

Standard Authorization Request (SAR)

Complete and submit this form, with attachment(s) to the [NERC Help Desk](#). Upon entering the Captcha, please type in your contact information, and attach the SAR to your ticket. Once submitted, you will receive a confirmation number which you can use to track your request.

The North American Electric Reliability Corporation (NERC) welcomes suggestions to improve the reliability of the bulk power system through improved Reliability Standards.

| Requested information | | | |
|--|--|--------|--|
| SAR Title: | MOD-026-1 Verification of Models and Data for Generator Excitation Control System or Plant Volt/Var Control Functions, MOD-027-1 Verification of Models and Data for Turbine/Governor and Load Control or Active Power/Frequency Control Functions | | |
| Date Submitted: | June 10, 2020 | | |
| SAR Requester | | | |
| Name: | Allen Shriver, Chair Jeffery Billo, Vice Chair | | |
| Organization: | Inverter-Based Resource Performance Task Force (IRPTF) | | |
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| SAR Type (Check as many as apply) | | | |
| <input checked="" type="checkbox"/> New Standard | <input type="checkbox"/> Imminent Action/ Confidential Issue (SPM Section 10) | | |
| <input checked="" type="checkbox"/> Revision to Existing Standard | <input type="checkbox"/> Variance development or revision | | |
| <input type="checkbox"/> Add, Modify or Retire a Glossary Term | <input type="checkbox"/> Other (Please specify) | | |
| <input type="checkbox"/> Withdraw/retire an Existing Standard | | | |
| Justification for this proposed standard development project (Check all that apply to help NERC prioritize development) | | | |
| <input type="checkbox"/> Regulatory Initiation | <input checked="" type="checkbox"/> NERC Standing Committee Identified | | |
| <input type="checkbox"/> Emerging Risk (Reliability Issues Steering Committee) Identified | <input type="checkbox"/> Enhanced Periodic Review Initiated | | |
| <input type="checkbox"/> Reliability Standard Development Plan | <input checked="" type="checkbox"/> Industry Stakeholder Identified | | |
| Industry Need (What Bulk Electric System (BES) reliability benefit does the proposed project provide?): | | | |
| The NERC Inverter-based Resource Performance Task Force (IRPTF) undertook an effort to perform a comprehensive review of all NERC Reliability Standards to determine if there were any potential gaps or improvements based on the work and findings of the IRPTF. The IRPTF identified several issues as part of this effort and documented its findings and recommendations in a white paper. The "IRPTF Review of NERC Reliability Standards White Paper" was approved by the Operating Committee and the Planning Committee in March 2020. Among the findings noted in the white paper, the IRPTF identified issues with MOD-026-1 and MOD-027-1 that should be addressed. | | | |

Requested information

MOD-026-1 and MOD-027-1 require, among other things, GOs to provide verified dynamic models to their Transmission Planner (TP) for the purposes of power system planning studies. Both standards contain language that is specific to synchronous generators and is not applicable to inverter-based resources (IBRs). For example, sub-requirement 2.1.3 in MOD-026-1 states that each verification shall include “model structure and data including, but not limited to reactance, time constants, saturation factors, total rotational inertia...” The standards should be revised to clarify the applicable requirements for synchronous generators and IBRs. For example, total rotational inertia should not be required for IBRs, while voltage ride-through control settings should only be required of IBRs and not synchronous generators.

Additionally, to some degree, all dynamic model parameters affect the response of a represented resource in dynamic simulations performed by power engineers. Accurate model response is required for the engineers to adequately study system conditions. Hence, it is crucial that all parameters in a model be verified in some way. However, a significant number of parameters in the models are not verified in the typical verification tests used to comply with MOD-026-1 and MOD-027-1. For example, the test currently used to comply with MOD-026-1 does not verify the model parameters associated with voltage control behavior during large disturbance conditions.

Purpose or Goal (How does this proposed project provide the reliability-related benefit described above?):

This SAR proposes to revise MOD-026-1 and MOD-027-1 and/or create a new standard to clarify requirements related to IBRs and to require sufficient model verification to ensure accurate generator representation in dynamic simulations.

