

## 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-025-2 Verification and Data Reporting of Generator Capability		
Date Submitted:	11/01/2021		
SAR Requester			
Name:	Jason Eruneo, SAR DT chair		
Organization:	Project 2021-01 SAR DT		
Telephone:	727-344-4200	Email:	Jason.Eruneo@duke-energy.com
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 checked="" type="checkbox"/> Add, Modify or Retire a Glossary Term	<input type="checkbox"/> Other (Please specify)		
<input checked="" 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 type="checkbox"/> Industry Stakeholder Identified		
Industry Need (What Bulk Electric System (BES) reliability benefit does the proposed project provide?):			
<p>The current industry need for this standards project is that industry implementation of MOD-025-2 has not resulted in useful unit capability data being provided for planning models of generating resources and synchronous condensers (i.e., the purpose statement of the standard). The primary reliability benefit of this project will be to correct these issues such that suitable and accurate data can be established through the verification activities performed by respective equipment owners. BPS planning assessments rely on accurate data, including machine active and reactive power capability, to identify potential reliability risks and develop mitigating actions for those risks.</p> <p>The current MOD-025-2 verification testing activities require significant time, expertise, and coordination; however, they do not result in data that should be used by planners for modeling purposes. The current standard does allow for optional calculations to be performed to help facilitate better information sharing; however, calculations are not required nor can be used in many cases when</p>			

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auxiliary equipment limits or system operating conditions prohibit reaching the actual machine capability or limiters. This standards’ project will address these issues.

Other benefits of this standards’ project to address issues with MOD-025-2 include, but are not limited to, the following:

- Preventing over- or under-estimation of generating facility active and reactive power, which could lead to potential reliability risks or unnecessary and expensive solutions to mitigate
- Identifying limitations within a generating facility that could constrain the resource from reaching the expected active/reactive capability at any given time
- More clearly communicating the necessary data to be used for modeling the respective resources in steady-state power flow models
- Ensure that the data users are part of the verification process to ensure that the necessary and usable data is provided and utilized appropriately
- Ensure that raw test data alone is not used for resource modeling, but is analyzed, adjusted, and contextualized to account for measured system conditions
- Coordinating with PRC-019 activities to develop a composite capability curve, inclusive of equipment capabilities, limiters, and other plant limitations to develop an appropriate capability curve
- Ensuring that other means of verification (other than testing) can be more effectively leveraged to gather necessary and suitable data for verifying plant/machine capability
- Augmenting the applicability section of MOD-025-2 to include (non-generation) transmission-connected reactive resources – both rotating machine (i.e. synchronous condenser) and power-electronics based – will enhance the BES reliability by ensuring that the capability, models and performance is verified and validated for all varieties of dynamic reactive resources utilized in providing Essential Reliability Services (ERS) in the BES

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

The intent of this standard revision project is to address the issues that exist with MOD-025-2 regarding verification and data reporting of generator active and reactive power capability (and any other relevant equipment capability). Currently, implementation of the standard rarely produces data that is suitable for planning models (i.e., the stated purpose of the standard). The vast majority of testing cases are limited by limits within the plant or system operating conditions that prohibit the generating resource from reaching its “composite capability curve” – the equipment capability or associated limiters. The goal of the proposed project is to:

- Ensure that testing and other verification activities produce useful data for verification of plant active and reactive power capability
- Ensure that the data is used by Transmission Planners and Planning Coordinators in an appropriate manner, with a sufficient degree of analysis prior to use

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- Ensure that the data is applicable and usable by the Transmission Planner and Planning Coordinator for reliability studies
- Ensure Generator Owners appropriately identify limits within their generating resources (and synchronous condensers), and effectively communicate those limits to Transmission Planners and Planning Coordinators for the purposes of modeling these resources in reliability studies

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

The scope of this project is to modify MOD-025-2 to ensure that data provided through verification activities performed by applicable Generator Owner or Transmission Owners produce suitable data for the purposes of developing accurate planning models in Transmission Planner and Planning Coordinator reliability studies. The SDT will identify a path that best meets the project goal and scope. This path may include revisions to MOD-025-2, replacement of MOD-025-2 with a new standard, or retirement of MOD-025-2. The SDT should consider and address, at a minimum, the following:

