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| PGRR Number | [109](https://www.ercot.com/mktrules/issues/PGRR109) | PGRR Title | Dynamic Model Review Process Improvement for Inverter-Based Resource (IBR) Modification |

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| Date | October 17, 2023 |

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| Market Segment | Independent Generator |

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| Comments |

Southern Power Company, EDF Renewables, Invenergy, and Luminant (“Joint Commenters”) appreciate the opportunity to comment on Planning Guide Revision Request (PGRR) 109 and offer language amendments that align with ERCOT’s aim to improve Inverter-Based Resource (IBR) model quality while preserving operational autonomy and responsiveness. ERCOT has recently proposed a suite of new policies designed to improve grid performance during voltage and frequency disturbances, including IBR ride-through requirements,[[1]](#footnote-1) the West Texas Synchronous Condenser Project, ride-through requirements for large loads,[[2]](#footnote-2) high-resolution data recording requirements,[[3]](#footnote-3) and dynamic model review process improvement for IBRs—the subject of these comments.

In its presentation of this policy suite to the Reliability and Markets Committee on June 19, 2023, ERCOT described the policy goal of PGRR109 as “supplement current model benchmarking requirements by requiring ERCOT and transmission operator ***notification*** before ***parameter changes*** are implemented in the field.”[[4]](#footnote-4) However, the language proposed in this revision request goes far beyond simple notification. Instead, PGRR109 would create a burdensome pre-approval process for any equipment or settings modification that will stress the resources of IBR owners, Transmission Service Providers (TSPs), and ERCOT staff alike. The Joint Commenters especially highlight the following concerns with ERCOT’s proposed language:

1. The fact that even minor settings or equipment changes could trigger a Generator Interconnection or Modification (GIM) request.
2. The lengthy review period added to an already tight pre-commissioning timeline established in PGRR103.
3. The lack of any definition or threshold for the types of equipment or settings changes that would precipitate the need for a pre-approval.[[5]](#footnote-5)
4. The current challenges in obtaining updated models from vendors and in successfully submitting a package deemed acceptable to ERCOT. An increased frequency of model updates for minor settings and equipment changes would exacerbate an already complicated process and could result in an infinite modeling-benchmarking loop to comply with the requirements in PGRR109 and in Planning Guide Section 6.
5. The fact that this proposed revision request overtakes current North American Electric Reliability Corporation (“NERC”) Standards MOD-026-1 and MOD-027-1 as well as the newest version of MOD-026-2 currently being drafted.[[6]](#footnote-6)

As such, Joint Commenters respectfully request that ERCOT and Market Participants consider the following changes proposed in these comments:

* Remove the addition of IBR settings and equipment changes in paragraph (1)(c) of Planning Guide Section 5.2.1, Applicability.
* Ensure that ERCOT’s review period for models during the pre-commissioning process would not count against the time limit for Part 3 testing established in PGRR103.[[7]](#footnote-7)
* Specify that only equipment changes that affect the dynamic response of the facility at the Point of Interconnection (POI), in addition to changes described in the existing Section 5.2.1, would require the need for an updated model review prior to implementation.
* Eliminate the pre-approval process for settings changes, but require IBR owners to submit an updated dynamic model for settings changes that affect dynamic response at the POI for review within 180 days following implementation.

**Adding Broad Language to Applicability May Have Adverse, Unintended Consequences**

Joint Commenters strongly recommend removing subparagraph (1)(c)(iii) from Section 5.2.1. Any Resource Entity subject to the Applicability section must initiate a GIM request, provide requested supporting documentation, and pay the Generation Interconnection Fee.[[8]](#footnote-8) The process requires additional testing and modeling requirements – harmonics, reactive studies, grounding, cable studies, etc.

Moreover, NOGRR245 as proposed by ERCOT[[9]](#footnote-9) also references this section. Any modification in paragraph (1)(c) of Section 5.2.1, for which an IBR initiates a GIM on or after June 1, 2023, and such modification is implemented after January 1, 2028, would also require full compliance with voltage ride-through requirements and must meet or exceed Sections 5, 7, and 9 of the Institute of Electric Engineers (“IEEE”) 2800-2022, Standard for Interconnection and Interoperability of Inverter-Based Resources (IBRs) Interconnecting with Associated Transmission Electric Power Systems (“IEEE 2800-2022 standard”).