Project Scope (Define the parameters of the proposed project):

The proposed scope of this project is as follows:

- a. Update requirement language to better reflect all types of generation resources and not just synchronous resources.
- b. Consider ways to require sufficient model verification to ensure accurate generator representation in dynamic simulations of typical phenomena that would be studied by power system engineers, including large disturbances.

Detailed Description (Describe the proposed deliverable(s) with sufficient detail for a drafting team to execute the project. If you propose a new or substantially revised Reliability Standard or definition, provide: (1) a technical justification¹ which includes a discussion of the reliability-related benefits of developing a new or revised Reliability Standard or definition, and (2) a technical foundation document (e.g., research paper) to guide development of the Standard or definition):

NERC MOD-026-1 focuses on verification of data for generator excitation control system or plant volt/var control functions and MOD-027-1 focuses on verification of data for turbine-governor and load control or active power-frequency control functions. Specifically, MOD-026-1 states in footnote 1 that the excitation control system for aggregate generating plants (i.e., wind and solar PV) includes the volt/var control system including the voltage regulator and reactive power control system controlling and coordinating

¹ The NERC Rules of Procedure require a technical justification for new or substantially revised Reliability Standards. Please attach pertinent information to this form before submittal to NERC.

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plant voltage and associated reactive capable resources. This language is slightly ambiguous on whether the verification activities include the inverter-level parameter values of the dynamic models. Various testing engineers and entities have stated that they are uncertain as to whether the standard applies to the plant-level parameters or the aggregate representation of the inverter-level settings.

Most commonly, verification test reports for inverter-based resources involve a small set of small disturbance tests including, but not limited to, the following:

- Capacitor switching test
- Plant-level voltage or reactive power reference step test
- Plant-level frequency reference step test
- Plant-level frequency play-in or step test

These tests do not perturb the generating resource such that the parameter values that dictate the large disturbance behavior of the resource are verified in any way. While some incorrect model parameters may be identified during these tests, the tests do not verify that the parameters selected for the model accurately capture the full dynamic behavior of the resource. This gives a false impression to TPs and PCs that the full set of parameters are verified for use in planning studies.

This issue is one of the predominant reasons why ride-through operation modes such as momentary cessation were able to persist and promulgate in IBRs without the knowledge of planners and system operators until the Blue Cut Fire and Canyon 2 Fire events exposed them. The dynamic models did not accurately represent this large disturbance behavior due to the model deficiency and because certain key parameters that govern large disturbance response were incorrectly parameterized. However, many of the same plants that entered momentary cessation mode during these events were able to provide verification reports that demonstrated that the small disturbance behavior driven mainly by plant-level control settings reasonably matched modeled performance in compliance with these standards.

Cost Impact Assessment, if known (Provide a paragraph describing the potential cost impacts associated with the proposed project):

The SAR proposes to clarify and address gaps in the requirements in MOD-026-1 and MOD-027-1. The cost impact is unknown.

Please describe any unique characteristics of the BES facilities that may be impacted by this proposed standard development project (e.g., Dispersed Generation Resources):

The abovementioned reliability gap exists for both synchronous generators and IBRs. However, it is potentially more severe for IBRs since their behavior is based more on programmable control functions than for synchronous generators which have behavior that is based more on the physical characteristics of the machine. Additionally, the IRPTF noted that it is not feasible to stage large disturbances for verification purposes, so other methods for verification of model performance under large disturbance conditions may need to be developed.

