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| PGRR Number | [121](https://www.ercot.com/mktrules/issues/PGRR121#summary) | PGRR Title | Related to NOGRR272, Advanced Grid Support Requirements for Inverter-Based ESRs |

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| Date | August 22, 2025 |

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| Submitter’s Information |
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| Phone Number |  |
| Market Segment | Not Applicable |

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| Comments |

Tesla Inc. (“Tesla”) respectfully submits these comments to Planning Guide Revision Request (PGRR) 121 for consideration at the August 27, 2025 Technical Advisory Committee (TAC) meeting. In order to facilitate the use of accurate models in planning and operations, Tesla suggests allowing submission of two modeling packages: one model that reflects the advanced grid support (AGS) capabilities required under PGRR121 and Nodal Operating Guide Revision Request (NOGRR) 272, Advanced Grid Support Requirements for Inverter-Based ESRs, and a second model that reflects the resource without those capabilities enabled. This is necessary to ensure that an accurate model is used for planning and operations, with these capabilities currently turned off, while also providing ERCOT with the ability to ensure that new Energy Storage Resources (ESRs) have the required AGS capabilities.

Tesla supports the widespread adoption of grid-forming inverters and is a market leader in their development and use. We appreciate and concur with all parties involved in the discussion of these revision requests who have stated a preference for market-based solutions. Ultimately, creating incentives will maximize the reliability benefits of this technology.

In addition, Tesla continues to support PGRR124, ESR Maintenance Exception to Modifications. Passing the policies associated with PGRR124 could involve amending the language included in NOGRR272 to state that “The requirements of this Section apply to those portions of any subsequent ESR modifications that increase MW capacity or make non-in-kind replacements of equipment.” However, Tesla will make the case for that during discussions of PGRR124. To the extent that ERCOT stakeholders conclude that PGRR124 is appropriate, modifying this sentence will be necessary in an associated NOGRR that has not yet been drafted. We hope that ERCOT appreciates the collaborative spirit of this approach to the revision request.

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| Revised Cover Page Language |

None

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| Revised Proposed Guide Language |

**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 (5) of Section 5.5, Generator Commissioning and Continuing Operations. For existing Generation Resources and ESRs, these reports shall be provided as required in paragraph (6) 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 for Generation Resources, ESRs, or Transmission Elements that are not required to comply with Nodal Operating Guide Section 2.14, Advanced Grid Support Requirements for Inverter-Based ESRs, 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 Transmission-Connected Inverter-Based Resources (IBRs), Type 1 Wind-powered Generation Resources (WGRs), Type 2 WGRs, and Type 3 WGRs, 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.

(iv) For inverter-based Energy Storage Resources (ESRs) required to comply with Nodal Operating Guide Section 2.14, results for the model quality tests listed in paragraphs (A) through (G) below 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. In addition, a separate model that does not reflect these capabilities must be provided and used for all other purposes in the ERCOT Protocols, Nodal Operating Guide, and Planning Guide other than this paragraph, including but not limited to the quarterly stability assessment and as-built comparison required under paragraph (4) of Section 5.5. (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: The high and low voltage ride-through profiles as described in Nodal Operating Guide Section 2.9.1, shall be applied to the POI to demonstrate the Facility’s dynamic response.

(D) Frequency change and inertia response test: A frequency change increase and decrease shall be applied to the POI to demonstrate the Facility’s dynamic response.

(E) System strength test: The Facility shall be tested under multiple equivalent short circuit ratios, as described in the Dynamics Working Group Procedure Manual. This tests the robustness of the model to varying system conditions.

(F) Phase angle jump test: A step change is applied to the phase angle. This tests the capability to maintain the voltage phasor and resistance to angle change.

(G) Loss of synchronous machine test: This test confirms the performance of the Facility to maintain synchronism and voltage phasor after changes occur on the ERCOT System. This test is not intended to require the Facility to operate reliably without connecting to the ERCOT Transmission Grid.

(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.