1. Revisions to MOD-025-2 to ensure that verification activities produce data and information that can be used by Transmission Planners and Planning Coordinators for the purposes of developing accurate and reasonable plant active and reactive capability data (including possibly representation of the “composite capability curve” inclusive of capability and limiters, where applicable).
2. Ensure that each Planning Coordinator and the area Transmission Planners develop requirements for the Planning Coordinator area real and reactive capability data verification.
3. Ensure that Generator Owners provide the data specified by the Planning Coordinator and Transmission Planners for the Planning Coordinator area.
4. Ensure that verification activities can apply other methods beyond only testing (or real-time data) that allow plant capability information, protection settings, PRC-019 reports, and other documentation to also complement the verification activities.
5. Ensure that data provided by the applicable Generator Owners and Transmission Owners is analyzed and used appropriately by Transmission Planners and Planning Coordinators.
6. Ensure that the data provided by Generator Owners, if different from tested values, is acceptable to the Planning Coordinator and Transmission Planners with the standard providing guidance on acceptable reactive capability reporting if system conditions prevent reaching actual capability.
7. Ensure alignment of the MOD-025-2 standard with MOD-032-1 regarding data submittals for annual case creation and PRC-019-2 regarding collection of information that can be effectively used for verification purposes. Ensure activities across standards can be applied to effectively meet the purpose of these standards, and avoid any potential overlap or duplication of activities. This is dependent on the success of bullet number 1.
8. If a new performance standard is created to replace MOD-025-2, ensure that equipment limitations reached during a staged test are documented, with a classification such as expected (e.g., system voltage limit reached) or unexpected (e.g., plant tripped or excitation limiter reached unexpectedly), and communicated to the Transmission Planner. In cases of an

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unexpected limitation reached, ensure that the equipment owner develops and implements a plan to address this unexpected limitation.

9. Review and revise the “Applicability – Facilities” section, “Applicability – Functional Entities” section, and Requirements (including applicable attachments) as needed in MOD-025-2 to comprehensively address all varieties of transmission-connected dynamic reactive resources that are utilized in providing ERS in the BES. As needed, define new Glossary Terms for all or some of the transmission-connected dynamic reactive devices noted in the System Analysis and Modeling Subcommittee (SAMS) white-paper *Transmission Connected Dynamic Reactive Resources – Assessment of Applicability in Reliability Standards*.

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 justification<sup>1</sup> 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):

The NERC PPMVTF developed *White Paper: Implementation of NERC Standard MOD-025-2*<sup>2</sup> that recommends NERC initiate a standards project to address these issues with MOD-025-2. The white paper provides a detailed description and technical justification of the gaps that exist in MOD-025-2 and how the current standard may be leading to inaccurate data being used in BPS reliability studies. Further, the NERC PPMVTF *Reliability Guideline: Power Plant Model Verification and Testing for Synchronous Machines*<sup>3</sup> also describes in detail how testing activities per MOD-025-2 can lead to unusable data, and provides further guidance that a SDT could use to develop solutions to these issues.

The “Applicability – Facilities” and “Applicability-Functional Entities” sections in MOD-025-2 will be reviewed and revised to address (non-generation) transmission-connected dynamic reactive resources based on the recommendations summarized in Table 1 of the SAMS white-paper *Transmission Connected Dynamic Reactive Resources – Assessment of Applicability in Reliability Standards*. The white-paper also provides the technical justifications for the recommended revisions and the associated reliability benefits. As needed, revise Requirements (including applicable attachments) to ensure they continue to address the additional Facilities. As needed, define new Glossary Terms for all or some of the transmission-connected dynamic reactive devices noted as items 1.a – 1.j in the Additional Considerations section of the SAMS white-paper.

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

The aforementioned NERC PPMVTF *White Paper: Implementation of NERC Standard MOD-025-2* includes an example of one Registered Entity’s MOD-025-2 implementation costs (excluding cost of shifting the optimization of generation fleet assets due to minimum load testing requirements). The entity’s average test cost was \$1,259 (897 tests) and \$4,326 per generator (261 generators). The

<sup>1</sup> 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.

<sup>2</sup> [https://www.nerc.com/comm/PC/Power%20Plant%20Modeling%20and%20Verification%20Task%20Force/PPMVTF\\_White\\_Paper\\_MOD-025\\_Testing.pdf](https://www.nerc.com/comm/PC/Power%20Plant%20Modeling%20and%20Verification%20Task%20Force/PPMVTF_White_Paper_MOD-025_Testing.pdf)

<sup>3</sup> [https://www.nerc.com/comm/PC\\_Reliability\\_Guidelines\\_DL/Reliability\\_Guideline\\_-\\_PPMV\\_for\\_Synchronous\\_Machines\\_-\\_2018-06-29.pdf](https://www.nerc.com/comm/PC_Reliability_Guidelines_DL/Reliability_Guideline_-_PPMV_for_Synchronous_Machines_-_2018-06-29.pdf)

