)**

The relationship between the negative sequence component of *IBR unit* currents and the negative sequence components of the respective *POC* negative sequence voltage components is not specified by this document. The required relationship may be specified by the Connecting Transmission Owner in the Interconnection Agreement.

6. **Clause 7.2.2.3.4 – Current Injection During Ride-Through Mode (negative sequence current injection from type 3 wind turbines)**

Negative sequence currents of Type 3 (doubly fed asynchronous generator) wind turbines, shall not be required to follow a predefined proportional relationship to the negative sequence voltages at the *POC*s.

7. **Clause 7.2.2.3.5 – Performance Specifications (ride-through dynamic performance requirement applicability)**

The dynamic performance requirements specified in Table 13 of the Standard~~,~~ for IBR unit terminal current are desired with the exception of the settling time and settling band requirements, and shall be applicable to all contingencies within the Planning Design Criteria defined by the New York State Reliability Council. The settling time and settling band requirements of Table 13 are recommended goals for typical system conditions and are not mandatory.

8. **Clause 7.2.2.4 – Consecutive Voltage Deviations Ride-Through Capability (*ride-through* for dynamic voltage oscillations)**

Where interconnection system impact studies for an *IBR plant* indicate post-fault voltage oscillations repeatedly exceeding the limits of the *continuous operating region*, the studies shall define voltage *ride-through* performance requirements applicable to such situations. The *IBR plant* shall provide the performance thus required.

9. **Clause 7.2.2.4 – Consecutive Voltage Deviations Ride-Through Capability (energy dissipative device limitations)**

Where *IBR plants* interconnected to the New York Transmission System via HVDC transmission apply energy dissipative devices to meet *ride-through* requirements, the *IBR plant* interconnection studies shall define the credible magnitude and duration of repeated fault events, within the time frame of the energy dissipative device's thermal cool-down period, that may be credibly experienced within New York Reliability Council planning design criteria and

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reasonable engineering judgement. The defined event scenario shall be applied as the minimum duty cycle requirements and energy ratings of the dissipative devices.

~~Exception~~Exceptions to the requirements of Clause 7.2.2.4 of the Standard shall be ~~defined by the NYISO. This exception~~subject to any more stringent or specific requirements of NERC, NPCC or NYSRC. These exceptions shall specifically include dc choppers and similar devices used for interconnection of generation resources with the New York Transmission System via HVDC tie lines.

10. ~~10.~~ **Clause 7.2.2.6 – Restore Output after Voltage Ride-Through (Recovery Time)**

If interconnection studies reveal that IBR plant voltage disturbance recovery times for active power equal to or close to one second may result in voltage collapse, delayed voltage recovery, or other adverse system performance consequences and a slower recovery time is deemed to be favorable, to the New York Transmission System, a suitable recovery time less than ten seconds shall be specified by the NYISO.

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NYSRC Procedure for Application of IEEE 2800-2022 Standard for Large IBR Generating Facilities for the New York Control Area, continued

CLAUSE 8 – POWER QUALITY

Excluded.

CLAUSE 9 – PROTECTION

Adopted in full.

CLAUSE 10 – MODELING DATA

~~Excluded~~

Adopted in full.

CLAUSE 11 – MEASUREMENT DATA FOR PERFORMANCE MONITORING AND VALIDATION

~~Excluded.~~

Excluded are the last four rows of Table 19 which involve measurements specifically related to power quality performance; rapid voltage change, short-term harmonics, long-term harmonics

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CLAUSE 12 – TEST AND VERIFICATION REQUIREMENTS

~~Excluded. However, the following shall apply in substitution:~~

~~1. Forthcoming IEEE 2800.2~~
~~It is recognized that IEEE 2800.2 "Guide for Test and Verification Procedures for Inverter Based Resources Interconnecting with Bulk Power Systems" is undergoing development and will include test, evaluation, model validation and monitoring criteria.~~