The other items in the current Applicability section are all major modifications that could be characterized as a repowering or retrofit. IBR settings and equipment changes, including minor settings modifications, should not be included in this section. Joint Commenters believe that ERCOT and the TSP can properly evaluate applicable inverter settings changes through a dynamic stability study without adding the requirement to the Applicability section. Conversely, keeping the proposed subparagraph (1)(c)(iii) in the language may create adverse and unintended consequences due to the references to this section made by the Nodal Operating and Planning Guides.

**Continuing Operations - Notification After Implementation Is a Better Approach Than Pre-Approval**

In PGRR109, ERCOT implicitly delegates to themselves the exclusive authority to approve or reject equipment and control settings modifications at existing IBRs. As proposed, IBR owners must submit for review “any modification to settings or equipment […] that affects electrical performance.” The proposed process may take up to approximately 170 days[[10]](#footnote-10) to fully approve or reject the settings or equipment change based on ERCOT’s assessment for the need to perform a limited dynamic stability study. ERCOT has so far been reluctant to further define or clarify the type of settings changes that would trigger the review process outlined in PGRR109. This forces an interpretation that “any” modification, even minor changes, could trigger a lengthy review process.

Joint Commenters are willing to submit updated models prior to the implementation of certain equipment modifications—namely, equipment modifications that would alter the dynamic response at the POI in addition to the facility modifications listed in the existing Applicability section.

Joint Commenters believe that notifying ERCOT of settings changes after implementation is a better approach, for several reasons.

1. To obtain the best plant performance, IBR owners tune settings through an iterative process. Additionally, troubleshooting often requires a process in which multiple settings are adjusted in series or in tandem to isolate the problem. In certain scenarios, IBR owners simply would not be able to forecast which settings adjustments will ultimately be needed to comply with a pre-approval process.
2. Submitting a model prior to implementing a change does not make sense operationally. A generator typically will first implement settings change(s) to generate the field response and data output necessary for model accuracy measurement.
3. A review process prior to making settings changes effectively takes quick-response actions off the table. In addition to the review period, which may take up to approximately 170 days as proposed in ERCOT’s comments, the time to procure updated models from vendors or consultants is not insignificant. Obtaining updated models can (and routinely does) take months and is also generally an iterative process.
4. Notification after-the-fact preserves the autonomy of IBR operators to maintain flexibility and discretion of decision-making in real-time operations. While ERCOT may allow temporary authorizations “to address any identified performance deficiency,” Joint Commenters are concerned that this will not cover all scenarios in which an IBR Owner would need to make quick responses in the field necessary for reliability and optimal plant performance.
5. This is the industry-established recommendation found in NERC Standards MOD-027-1 and MOD-026-1, Requirement 4.

**Pre-Approval Will Add Burden to IBR Owners, OEMs, and TSPs in an Already Constrained Process.**

Joint Commenters agree that significant settings or equipment changes that change the dynamic response at the POI should result in a correlating model update and review process. We are concerned, however, that the proposed language of PGRR109 may exacerbate existing challenges in obtaining model updates. Obtaining accurate, timely model updates from Original Equipment Manufacturers (“OEMs”) is an ongoing challenge for IBR owners. Procuring an updated dynamic model package can take weeks to months to complete. In cases when the vendor goes out of business or when the inverter equipment models are discontinued, it becomes extremely difficult to obtain the required updates.

Joint Commenters agree the core purpose of all modeling efforts is to maintain the most accurate and reliable facility models available, preferably via User-Defined Models (“UDMs”) validated by the equipment manufacturer.[[11]](#footnote-11) However, our industry experience indicates that often generic models offer the only attainable source of dynamic modeling information. In many instances, these generic models are vendor provided and represent the closest approximation of the existing facility for the intended studies—but these may not be as precise for every setting parameter as UDMs often are. Therefore, implementation of PGRR109 requirements as proposed by ERCOT may result in redundant efforts on IBR owners, TSPs, and ERCOT Staff since the generic model output may not be demonstrably different from a pre-settings change version for many parameter settings changes in the field.