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verification testing of units generally results in transferring energy to a higher cost resource during the test period. Further, the data produced is often NOT suitable for planning studies, which does not serve the intended purpose of the standard and makes the added cost unjustified.
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 current MOD-025-2 was written around synchronous generation, although it is not specifically applicable only to synchronous generators. Therefore, the project should ensure the language is clear and concise regarding how to handle BES dispersed generating resources (e.g., wind, solar photovoltaic, and battery energy storage systems).
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 Operator, Reliability Coordinator, etc. See the most recent version of the NERC Functional Model for definitions):
<ul style="list-style-type: none"> <li>• Generator Owner and Transmission Owner of synchronous condensers (asset owner that is in the best position to ascertain resource capability)</li> <li>• Transmission Planner and Planning Coordinator (user of the information provided by the Generator Owner; currently has no responsibility of ensuring accurate data per current MOD-025-2 standard)</li> </ul>
Do you know of any consensus building activities <sup>4</sup> in connection with this SAR? If so, please provide any recommendations or findings resulting from the consensus building activity.
The NERC PPMVTF White Paper, approved by NERC RSTC, details the challenges with MOD-025-2. The team deliberated this subject for a significant amount of time, and have identified major issues with the standard that need to be addressed by an SDT. The PPMVTF believes that a significant revision to MOD-025-2 is needed, that testing activities are useful and should be retained, but that the activities can focus on more effective means of collecting useful data for planning models. One dissenting opinion of PPMVTF membership believed the standard should be retired completely and not replaced with an alternative.  <i>Transmission Connected Dynamic Reactive Resources – Assessment of Applicability in Reliability Standards</i> white-paper approved by SAMS members.
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)?
The NERC standards development Project 2020-02 ( <a href="#">Transmission-connected Dynamic Reactive Resources</a> ) SAR includes MOD-025-2, specifically addressing the applicability of transmission-connected reactive devices in addition to generators and synchronous condensers. Content from Project 2020-02 SAR was incorporated into this document.

<sup>4</sup> 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.

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The SAR on PRC-019-2 submitted to NERC by the System Protection and Control Subcommittee is also related in that there is significant overlap of activities in PRC-019-2 and the development of planning models of machine capability. The PRC-019-2 SAR falls under the purview of Project 2021-01, and was maintained as a separate SAR.

Project 2021-01 will coordinate with Project 2020-06 (Verifications of Models and Data for Generators), if there is overlapping scope of work or recommended revisions to MOD-026/027.

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.

There are two key industry reference documents on this subject:

1. NERC *Reliability Guideline: Power Plant Model Verification and Testing for Synchronous Machines*<sup>5</sup> (July 2018) that provides recommended practices for synchronous machine capability testing. An appendix is devoted to MOD-025-2 testing, and highlights the challenges and inherent errors in MOD-025-2 to obtain useful data that can be applied for planning models.
2. NATF *Modeling Reference Document Reporting and Verification of Generating Unit Reactive Power Capability for Synchronous Machines*<sup>6</sup> (April 2015) that describes testing activities per MOD-025-2 and means of ensuring data is sufficient for planning studies.

Neither industry reference document addresses the identified shortcomings of the standard described above and in NERC PPMVTF *White Paper: Implementation of NERC Standard MOD-025-2*.<sup>7</sup> These reference materials help industry understand how to implement the standards using best practices, but do not address the reliability gaps created by the standard requirements themselves which is leading to inaccurate data being used in planning assessments.

### 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.

<sup>5</sup> [https://www.nerc.com/comm/PC Reliability Guidelines DL/Reliability Guideline - PPMV for Synchronous Machines - 2018-06-29.pdf](https://www.nerc.com/comm/PC%20Reliability%20Guidelines%20DL/Reliability%20Guideline%20-%20PPMV%20for%20Synchronous%20Machines%20-%202018-06-29.pdf)

<sup>6</sup> <https://www.natf.net/docs/natf/documents/resources/planning-and-modeling/natf-reference-document-reporting-and-verification-of-generating-unit-reactive-power-capability-for-synchronous-machines.pdf>

<sup>7</sup> [https://www.nerc.com/comm/PC/Power%20Plant%20Modeling%20and%20Verification%20Task%20Force/PPMVTF White Paper MOD-025 Testing.pdf](https://www.nerc.com/comm/PC/Power%20Plant%20Modeling%20and%20Verification%20Task%20Force/PPMVTF%20White%20Paper%20MOD-025%20Testing.pdf)



<b>Reliability Principles</b>	
<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.

<b>Market Interface Principles</b>	
Does the proposed standard development project comply with all of the following <a href="#">Market Interface Principles</a> ?	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

<b>Identified Existing or Potential Regional or Interconnection Variances</b>	
Region(s)/ Interconnection	Explanation
N/A	None identified.

## For Use by NERC Only

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

**Version History**

<b>Version</b>	<b>Date</b>	<b>Owner</b>	<b>Change Tracking</b>
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