April 27,2023

Mr. Rodger Clayton, Chair
Reliability Rules Subcommittee/Reliability Compliance Monitoring Subcommittee
New York State Reliability Council, L.L.C. (NYSRC)

Dear Mr. Clayton,

The Alliance for Clean Energy New York (ACE NY) and the American Clean Power Association (ACP) appreciate the opportunity to provide feedback on PRR 151 and the adoption of certain aspects of IEEE 2800-2022. On behalf of our member companies that are active in the NYISO market and their review of the standard, the key high-level comments and recommendations from ACE NY stakeholders are:

Timeline of implementation – The timeline of implementation of IEEE 2800-2022 standard should be measured and not rushed, and should consider several factors, such as:

Availability of a testing and verification standard or recommended practice, which is critical before IEEE 2800 – 2022 clauses can be adopted, as this determines the cost of inverters, modeling data, and provides a clear understanding of clauses where IEEE 2800 - 2022 has additional requirements for inverter-based resources (IBRs) compared to the previous standard. In addition, self-certifying compliance without the verification/testing requirements is challenging for Original Equipment Manufacturers (OEMs) and developers. Testing and verification procedures are currently being developed under the IEEE 2800.2 standard, so the timing for implementation of IEEE 2800-2022 should be linked to the finalization of the IEEE 2800.2 standard.

NYISO Queue Reform is underway, potentially transitioning the process from the current serial process to cluster studies, which will have a cost and timeline impact. Considering implementation of IEEE 2800-2022 before the queue reform is complete will increase uncertainty around costs and timeline. Therefore, NYISO and NYSRC should consider the impacts and propose a clear timeline for implementation of the standard.

Retrospective Implementation – IEEE 2800 - 2022 should not be implemented retrospectively as the existing IBR are operational and planned projects have been developed. The base standard itself recommended, "*The application of this standard may be limited to IBR plants for which* ***interconnection requests are submitted after the date by which this standard is enforced*** *by the responsible authority governing interconnection requirements (AGIRs)*." OEMs have supplied equipment for projects based on existing standards and applying a new standard retrospectively

will seriously delay renewable project interconnection. This will add costs that in many cases cannot be recovered as the project is already locked in a power purchase agreement (or in the case of New York, a contract to sell Renewable Energy Credits (RECs) to the New York State Energy Research and Development Authority (NYSERDA). Retroactive application of standards sets a harmful precedent that undermines the business certainty necessary to develop and finance IBR projects. Retroactive standards will delay project completion and could impede the ability to achieve the Climate Leadership and Community Protection Act (CPCLA) goals in New York, impacting NYISO operations.

Clarification on Clauses of the standard – There are several clauses in the IEEE 2800-2022 regarding reactive power capability and performance, primary frequency response, and fault ride through capability and performance, which are new for IBR resources. Therefore, clear guidance on the test and compliance demonstration is needed in the absence of P2800.2. Moreover, the adoption document that refers to clauses from the base standard is ambiguous in some places and therefore further clarification is needed.

These three issues and questions that need clarification are discussed in the following sections:

I. **Incorporation of standard into NYISO interconnection process**
II. **OEM Implementation – IBR capabilities**
III. **Consideration of queue reform**
IV. **Implications of retroactive implementation**
V. **Technical components**

I. Incorporation of standard into NYISO interconnection process

A. Studies and timeline of implementation.

The IEEE 2800 – 2022 covers several areas of transient and sub transient stability studies. While considering implementing the standard into NYISO interconnection process, the following important questions should be fully considered:

a. Is there a roadmap for how these studies will be conducted and evaluated?
b. Typically, EMT analysis is highly time-consuming. How does NYISO intend to conduct these studies without delaying projects?
c. At what stage in the interconnection study process will EMT evaluations take place to determine the costs? As noted below, EMT evaluations based on the requirement provide more value later in the interconnection process once a project has finalized plans for the equipment that will be used.
d. Which party is responsible/required to conduct the EMT studies?

Regarding EMT studies, if a project has interconnection studies performed prior to IEEE P2800.2 (testing and validation procedures) being published, the project should be grandfathered. In the

case that the testing and validation procedure differs from the previous study conducted before IEEE P2800.2 implementation, then they should not be restudied.

EMT models are proprietary. If EMT studies are required during the interconnection process, the models from projects that are owned by others would not be available to developers. The developers can model their own projects, but do not have the ability to develop the models considering other projects. NYISO should consider this while evaluating the system side and provide specifications or requirements for developers to share the model.

e. What is the timeline for demonstrating compliance with the proposed rule based on PRR151 with underlying clauses from IEEE 2800 - 2022? Which projects will be required and when will it be rolled out by NYISO?