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| Revised Cover Page Language |

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| Requested Resolution  | Normal  |
| Planning Guide Sections Requiring Revision  | 5.2.1, Applicability5.5, Generator Commissioning and Continuing Operations6.2, Dynamics Model Development |
| Related Documents Requiring Revision/Related Revision Requests | None |
| Revision Description | This Planning Guide Revision Request (PGRR) introduces a new requirement for Interconnecting Entities (IEs) associated with Inverter-Based Resources (IBRs) to undergo a dynamic model review process prior to Resource Commissioning Date. Additionally, this PGRR mandates that Resource Entities owning or controlling operational IBRs must undergo a review process before implementing any changes to equipment that could impact the dynamic response of the facility at the Point of Interconnection (POI) and necessitate dynamic model updates. To align with data verification and modeling requirements in the North American Electric Reliability Corporation (NERC) Standards MOD-026-1 and MOD-027-1, this PGRR proposes that Resource Entities owning or controlling operational IBRs must submit dynamic model updates within 180 days of making changes to settings that impact the dynamic response of the facility at the POI and necessitate dynamic model updates.As part of the review process, ERCOT shall review the model quality tests submitted by an IE or Resource Entity. In the case of operational IBRs, the review process may require the interconnecting Transmission Service Provider (TSP) conducting a limited dynamic stability study to compare and evaluate the electrical performance before and after the proposed modifications. |
| Reason for Revision |  Addresses current operational issues. Meets Strategic goals (tied to the [ERCOT Strategic Plan](http://www.ercot.com/content/wcm/lists/144926/ERCOT_Strategic_Plan_2019-2023.pdf) or directed by the ERCOT Board). Market efficiencies or enhancements Administrative Regulatory requirements Other: (explain) Improves dynamic model review process.*(please select all that apply)* |
| Business Case | IBRs have distinct design and operational characteristics compared to conventional synchronous generators. Unlike synchronous generators, the performance of IBRs relies mainly on power electronics controls, which make them highly responsive and sensitive to even minor adjustments in control settings. Therefore, even minor adjustments to control settings can have a substantial impact on the grid.Currently, there is no review process in place for IBRs before the Resource Commissioning Date to ensure that the "as-built" data accurately represent the parameters and performance of the as-studied data that were used in the quarterly stability assessment. Before a new IBR can commence commercial operation, it should provide substantial evidence demonstrating that its as-built performance and installed control parameters align with the model utilized in the quarterly stability assessment.In addition, if modifications to operational IBRs fall outside of applicability as described in paragraph (1)(c) of Section 5.2.1, Applicability, Resource Entities are not required to undergo any review process. The only requirement is for Resource Entities to submit dynamic model updates, model quality tests, and plant verification reports after implementing the changes in the field. Modifications made to settings or equipment by Resource Entities without undergoing a review process can potentially result in unexpected trips or unstable responses during disturbances. Having a proper review process in place is crucial to ensuring that such modifications are thoroughly reviewed before being implemented in the field.This PGRR is aligned with the recommendations from the NERC as described in the 2022 Odessa Disturbance report.  |

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| Revised Proposed Guide Language |

**5.2 General Provisions**

***5.2.1 Applicability***

(1) The requirements in Section 5, Generator Interconnection or Modification, apply to the following:

(a) Any Entity proposing to interconnect any generator with an aggregate nameplate capacity of one MW or greater, including but not limited to any Generation Resource or Energy Storage Resource (ESR), to the ERCOT System;

(b) Any Entity proposing to interconnect a Settlement Only Generator (SOG) to the ERCOT System; or

(c) Any Resource Entity seeking to modify a Generation Resource, ESR, or SOG that is connected to the ERCOT System by:

(i) Increasing the real power rating from that shown in the latest Resource Registration data by one MW or greater within a single year;

(ii) Changing the inverter, turbine, generator, or power converter associated with a facility with an aggregate real power rating of ten MW or greater, unless the replacement is in-kind;

(iii) Changing or adding a Point of Interconnection (POI) to a facility with an aggregate real power rating of ten MW or greater; or

(iv) Increasing the aggregate nameplate capacity of a generator less than ten MW to ten MW or greater.