~~2. Self-certification of compliance~~
~~The attestation of IBR plant compliance with IEEE 2800-2022, as amended by this document, will be based on IBR plant performance in the fundamental frequency phasor-domain using system models (e.g., PSSE load flow, short-circuit and dynamic models and databases) that are provided to the IBR Developer by NYISO.~~

~~IBR performance constraints that can only be identified by EMT representations of the external transmission system are excluded from Reliability Rule B.5, to be covered in future Reliability Rules.~~

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~~Addendum - Background Notes on the Development of Potential Reliability Rule (PRR) 151 adopted by NYSRC Executive Committee as Reliability Rule B.5 on 2/9/2024~~

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~~1. Need for rule change, including advantages and disadvantages~~

~~The NYISO Interconnection Queue as of 6/30/23 has approximately 120,000 MWs of Large Facility (>20 MW) Inverter Based Resources (IBR). NYSRC does not presently have specific IBR interconnection criteria in its Reliability Rules. PRR 151 is therefore proposed for EC approval to be applicable to all future IBR projects seeking interconnection to the NYCA.~~

~~This proposal is based upon: (1) recent disturbances in Texas, California and Utah where IBRs failed to perform reliably; (2) the cumulative magnitude of IBRs in NYCA per New York State's CLCPA mandates; (3) NERC's recommendation for Authorities Governing Interconnection Requirements (AGIR) to immediately adopt IEEE Standard 2800-2022; (4) FERC's RM22-12-000 NOPR on Reliability Standards to Address Inverter Based Resources; and (5) FERC Order 2023 on Improvements to Generator Interconnection Procedures and Agreements.~~

~~It is noted that IEEE 2800-2022 compliant IBR Plant specifications will evolve from the as-designed stage through the as-built stage. Corresponding models and data likewise will evolve from those required for interconnection studies (as-designed IBR Plant) to those required for test and verification studies (as-built IBR Plant).~~

~~PRR 151 is focused on the interconnection study stage for the as-designed IBR Plant with the adoption of a critical subset of IEEE Standard 2800-2022 requirements, as amended for NYCA applicability. Further revisions to incorporate and adopt all pertinent IEEE Standard 2800-2022 requirements will be included in subsequent PRRs.~~

~~The advantage to immediate adoption of PRR 151 is that it establishes minimum IBR interconnection criteria critical to NYCA reliability as NYCA transitions to higher penetration of inverter-based resources per CLCPA mandates. There are no disadvantages.~~

~~Comments~~

~~1. IEEE Standard 2800-2022: "IEEE Standard for Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems" is covered by IEEE Copyright, available through IEEE Xplore: https://ieeexplore.ieee.org/document/9762253~~

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~~2. New Glossary Terms:~~

- ~~"Large IBR Generating Facility" in this PRR is based on:~~
  - ~~IEEE Standard 2800-2022 definition of a grouping of one or more IBR unit(s) and possibly supplemental IBR device(s) operated by a common Facility level controller along with a collector system to achieve the performance requirements of this standard at a single reference point of applicability (RPA), and~~
  - ~~FERC's definition of Large Generating Facilities having capacities greater than 20 MWs.~~
- ~~"Interconnection Studies" in this PRR are based upon the studies outlined in NYISO's OATT Attachment X and Transmission Expansion and Interconnection Manual.~~
- ~~"IBR Plant Developer" as used in this PRR includes an IBR Plant Developer or IBR Plant Owner or IBR Plant Operator.~~

~~3. IEEE 2800-2022 requirements for this PRR specifically apply to the IBR Developer where:~~

- ~~Requirements designated with the word "shall" are mandatory.~~
- ~~Requirements designated with the words "should", "may" or "can" are not mandatory.~~

~~4. Exclusions from the requirements in IEEE 2800-2022 for this PRR are:~~

- ~~Section 8: Power Quality~~
- ~~Section 10: Modeling Data~~
- ~~Section 11: Measurement Data for Performance Monitoring and Validation~~
- ~~Section 12: Test and Verification Requirements~~