Section 10.2 provides the flexibility in model submission, but until details of "design evaluation" are available, it should not be included by NYISO. Stakeholders need further clarity on when the models are required. For example, a feasibility study may only need steady state and short circuit; SRIS may add the dynamic model; and the Class Year may add the EMT model. Therefore, in the process to explore adopting this standard, NYISO should clarify when and where in the process EMT study models are required.

f. Several NERC standard authority requests (SARs) are underway. PRR 151 should not get approved and implemented before the NERC standard, because the rule would need to be revised to accommodate the new standard later to address discrepancies.

B. Study Cost Changes

The New York State Reliability Council (NYSRC) and the NYISO should consider the cost impact of additional studies. EMT studies are normally more costly than system impact studies and need specific expertise. The proposal to adopt this standard needs to consider:

a. Does NYISO have the necessary resources and expertise to conduct these studies?

b. If NYISO needs to outsource EMT studies to external consultants, what would be the cost impact to the developers?

c. How does NYISO intend to allocate study costs for these studies?

d. Will NYISO allow EMT studies contracted by the developer with approved consultants?

C. Criteria for Evaluation

Considering the volume of projects that are in the queue and potential new projects, evaluating all the projects for EMT studies will be extremely challenging.

a. How will the NYSRC and the NYISO determine which projects are subject to system wide EMT evaluation, and is there a criterion for evaluation of projects that should go through these studies? The system wide EMT studies are time consuming and challenging, and they should be optional studies based on criteria set by NYISO.

b. If projects drop from the queue would this trigger EMT restudies?

c. How will clusters be established for EMT studies?

d. In our experience, EMT studies refine the control settings, damping, speed of response, etc. Could this evaluation be done after a material modification is approved and after the Class Year?

e. In connection with this effort, the NYSRC should specify that additional study requirements under the final rule shall not constitute a material modification for IEEE 2800-2022 requirements that do not trigger broader system impact analysis.

D. Data Availability from OEMs

To conduct the reliability analysis, NYISO needs EMT mode (equipment) that complies with IEEE 2800 -2022 from OEMs, which will be input for conducting the analysis. Until the IEEE P2800.2 testing and verification procedures are established, this information will likely not be available. It will be challenging to perform EMT studies since equipment specifications could change in the future to comply with the new requirements. Therefore, it is imperative that OEMs be able to provide correct model data to developers or NYISO to do the reliability analysis of the standard and develop mitigations. If incorrect data is provided as input to these complex sub-transient studies, it would result in erroneous additional costs for the projects.

NYSRC should conduct a survey to check if the OEMs can provide the necessary model data and equipment within the timeline NYSRC would like to implement the IEEE 2800-2022 standard. Implementation must be delayed until this data is available.

a. NYSRC should confirm with inverter manufacturers that the inverter communication cards can adequately respond to the proposed response times as older inverters would need firmware updates to respond as per the new standard.

b. Would NYISO work with OEMs on a timeline for availability of models that are compliant with the requirements?

c. A new IBR will provide its EMT model. Is NYISO going to test the IBR performance connected to an infinite bus only? If not, NYISO will need to develop an EMT model for the existing system, or develop an equivalent, integrate the plant models, and test it. What is the plan to develop such a system wide model?

E. Capital Cost Impacts

The new standard requires additional software and hardware. The associated capital costs should be assessed prior to adopting this standard. Questions to consider include: Do OEMs have a clear understanding of the capital cost impacts to projects? What is the impact on overall project cost, and how can this be minimized?

II. OEM Implementation – IBR capabilities

NYSRC should coordinate with OEMs to conduct a survey to understand the technical feasibility of implementation and associated timelines prior to implementing the standard. As of today, many of the procured inverters cannot satisfy all the requirements of the standard that have been proposed to be adopted through PRR151. With the supply chain issues and the development

timelines which are already difficult to achieve, if the standards require new IBRs to be connected, how can these be procured? How can projects interconnect and support CLCPA goals? There is a huge risk of projects dropping out of the queue.

Slide 10 of the survey[1] conducted by NERC shows that the OEMs expect to deliver IBRs compliant with the standard in 2025-2026. For projects where the equipment is already ordered and in production, the OEMs do not plan to incorporate IEEE 2800 -2022 into the designs. NYSRC should conduct an independent survey like this. Additional time needed for the developers to redesign BOP equipment that can interface/integrate with the new products should be taken into consideration when deciding on compliance timelines.