(2) For the purposes of Section 5, the term “generator” includes but is not limited to a Generation Resource, SOG, and ESR.

(3) For the purposes of determining the appropriate requirements in Section 5, a generator is considered a “large generator” if it currently has or is proposed to have an aggregate nameplate capacity of ten MW or greater. A generator is considered a “small generator” if it currently has or is proposed to have an aggregate nameplate capacity of less than ten MW.

(4) Notwithstanding paragraph (3), above, if a Resource Entity is proposing to increase the real power rating of an existing generator by one MW or greater but less than ten MW, that generator shall be considered a small generator for the purposes of the interconnection process described in Section 5.

(5) Notwithstanding paragraphs (3) and (4), above, if a Resource Entity is proposing to increase a generator’s real power rating by ten MW or more, or is proposing to increase a generator’s real power rating from less than ten MW to ten MW or more, that generator shall be considered a large generator for the purposes of the interconnection process described in Section 5.

(6) For the purposes of determining the appropriate requirements in Section 5, ERCOT may require two or more separate generator interconnection requests to the same substation to follow the interconnection process applicable to the large generators, if, following the proposed change, those generators would have an aggregate nameplate capacity of ten MW or greater, and the projects are proposed by the same Entity or Affiliates.

(7) For a new or modified generator that has been designated as a Self-Limiting Facility or as a component of a Self-Limiting Facility, the categorization of the generator as a small generator or large generator pursuant to paragraphs (3) through (5) above shall be determined using the Self-Limiting Facility’s established limit on the total MW Injection, or if applicable, the proposed increase in that value instead of the nameplate capacity of the Self-Limiting Facility.

**5.5 Generator Commissioning and Continuing Operations**

(1) Each Interconnecting Entity (IE) shall meet the conditions established by ERCOT before proceeding to Initial Energization, Initial Synchronization, and commercial operations. These conditions may require proof of meeting applicable ERCOT requirements, which may include, but are not limited to, reactive capability, voltage ride-through standards, dynamic model template submission, Automatic Voltage Regulator (AVR), Primary Frequency Response (PFR), Power System Stabilizer (PSS), Subsynchronous Resonance (SSR) models, and telemetry.

(2) Prior to the Resource Commissioning Date of an Inverter-Based Resource (IBR), the IE associated with the IBR shall submit the appropriate dynamic models for the “as-built” data and the data submitted for the quarterly stability assessment, documentation clearly indicating any differences, results of the model quality tests of the “as-built” data overlaid with the results of the data submitted for the quarterly stability assessment, and associated simulation files pursuant to paragraph (5)(c) of Section 6.2, Dynamics Model Development. Submissions shall be sent electronically to Dynamicmodels@ercot.com for ERCOT review, and the phrase "IBR prior to commissioning" must be included in the subject line of the submission email. ERCOT shall respond to the IE within 10 Business Days of the submission, indicating whether the submission is acceptable or if additional information is required. If additional time is needed for review, ERCOT can extend this review period by up to an additional 20 Business Days, and an email will be sent to notify the IE that it needs additional time to review the submission. The time for ERCOT to review models and associated documentation will be a qualified cause to extend the allowed time to complete the conditions established by ERCOT for commercial operations. The IE shall track and include accumulated delays in any request for extension of the time limit for completion of the conditions for commercial operations.

(3) No later than 30 days following the Resource Commissioning Date, the IE shall submit updates to the resource dynamic planning and operations models through the online Resource Integration and Ongoing Operations (RIOO) system based on “as-built” data and provide a plant verification report as required by paragraph (5)(b) of Section 6.2. Pursuant to paragraph (5)(c) of Section 6.2, the IE shall include model updates with model quality tests.