~~5. Miscellaneous Notes~~

- ~~EMT models and studies are not required by this PRR but may be required by the as-built requirements, to be covered in future PRRs.~~
- ~~IEEE Standard 2800-2022 does not explicitly specify requirements for HVDC facilities. However, it does include requirements for VSC-HVDC transmission facilities connecting isolated IBR to the AC transmission system.~~
- ~~IBR models and data for IBR plant compliant with IEEE Standard 2800-2022 may be modified as the IBR plant progresses through the interconnection process. The procedures for obtaining the as-designed models and data, and their updating during the various stages of interconnection are addressed by NYSRC's existing Reliability Rule I - Modeling and Data, I.4 - Transmission Data.~~
- ~~NYSRC Policy 1, Section 5: Exceptions to Reliability Rules covers exception procedures . A request for a new exception to a Reliability Rule, or the removal or modification of a current exception to a Reliability Rule (an Exception Change) must be submitted to the Executive Committee for approval. An Exception Change request to the Executive Committee shall be initiated in one of three ways: (1) a request by a transmission owner following an annual transmission owner review of current exceptions, (2) a request made at any time by a market participant, or (3) a request by the NYISO or any member of the Executive Committee.~~

1.0 ATTESTATIONS

The Generator Owner shall submit three attestations and associated modeling data to the NYISO as detailed below:

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1.1 **Cluster Study Requirements** - The Generator Owner shall submit to the NYISO, at the time of interconnection request, models for use by NYISO and its consultants in the Cluster Study Process that replicate the performance of their proposed IBR plant and an attestation that these models exhibit performance compliant with the *Standard,* as amended by this document.

1.2 Pre-Commissioning Testing - The Generator Owner shall submit to the NYISO, upon finalization of plant design and prior to entering commercial operation, an attestation that states compliance with the requirements in Section 2.0 below.

1.3 Commissioning Testing - The Generator Owner shall submit to the NYISO no later than 365 days after the date of commercial operation, an attestation that states compliance with the requirements of Section 3.0 below.

2.0 Pre-Commissioning Testing

2.1 Validation of IBR Unit and PPC Models - The validity of IBR unit and Power Plant Controller (PPC) models shall be confirmed by comparison of type test results and simulations of the type tests using these models using the procedures specified in Clause 6 of the *Recommended Practice*:

2.1.1 All IBR units and plant controllers shall be type tested in accordance with the type test procedures specified in Clause 5 of the *Recommended Practice*.

2.1.2 EMT models of IBR units and plant controllers shall be validated against the respective type test results in accordance with Clause 6 of the *Recommended Practice*.

2.1.3 The Generator Owner shall provide a comprehensive Model Validation Report that includes the following items:

2.1.3.1 Description of test conditions relevant to the test results (e.g., source impedances, method used to perform ride-through tests, etc.).

2.1.3.2 Measures taken to replicate test conditions in the EMT simulations of the type tests.

2.1.3.3 Type test results documented as specified in the *Recommended Practice*.

2.1.3.4 Simulation results using the IBR unit and IBR plant controller models for comparable tests.

2.1.3.5 Analysis and explanation of differences between type test and simulation results, including assessment of whether differences are material.

2.2 Design Evaluation - A plant model of the *Large IBR Generating Facility*, consisting of validated IBR unit models, power plant control (PPC) model(s), supplemental IBR devices, and balance of plant component models, shall be constructed and used to evaluate performance of the *Large IBR Generating Facility* with respect to the applicable performance requirements of the *Standard* as modified by this document. This design evaluation shall be performed in accordance with Clause 7 of the *Recommended Practice:*

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2.2.1 All IBR unit and plant controller models used for design evaluation shall be validated.

2.2.2 All IBR unit and plant controller models used for design evaluation shall reflect the actual makes, models, and controller firmware versions of the as-built equipment.

2.2.3 The plant model used for design evaluation shall represent the detail, topology, and parameters of the plant with aggregations and simplifications permitted to the extent that verification of plant performance in accordance with the *Standard* is not materially compromised, and has been verified in accordance with Clause 7.2 of the *Standard*.