Section 10.1 of the standard does not provide details of "design evaluation" which are not available to date, and it is being worked on in IEEE P2800.2. Therefore, no adoption clause should refer to such until IEEE P2800.2 is approved and published. Moreover, no clarity on when such "design evaluation" studies will be performed is stated. Submission of a "verified model" is not available. Therefore, the NYSRC and NYISO should not mandate PRR 151 at present, and the NYSRC should commit to more specific language prior to NYISO mandating PRR 151 Section 10 (a).

Details on the scope of "design evaluation study" should be provided before adoption of this requirement. NYISO should work with OEMs on the timelines for availability of models that are compliant with IEEE 2800 – 2022 Appendix G before requiring these models independent of a project. NYSRC and the NYISO need to work with manufacturers to secure proprietary models not available to IBRs. Multiple non-disclosure agreements between the parties will need to be facilitated.

Finally, self-certifying compliance without the verification/testing requirements is challenging for OEMs and developers. This requirement should only be applicable once the detailed testing and verification procedures are defined.

III. Consideration of Queue Reform

Right now, the NYISO is going through a critically important queue reform exercise, which throws another challenge into the implementation timeline. Implementing both IEEE 2800 – 2022 and queue reform has the potential for many projects to be seriously delayed, compromising the ability to interconnect needed generation projects in a timely manner and the ability for New York to meet the goals of the CLCPA. NYSRC and NYISO should coordinate on implementation of both the changes and provide clear guidance that minimizes impacts to IBR projects and IBRs in the queue.

[1] https://www.esig.energy/download/session-2-ieee-2800-oem-readiness-aung-thant/?wpdmdl=9565&refresh=636027209ecc91667245856

IV. Implications of Retroactive Implementation

ACE NY and ACP agree with the NYSRC proposal that IEEE 2800 – 2022 should not be implemented retrospectively, as the existing IBRs which are operational were evaluated with existing grid code compliance requirements in place, and therefore, in many cases will not be able to satisfy the additional requirements of the IEEE 2800 – 2022. Retrofitting or replacing inverters to meet these requirements is not currently necessary to address reliability concerns, is not always possible, and is costly. The additional costs for the projects cannot be recovered as the project is already locked in a power purchase agreement. This sets a harmful precedence that undermines the business certainty necessary to develop and finance IBR projects. This can contribute to delays in IBR project interconnections or discontinue the projects. Eventually this will impact operations due to shortage of supply from IBR resources that would have replaced retired fossil generation. Therefore, NYSRC should closely coordinate with NYISO operations for the implementation of the standard before determining to apply it to existing and planned generation. In addition to not applying retroactively, the standard should not be applied to repowered generation projects or to future material modifications to generation projects. Since these changes do not include a notable change of equipment, it would be challenging to comply with the requirements using existing equipment and is not currently necessary to maintain reliability.

V. Technical Implementation Issues

Several clauses included in IEEE 2800-2022 should be clarified, as these are new requirements for inverter-based resources (IBRs), which were not considered for other types of resources. The following section requests clarification on specific clauses of the standard.

A. Section 5.2 Clause 5.1 Reactive Power Support

Requirements in this clause are not clear, and further clarifications are needed of the language. Base standard clause 5.1 requires reactive power support per Fig.6, including zero active power at a reference point of applicability (RPA). Adoption clause 5.1 states reactive power support at zero active power is needed per base standard clause 5.1. However, in the same paragraph it states reactive power support without energy storage at zero active power is NOT needed unless it is needed per an ancillary service agreement with the NYISO. These two statements are contradictory in nature and need clarification.

Please note at zero active power, in the case of a wind turbine generator (if such is due to lack of wind and wind speed is below cut in speed), reactive power capability gets limited by cooling. Therefore, one needs to account for such while adopting clause 5.1 of the base standard and provide flexibility. For solar projects, insulated gate bipolar transistor (IGBT) technology in inverters allows for reactive power generation including at zero active power. For some manufacturers, it is an add-on when purchasing that the developer will need to specify.

If a resource does not want to participate in ancillary service, does it not need to support reactive power at zero active power? Adoption of clause 5.1 would require significant auxiliary power in

addition to the add-on night var capability. Therefore, more clarity is needed on the exception for capability at zero active power.

B. Section 5.3 Clause 5.1

Adoption clause 5.3 states, "The time response shall not be degraded by repetition of voltage change events or changes of required reactive power." Please provide clarity on this requirement as this is a qualitive statement, and no compliance can be shown in a quantitative manner.