(4) During continuing operations:

(a) Prior to the implementation of modification to equipment associated with IBRs that would alter the dynamic response of the facility at the Point of Interconnection (POI) and requires dynamic model updates, and not already described in paragraph (1)(c) of Section 5.2.1, Applicability, the proposed modification shall be reviewed by the interconnecting Transmission Service Provider (TSP) and ERCOT:

(i) The Resource Entity shall submit the appropriate dynamic model for the proposed modification, results of the model quality tests overlaid with the results before the modification, and associated simulation files pursuant to paragraph (5)(c) of Section 6.2. Submissions shall be sent electronically to Dynamicmodels@ercot.com for ERCOT review, and the phrase "IBR proposed modification" must be included in the subject line of the submission email. The Resource Entity may withdraw its modification plan at any time during the review process if the Resource Entity no longer wishes to proceed with the modification.

(ii) ERCOT shall respond to the Resource Entity within 10 Business Days of the submission in paragraph (i) above, indicating whether the submission is acceptable or if additional information is required. ERCOT can extend this review period by up to an additional 20 Business Days, and an email will be sent to notify the Resource Entity that it needs additional time to review the submission.

(iii) Upon completing its review of the model quality tests, ERCOT shall notify the Resource Entity and the interconnecting TSP of its determination. The notification will indicate one of the following:

(A) ERCOT recommends that the interconnecting TSP conduct a limited dynamic stability study comparing electrical performance before and after the proposed modification, and reasonably evaluate whether the proposed modification may present dynamic stability risks that should be subject to further study.

(B) The proposed modification is applicable to paragraph (1)(c) of Section 5.2.1. The Resource Entity shall initiate a Generator Interconnection or Modification (GIM) request through RIOO.

(C) The proposed modification is deemed unacceptable.

(D) The proposed modification is deemed acceptable without need for a dynamic stability study.

(iv) Within 90 days of the receipt of the accepted submission in paragraph (iii)(A) above, the interconnecting TSP shall submit its dynamic stability study report to ERCOT electronically to Dynamicmodels@ercot.com.

(v) ERCOT shall review the dynamic stability study report submitted by the interconnecting TSP within 10 Business Days.  ERCOT can extend this review period by up to an additional 20 Business Days, and an email will be sent to notify the interconnecting TSP and the Resource Entity that it needs additional time to review the dynamic stability study report.

(vi) Upon completing its review and ERCOT acceptance of the dynamic stability study report, ERCOT shall notify the Resource Entity and the interconnecting TSP of its determination. The notification will indicate one of the following:

(A) The proposed modification is deemed acceptable.

(B) The proposed modification is applicable to paragraph (1)(c) of Section 5.2.1. The Resource Entity shall initiate a GIM request through RIOO.

(vii) ERCOT, in consultation with the interconnecting TSP, may allow the proposed changes to be temporarily implemented prior to the completion of the above review process in order to address any identified performance deficiency.

(b) When there have been modifications to settings associated with IBRs that alter the dynamic response of the facility at the POI and require dynamic model updates as required by paragraph (5) of Section 6.2, the Resource Entity will notify ERCOT of the modification in RIOO as soon as practicable and those updated models shall be submitted to ERCOT within 180 days of making the modification(s) and be reviewed by the interconnecting TSP and ERCOT:

(i) The Resource Entity shall submit the appropriate dynamic model reflecting the modification(s), results of the model quality tests overlaid with the results before the modification(s), and associated simulation files pursuant to paragraph (5)(c) of Section 6.2. Submissions shall be sent electronically to Dynamicmodels@ercot.com for ERCOT review, and the phrase "IBR settings modification" must be included in the subject line of the submission email. The Resource Entity may withdraw its model modification at any time during the review process if the Resource Entity reverts the modification of settings.

(ii) ERCOT shall respond to the Resource Entity within 10 Business Days of the submission in paragraph (i) above, indicating whether the submission is acceptable or if additional information is required. ERCOT can extend this review period by up to an additional 20 Business Days, and an email will be sent to notify the Resource Entity that it needs additional time to review the submission.

(iii) Upon completing its review of the model quality tests, ERCOT shall notify the Resource Entity and the interconnecting TSP of its determination. The notification will indicate one of the following:

(A) ERCOT recommends that the interconnecting TSP conduct a limited dynamic stability study comparing electrical performance before and after the settings modification, and reasonably evaluate whether the settings modification may present unintended dynamic stability risks that should be subject to further study.