2.2.4 The Generator Owner shall specify a system representation that is adequate for each test appropriate to local conditions, such that it allows the demonstration of conformity in accordance with performance requirements specified.

2.2.5 The Generator Owner shall provide a comprehensive Design Evaluation Report that includes:

2.2.5.1 Comparison of the verified plant model and the fully detailed single-line diagram of the plant. All simplifications and aggregations shall be clearly identified with justifications provided.

2.2.5.2 Benchmarking of plant model performance between the simulation domains employed for Design Evaluation.

2.2.5.3 Plotted results for each of the tests specified in Clause 7.3 of the *Recommended Practice* with exception of test specified in subclause 7.3.5 (harmonic performance).

2.2.5.4 Results of all Design Evaluation Simulations demonstrating compliance with the requirements of the *Standard*.

2.3 Attestation - The Generator Owner shall submit to the NYISO upon finalization of plant design and prior to entering commercial operation, an attestation that states compliance with the following requirements:

2.3.1 That it has performed IBR unit and supplemental IBR device model validations in accordance with Clause 6 of the *Recommended Practice*.

2.3.2 That the IBR facility models used to represent the *Large IBR Generating Facility* have been verified in accordance with Clause 7.2 of the *Recommended Practice* to be an accurate representation of the equipment that will be installed or has been installed on site.

2.3.3 That it performed, prior to plant entering commercial operation, the design evaluation specified in Clause 7.3 of the *Recommended Practice* and that the *Large IBR Generating Facility* meets applicable performance requirements of the *Standard,* as amended by this document.

2.3.4 That the Generator Owner has created Model Validation and Design Evaluation Reports covering all items in 2.3.1 through 2.3.3 above, and submitted said reports to a Third Party Consultant for review, and to the NYISO upon request.

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2.3.5 That the third-party consultant has reviewed the Model Validation and Design Evaluation Reports and certifies in writing that all simplifications and aggregations in the model are reasonable and immaterial to the conclusions, and that the *Large IBR Generating Facility* can be expected to perform in accordance with the requirements of the *Standard,* as amended by this document.

2.3.6 That the third-party consultant performing this review is an independent qualified entity competent in the review of the information described in the Model Validation and Design Evaluation Reports, with no common ownership with the Generator Owner, was not involved in the development of models or design of the plant, and has been offered no incentives to reach any specific conclusion.

3.0 Commissioning Testing

3.1 As-Built Installation Evaluation - The consistency of models and parameters used in the design evaluation with the as-built Large IBR Generating Facility shall be confirmed in accordance with the procedures specified in Clause 8 of the *Recommended Practice*:

3.1.1 The Generator Owner shall verify that the as-built IBR Plant is consistent with the models used in the Design Evaluation, including:

3.1.1.1 IBR units are of the same make, model, and firmware version

3.1.1.2 Adjustable parameter settings

3.1.1.3 Plant topology

3.1.1.4 Balance of plant parameters (e.g., transformer impedances)

3.1.2 If the as-built evaluation identifies changes to the facility or other material discrepancies between the models used for Design Evaluation and as-built conditions, revision of models and re-performance or partial re-performance of the design evaluation shall be required. Any design evaluation re-performance shall be performed in accordance with the design evaluation procedures as specified in this document.

3.2 Commissioning Tests - Tests shall be performed at the commissioning of the *Large IBR Generating Facility* but prior to entering commercial operation that confirm, to the extent possible, performance in conformity with the requirements of the *Standard* as amended by this document. Commissioning Tests shall be performed and documented in conformance with Clause 9 of the *Recommended Practice:*

3.2.1 The Generator Owner shall submit a detailed Commissioning Test Plan to the Transmission Owner ninety (90) days prior to commencement of plant commissioning tests.

3.2.2 Commissioning tests shall include each of the performance tests specified in Clause 9 of the *Recommended Practice*, with exception of tests specified in Sub-Clauses 9.11 through 9.14.