Adoption clause 5.3 also states, "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." There is no such definition of continuous reactive power in the base standard. Moreover, base standard clause 5.2.2 Table 5 allows use of switched shunt/tap changer up to 60s to restore dynamic capability of IBR equipment. Considering such, restricting reactive power's step less than 1% is overly conservative and not just. Finally, in a weak grid due to step change in voltage reference, IBR's reactive response resembles step change, and something erroneous might constitute a noncompliance.

The request is to remove the additional definition of "dynamic reactive power" in adoption clause 5.3.

C. Section 5.4 Clause 5.2.2

Regarding clause 5.2.2, stakeholders will need clarification of the performance requirement based on close-loop control + droop setting. Specifically, does the footnote 3 example for voltage droop clearly demonstrate the requirement?

D. Section 5.5- Clause 5.2.2

We appreciate the reference to Short Circuit Ratio (SCR) while meeting Table 5 of clause 5.2.2 of the base standard. However, reducing maximum step response time from 30s to 10s is NOT acceptable. In a weak system, such an aggressive step response might aggravate system damping. The request is to provide the range of step response per base standard clause 5.2.2 Table 5 of 1-30s.

Tap changer should not respond in less than 10s. This will cause too many operations and premature wear. The minimum SCR identified in the studies could potentially be too low for a stable fast response. There is a need to account for weak systems when requiring the fast response times as the fast controls may result in instability. A step response time of 10 seconds is too aggressive.

Please clarify the definition of short-circuit strength. Is it system strength or short circuit ratio? Can this value be extracted from the impact studies?

E. Section 6.1 Clause 6.1.1

For an IBR plant with energy storage capability, does the plant provide primary frequency response when not dispatched into market (*i.e*., dispatched to 0 MW)? Are there minimum states of charge for an IBR plant with energy storage capability where the resource is no longer required to provide primary frequency response? Please confirm that there is no lower limit for the minimum active power capability.

F. Section 7.2 Clause 7.2.2.2

The adoption clause states, "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), than twice the magnitude of abrupt voltage change, in per-unit of the nominal voltage." Please provide clarification and justification behind the specific adoption language beyond the stated language in the base standard IEEE 2800-2022.

G. Section 7.4 Clause 7.2.2.3.2

Adoption clause 7.3 states, "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." Base standard clause 7.2.2.2 provides the flexibility to consult with IBR owner on time duration of negative sequence voltage withstand capability. Therefore, the 2s withstand capability should be replaced with allowing mutual agreement of time duration with IBR owner.

H. Section 7.5 Clause 7.2.2.3.4

Adoption clause 7.4 states, “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 or design evaluation studies and with consideration of the characteristics of the IBR units, with default relationships as proposed by the IBR owner." The magnitude of the reactive component of the current can be determined by NYISO based on the interconnection/design evaluation studies but NOT the relationship. If an IBR's reactive current injection in FRT mode is based on the K factor method, then such cannot be changed to PI control and vice versa. Therefore, "relationship" should be replaced with "magnitude". This is also consistent with base standard clause 7.2.2.3.2.

I. Section 7.7 Clause 7.2.2.3.5

We appreciate the flexibility to meet Table 13 the base standard offered in adoption clause 7.7.

J. Section 7.8 Clause 7.2.2.4

Please clarify if adoption clause 7.2.2.4 is the base standard. The adoption of clause 7.2.2.4 in base standard in absence of testing procedures is particularly challenging. No OEM is willing to confirm

their ability to meet clause 7.2.2.4 without further clarity on testing. Therefore, this clause should NOT be adopted until IEEE P2800.2 is approved and published.

K. Section 9.9 Clause 7.2.2.4

This statement in the adoption clause 7.9 is unclear, "Exception to the requirements of Clause 7.2.2.4 of the Standard shall be defined by the NYISO." In the base standard, clause 7.2.2.4 already specifies that exceptions will be made between the IBR owner and TS Owner/TS Operator. Those exceptions were vetted in IEEE 2800 - 2022 thoroughly, and one single entity should not be allowed to make their own determination.

Conclusion

Again, the member companies of ACE NY and ACP that are active in the NYISO market sincerely appreciate the opportunity to comment on PRR 151 and the adoption of IEEE 2800-2022 by the New York State Reliability Council. While we have raised many technical issues with these comments, as well as questions that need clarification, we particularly note the issues of timing and grandfathering. We believe that a rapid adoption of this standard – especially without a full exploration of the questions raised – is premature. An overly hasty adoption will inevitably create issues of fairness, cost, disruption of the market, and further risk to New York's ability to meet its renewable electricity and climate action goals. We hope these issues are fully considered as you continue your deliberations.

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