(B) The settings modification is deemed unacceptable, and settings changes should be reverted.

(C) The settings modification is deemed acceptable without need for a dynamic stability study.

(iv) Within 90 days of the receipt of the accepted submission in paragraph (iii)(A) above, the interconnecting TSP shall submit its dynamic stability study report to ERCOT electronically to Dynamicmodels@ercot.com.

(v) ERCOT shall review the dynamic stability study report submitted by the interconnecting TSP within 10 Business Days. ERCOT can extend this review period by up to an additional 20 Business Days, and an email will be sent to notify the interconnecting TSP and the Resource Entity that it needs additional time to review the dynamic stability study report.

(vi) Upon completing its review and ERCOT acceptance of the dynamic stability study report, ERCOT shall notify the Resource Entity and the interconnecting TSP of its determination. The notification will indicate one of the following:

(A) The modification is deemed acceptable.

(B) The settings modification is deemed unacceptable, and settings changes should be reverted within five days of notification.

(c) Pursuant to paragraph (5)(c) of Section 6.2, the Resource Entity shall include model updates with model quality tests.

(d) The Resource Entity shall provide ERCOT with a plant verification report as required by paragraph (5)(b) of Section 6.2 at the following times:

(i) No later than 30 days after implementing a settings change as required by paragraph (7) of Section 6.2 for changes that do not require dynamic model updates, and no later than 180 days after implementing settings changes that do require model updates;

(ii) No earlier than 12 months and no later than 24 months following the later of the Resource Commissioning Date or March 1, 2021; and

(iii) A minimum of every ten years.

6.2 Dynamics Model Development

(1) To adequately simulate dynamic and transient events in the ERCOT System, it is necessary to establish and maintain dynamics data and simulation-ready study cases representing the dynamic capability and frequency characteristics of machines and equipment connected to the ERCOT System.

(2) Dynamics data is the network data and mathematical models required in accordance with the Reliability and Operations Subcommittee (ROS)-approved Dynamics Working Group Procedure Manual for simulation of dynamic and transient events in the ERCOT System.

(3) For Resource Entities, dynamics data includes the data needed to represent the dynamic and transient response of Resource Entity-owned devices and/or Loads including but not limited to generating units, plants, and other equipment when connected to the ERCOT System including the data for any privately owned transmission system or collection system used to connect the Resource to the ERCOT System.

(4) For Transmission Service Providers (TSPs), dynamics data needed to represent the dynamic and transient capability of TSP-owned devices including but not limited to Load shedding relays, protective relays, FACTS devices (e.g., SVC, STATCOMs), Direct Current Ties (DC Ties), variable-frequency transformers, automatically switched shunts, and transformers with automatic load tap changers.

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| [PGRR101: Replace paragraph (4) above with the following upon system implementation of NPRR1133:](4) For Transmission Service Providers (TSPs) and owners of Direct Current Ties (DC Ties), dynamics data includes the data needed to represent the dynamic and transient capability of dynamic devices including but not limited to Load shedding relays, protective relays, FACTS devices (e.g., SVC, STATCOMs), DC Ties, variable-frequency transformers, automatically switched shunts, and transformers with automatic load tap changers. |

(5) The owner of a generator Facility or any dynamic device shall provide appropriate dynamics data to ERCOT, including the data for a planned Facility, in accordance with the Dynamics Working Group Procedure Manual. The dynamic data shall include the following:

(a) A model with parameters that accurately represent the dynamics of the device and that is compatible with the current version of the planning and operations model software as described in the Dynamics Working Group Procedure Manual. If a user written model is provided:

(i) A model manual containing a technical description of the model characteristics, including descriptions for all model parameters and variables, a list of which parameters are commonly tuned for site-specific settings, and a description of procedures and considerations for using the model in dynamic simulations, including steady state representation and limitations for model adequacy and usability in the planning and operations model software; and

(ii) The user-written model shall allow the user to determine the allocation of machine identifiers (bus numbers, bus names, machine IDs etc.) without restriction.