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3.2.3 If the Transmission Owner wish to propose modifications to the Commissioning Test Plan, those modifications shall be submitted within fourteen (14) days of the Generator Owner's transmittal of the Commissioning Plan to the Transmission Planner. Alternatively, the Transmission Owner may indicate that no changes to the Commissioning Test Plan are needed.

3.2.4 The Generator Owner shall perform the commissioning in accordance with the Commissioning Test Plan. Representatives of the Transmission Owner shall be permitted to witness the commissioning tests.

3.2.5 The Generator Owner shall provide Commissioning Test results in a Commissioning Test Report in sufficient detail to demonstrate conformance of the *Large IBR Generating Facility* performance to the requirements of the *Standard*, as modified by this document, and to allow comparison with results of simulations of the commissioning tests using the plant model to assess plant model accuracy.

3.3 Commissioning Model Validation - The Generator Owner shall perform Commissioning Model Validation of the *Large IBR Generating Facility* in accordance with Clause 10 of the *Recommended Practice*. The Commissioning Report shall be supplemented with comparisons of the actual test results with simulations of the same events and the system conditions present at the time of the commissioning tests, to the extent that these conditions can be determined, using the IBR plant models that were used in the Design Evaluation step:

3.3.1 Any material deviations between simulated and actual performance, not reasonably attributable to unknown transmission system characteristics, shall be investigated and resolved by the Generator Owner.

3.3.2 Any model changes necessary to resolve discrepancies may require repetition of some or all the Design Evaluation to confirm that Plant performance is compliant with all requirements of the *Standard*, including requirements not directly confirmable by field testing (e.g., fault ride-through performance).

3.3.3 The Generator Owner shall document the Commissioning Model Validation in the Commissioning Test Report including comparisons between commissioning tests results and comparable simulation results with explanations of any significant differences with justification that any such differences are immaterial.

3.4 Attestation - The Generator Owner shall submit to the NYISO no later than 365 days after the date of commercial operation, an attestation that states compliance with the following:

3.4.1 That it performed, prior to *Large IBR Generating Facility* entering commercial operation, a verification that the as-built installation and the models used to represent the facility are compliant with the factors listed in Annex G of the *Standard.*

3.4.2 That commissioning tests of the facility have been performed in accordance with Clause 9 of the *Recommended Practice*.

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3.4.3 That the commissioning test results are accurate and consistent with *Recommended Practice*.

3.4.4 That *Large IBR Generating Facility* performance exhibited during commissioning tests are in compliance with the *Standard* as amended by this document.

3.4.5 That Commissioning Model Verification has been performed in accordance with Clause 10 of the *Recommended Practice* and that the model of the *Large IBR Generating Facility*, not inclusive of the external transmission system representation, is identical to the model used for Design Evaluation.

3.4.6 That there are no material differences in the *Large IBR Generating Facility* performance between commissioning test results and simulations of the same events and system conditions performed in the Post-Commissioning Model Verification.

3.4.7 That the current facility models submitted to NYISO remain an accurate representation of the installed equipment (e.g., inverter and control settings, protection settings, etc.) and plant design (e.g., transformed ratings and parameters, inverter type and model, collector impedances, etc.).

3.4.8 That the Generator Owner has created a Commissioning Test Report covering all items in 3.4.1 through 3.4.7 above, and submitted said report to a Third Party Consultant for review, and to the NYISO upon request.

3.4.9 That the third-party consultant has reviewed the Commissioning Test Report and certifies in writing that the commissioning test results are in conformance with performance requirements of the Standard, and that the Post-Commissioning Model Verification does not find any material discrepancies in the accuracy of the *Large IBR Generating Facility* model as used in the Design Evaluation.

3.4.10 That the third-party consultant performing this review is an independent qualified entity, competent in the review of the information described in the Commissioning Test Report, with no common ownership with the Generator Owner, was not involved in the development of models or design of the plant, and has been offered no incentives to reach any specific conclusion.

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