To assist the NERC Standards Committee in appointing a drafting team with the appropriate members, please indicate to which Functional Entities the proposed standard(s) should apply (e.g., Transmission

| Requested information |
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| Operator, Reliability Coordinator, etc. See the most recent version of the NERC Functional Model for definitions): |
| Transmission Planner, Generator Owner, Planning Coordinator |
| Do you know of any consensus building activities ² in connection with this SAR? If so, please provide any recommendations or findings resulting from the consensus building activity. |
| This issue was captured in the “IRPTF Review of NERC Reliability Standards White Paper” which was approved by the Operating Committee and the Planning Committee. Additionally, the issue was discussed in the IRPTF-produced “Improvements to Interconnection Requirements for BPS-Connected Inverter-Based Resources” reliability guideline. |
| Are there any related standards or SARs that should be assessed for impact as a result of this proposed project? If so, which standard(s) or project number(s)? |
| N/A |
| Are there alternatives (e.g., guidelines, white paper, alerts, etc.) that have been considered or could meet the objectives? If so, please list the alternatives. |
| The IRPTF did not identify any alternatives since there are gaps in the existing language for MOD-026-1 and MOD-027-1 that need to be resolved. |

| Reliability Principles | |
|---|---|
| Does this proposed standard development project support at least one of the following Reliability Principles (Reliability Interface Principles)? Please check all those that apply. | |
| <input checked="" type="checkbox"/> | 1. Interconnected bulk power systems shall be planned and operated in a coordinated manner to perform reliably under normal and abnormal conditions as defined in the NERC Standards. |
| <input type="checkbox"/> | 2. The frequency and voltage of interconnected bulk power systems shall be controlled within defined limits through the balancing of real and reactive power supply and demand. |
| <input checked="" type="checkbox"/> | 3. Information necessary for the planning and operation of interconnected bulk power systems shall be made available to those entities responsible for planning and operating the systems reliably. |
| <input type="checkbox"/> | 4. Plans for emergency operation and system restoration of interconnected bulk power systems shall be developed, coordinated, maintained and implemented. |
| <input type="checkbox"/> | 5. Facilities for communication, monitoring and control shall be provided, used and maintained for the reliability of interconnected bulk power systems. |
| <input type="checkbox"/> | 6. Personnel responsible for planning and operating interconnected bulk power systems shall be trained, qualified, and have the responsibility and authority to implement actions. |
| <input type="checkbox"/> | 7. The security of the interconnected bulk power systems shall be assessed, monitored and maintained on a wide area basis. |
| <input type="checkbox"/> | 8. Bulk power systems shall be protected from malicious physical or cyber attacks. |

² Consensus building activities are occasionally conducted by NERC and/or project review teams. They typically are conducted to obtain industry inputs prior to proposing any standard development project to revise, or develop a standard or definition.

| Market Interface Principles | |
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| Does the proposed standard development project comply with all of the following Market Interface Principles ? | Enter (yes/no) |
| 1. A reliability standard shall not give any market participant an unfair competitive advantage. | Yes |
| 2. A reliability standard shall neither mandate nor prohibit any specific market structure. | Yes |
| 3. A reliability standard shall not preclude market solutions to achieving compliance with that standard. | Yes |
| 4. A reliability standard shall not require the public disclosure of commercially sensitive information. All market participants shall have equal opportunity to access commercially non-sensitive information that is required for compliance with reliability standards. | Yes |

| Identified Existing or Potential Regional or Interconnection Variances | |
|---|-------------|
| Region(s)/ Interconnection | Explanation |
| None | N/A |

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| SAR Status Tracking (Check off as appropriate). | |
|---|--|
| <input type="checkbox"/> Draft SAR reviewed by NERC Staff | <input type="checkbox"/> Final SAR endorsed by the SC |
| <input type="checkbox"/> Draft SAR presented to SC for acceptance | <input type="checkbox"/> SAR assigned a Standards Project by NERC |
| <input type="checkbox"/> DRAFT SAR approved for posting by the SC | <input type="checkbox"/> SAR denied or proposed as Guidance document |

Version History

| Version | Date | Owner | Change Tracking |
|---------|-------------------|-----------------------------|--|
| 1 | June 3, 2013 | | Revised |
| 1 | August 29, 2014 | Standards Information Staff | Updated template |
| 2 | January 18, 2017 | Standards Information Staff | Revised |
| 2 | June 28, 2017 | Standards Information Staff | Updated template |
| 3 | February 22, 2019 | Standards Information Staff | Added instructions to submit via Help Desk |
| 4 | February 25, 2020 | Standards Information Staff | Updated template footer |