(b) Verification reports that support the model data based on documented field settings shall be provided as specified in the Dynamics Working Group Procedure Manual for Generation Resources, Energy Storage Resources (ESRs), and for Transmission Elements represented by a dynamic model. The reports shall demonstrate that the model parameters which are commonly tuned match site-specific settings implemented in the field. For new Generation Resources and ESRs, these reports shall be provided as required in paragraph (3) of Section 5.5, Generator Commissioning and Continuing Operations. For existing Generation Resources and ESRs, these reports shall be provided as required in paragraph (4) of Section 5.5. For Transmission Elements represented by a dynamic model, these reports shall be provided no later than two years following energization of new equipment and updated a minimum of every ten years.

(c) Results of model quality tests and associated simulation files that demonstrate acceptable performance of the models in the planning model and operations software as described in the Dynamics Working Group Procedure Manual. The Facility owner shall provide updated information whenever it provides a new or updated dynamic model to ERCOT representing a Generation Resource, ESR, or Transmission Element. These tests ensure the quality of the provided dynamic data and models for use in numerous system studies and consistency across planning and operations software platforms. Therefore, the Facility owner shall also assess sufficient sensitivities, including but not limited to Voltage Set Point at the Point of Interconnection (POI), real power output, and Reactive Power output to ensure acceptable model performance over the entire range of operating conditions. The Facility owner shall provide an explanation if model responses do not match.

(i) Facility owners shall include all site-specific dynamic models representing the Facility in the model quality tests. Facility owners can perform the tests in a simple test system without requiring ERCOT System information.

(ii) For Intermittent Renewable Resource (IRR) equipment aggregated together to form an IRR in accordance with paragraph (13) of Protocol Section 3.10.7.2, Modeling of Resources and Transmission Loads, the dynamic model shall represent the aggregated IRR.

(iii) Results for the following model quality tests shall be provided to demonstrate acceptable model performance. Additional details about each test, including the set up and description of desirable response, are included in the Dynamics Working Group Procedure Manual.

(A) Flat start test: A no-disturbance test shall be performed to demonstrate appropriate model initialization and the Facility’s dynamic response under a no-disturbance condition.

(B) Small voltage disturbance test: A voltage step increase and decrease shall be applied to the POI to demonstrate the Facility’s dynamic response.

(C) Large voltage disturbance test:

(1) For IRRs, ESRs, and inverter-based transmission equipment, the high and low voltage ride-through profiles as described in Nodal Operating Guide Section 2.9.1, Voltage Ride-Through Requirements for Intermittent Renewable Resources Connected to the ERCOT Transmission Grid, shall be applied to the POI to demonstrate the Facility’s dynamic response.

(2) For Resources other than IRRs, ESRs, and inverter-based equipment, a fault shall be applied to the POI to demonstrate the Facility’s dynamic response.

(D) Small frequency disturbance test: A frequency step increase and decrease shall be applied to the POI to demonstrate the Facility’s dynamic response.

(E) System strength test: The model for IRRs and inverter-based Resources shall be tested under a few equivalent short circuit ratios, as described in the Dynamics Working Group Procedure Manual. This tests the robustness of the model to varying system conditions.

(d) Inverter-Based Resources (IBRs) shall provide results of the unit model validation to demonstrate that the PSCAD model, as described in the Dynamics Working Group Procedure Manual, accurately represents the dynamic responses of all inverter-based dynamic devices within the Facility. This validation is not intended to be site-specific; rather it is intended to be a hardware type test, where models representing different inverter hardware are benchmarked for accuracy. Validation results for a specific model of inverter can be submitted for multiple uses of that model of inverter.

(i) The validation results shall be included when submitting a PSCAD model to ERCOT.

(ii) Results for the following unit model validation tests shall be provided to demonstrate model accuracy. Additional details about each test are included in the Dynamics Working Group Procedure Manual.

 (A) Step change in voltage;

 (B) Large voltage disturbance (voltage ride-through tests);

 (C) System strength test;

 (D) Phase angle jump test; and

 (E) Subsynchronous test.

(6) Dynamics data for a planned Facility will be updated by the Facility owner upon completion of the design for the Facility.

(7) Updated dynamics data for an existing Facility shall be provided to ERCOT when field tests, inspections, or other information demonstrates that the dynamics data should be changed to accurately represent the dynamic characteristics of the Facility.

(8) Dynamics Data is considered Protected Information pursuant to Protocol Section 1.3, Confidentiality.

(9) Dynamics data shall be provided with the legal authority to provide the information to all TSPs. If any of the information is considered Protected Information, the Facility owner shall indicate as such.

1. Nodal Operating Guide Revision Request (“NOGRR”) 245, Inverter-Based Resource (IBR) Ride-Through Requirements. [↑](#footnote-ref-1)
2. Nodal Protocol Revision Request (“NPRR”) 1191 Registration, Interconnection, and Operation of Customers with Large Loads; Information Required of Customers with Loads 25 MW or Greater, and related revision requests. [↑](#footnote-ref-2)
3. NOGRR 255, High Resolution Data Requirements. [↑](#footnote-ref-3)
4. Emphasis added, “[Item 7.2.1: Inverter-Based Resource and Large Load Ride Through Events: Background and Mitigation](https://urldefense.com/v3/__https%3A/www.ercot.com/files/docs/2023/06/12/7-2-1-inverter-based-resource-and-large-load-ride-through-events-background-and-mitigation.pdf__;!!FvyJbJE!U2CK9gBxTwS9j8kiOGHIYs7Grp9CjLqLUs2HhtkW7-YcZgRZ9Gd_a4fxRZJi-Tut0nphHu2-75KTxtCXlJPXZgk$)” presentation at slide 8, made at Reliability and Markets Committee meeting, June 19, 2023. [↑](#footnote-ref-4)
5. NERC Reliability Standard [FAC-002-4](https://www.nerc.com/pa/Stand/Reliability%20Standards/FAC-002-4.pdf) requires the Planning Coordinator to maintain a publicly available definition of “qualified change.” NERC provides suggestions for IBR settings and equipment qualified changes in the [Implementation Guidance for FAC-002-4](https://www.nerc.com/pa/comp/guidance/EROEndorsedImplementationGuidance/FAC-002-4%20R6%20Definition%20of%20Qualified%20Change%20%282020-05%20SDT%29.pdf) (August 2022). [↑](#footnote-ref-5)
6. Requirement 4 in [MOD-027-1](https://www.nerc.com/pa/Stand/Reliability%20Standards/MOD-027-1.pdf) states “Each Generator Owner shall provide revised model data or plans to perform model verification (in accordance with Requirement R2) for an applicable unit to its Transmission Planner within 180 calendar days of making changes to the turbine/governor and load control or active power/frequency control system that alter the equipment response characteristic.” Moreover, the Transmission Planner should respond within 90 calendar days of receiving the verified model information (Requirement 5). The 180-day timeline is also referenced in [MOD-026-1](https://www.nerc.com/pa/Stand/Reliability%20Standards/MOD-026-1.pdf) Requirement 4. [↑](#footnote-ref-6)
7. Planning Guide Section 5.5 (2) as proposed in PGRR103 – see [PGRR103 Board Report](https://www.ercot.com/files/docs/2023/09/04/103PGRR-24%20Board%20Report%20083123.docx) dated August 31, 2023. [↑](#footnote-ref-7)
8. Per Planning Guide Section 5.2.2. [↑](#footnote-ref-8)
9. See NOGRR245 comments filed by ERCOT on August 18, 2023. The NextEra Energy Resources comments as endorsed by ROS on September 14, 2023, also reference this Section and would trigger new voltage ride-through requirements for GIMs initiated on or after June 1, 2026. [↑](#footnote-ref-9)
10. Under ERCOT’s proposed framework for continuing operations, ERCOT may take up to 30 Business Days for the initial review of a proposed change. If deemed necessary, the TSP has 90 days to submit a requested limited dynamic stability study, upon which ERCOT may take up to another 30 Business Days for the review of that report. [↑](#footnote-ref-10)
11. While UDMs are preferable for their ability to better approximate real-world parameters, Joint Commenters support ERCOT’s continued acceptance of generic models where UDMs are not available. [↑](#footnote-ref-11)