

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:	TPL-001-5.1 Transmission System Planning Performance Requirements		
Date Submitted:	12/16/2021 (Revised on June 22, 2022)		
SAR Requester			
Name:	Allen Schriver, NextEra Energy (NERC IRPWG Chair) Julia Matevosyan, ERCOT (NERC IRPWG Vice Chair) (Revised by Project 2022-02 SAR Drafting Team)		
Organization:	NERC Inverter-Based Resource Performance Working Group (IRPWG)		
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SAR Type (Check as many as apply)			
<input type="checkbox"/> New Standard	<input type="checkbox"/> Imminent Action/ Confidential Issue (SPM Section 10)	<input type="checkbox"/> Add, Modify or Retire a Glossary Term	<input type="checkbox"/> Variance development or revision
<input checked="" type="checkbox"/> Revision to Existing Standard	<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 checked="" 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?):			
<p>Many areas of the North American bulk power system (BPS) continue to experience an increase in BPS-connected inverter-based resources (e.g., wind, solar photovoltaic (PV), battery energy storage systems (BESS), and hybrid power plants). NERC Reliability Standard TPL-001-5.1 is a foundational standard used for “establishing transmission system performance requirements within the planning horizon to develop a bulk electric system (BES) that will operate reliably over a broad spectrum of system conditions and following a wide range of probable contingencies.” Transmission Planners (TPs) and Planning Coordinators (PCs) develop and use models of the electrical grid to perform planning assessments (e.g., steady-state, dynamic, and short-circuit) to develop corrective action plans for future reliability issues identified. Ensuring that the TPL-001 standard is reflective of the evolving nature of the BPS and its resource mix is paramount to ensuring reliable operation and resilience of the BPS moving forward.</p>			

Requested information

The NERC Inverter-Based Resource Performance Task Force (IRPTF)¹ undertook a complete review of the NERC Reliability Standards in the context of increasing levels of BPS-connected inverter-based resources and published a white paper on the outcomes and recommendations of this review in March 2020.² The review was approved by the NERC Planning Committee and served as the technical justification for future standards revision efforts. The white paper recommended modifications to seven standards, and IRPWG presented four SARs to the NERC Reliability and Security Technical Committee (RSTC) in June 2020 that addressed the deficiencies identified in six of the seven standards.

Based on the outcome of the review, it was determined that the TPL-001-4/5³ needed clarifications “to address terminology throughout the standard that is unclear with regards to inverter-based resources” the next time the standard is revised. The language used in the white paper regarding “the next time the standard is revised” was based on the understanding that the NERC System Planning Impacts from Distributed Energy Resources Working Group (SPIDERWG) was developing a SAR and that the recommended modifications to TPL-001-5 from IRPWG could be included in the SPIDERWG SAR. The combined SAR was presented to the NERC RSTC at their March 2021 meeting and was rejected. The overarching comments received were with regards to the DER-related issues and a comment was made that the recommendations pertaining to BPS-connected inverter-based resources were not the primary focus of concern.

Therefore, IRPWG presents this SAR to move the effort forward regarding specifically BPS-connected inverter-based resources. This SAR does not include any modification to TPL-001-5 regarding the inclusion of distributed energy resources (DERs). IRPWG believes that industry needs to be proactive in addressing standards gaps, particularly, where lack of clarity and confusion may lead to studies not adequately capturing possible BPS reliability issues. As the North American BPS continues to experience rising penetration levels of BPS-connected inverter-based resources and is likely to do so into the foreseeable future, these changes are critical for overall BPS reliability and industry efforts to reliably integrate these resources.

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

This SAR revises requirements within the TPL-001-5 standard to provide clarity and consistency for how BPS-connected inverter-based resources are considered, modeled, and studied in planning assessments. The proposed revisions to TPL-001-5 will ensure industry is effectively and efficiently conducting planning assessments and that the requirements are equally suitable for inverter-based resources as they are for synchronous generation.

¹ The IRPTF has subsequently become the IRPWG under the NERC Reliability and Security Technical Committee (RSTC).

² NERC IRPTF, “IRPTF Review of NERC Reliability Standards,” March 2020:

https://www.nerc.com/comm/PC/InverterBased%20Resource%20Performance%20Task%20Force%20IRPT/Review_of_NERC_Reliability_Standards_White_Paper.pdf

³ At the time of review, the TPL-001-5 standard had just recently been approved by FERC and was yet to be subject to enforcement.

Requested information

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

As described in further detail below, the scope of this project includes consideration of the following revisions to TPL-001-5.1:

- Modify Requirements 3.3 and 4.3 and their applicable sub-requirements to make the term “GSU transformer” suitable for all generation types since it introduces confusion for BPS-connected inverter-based resources
- Modify Requirements 4.1.1 and 4.1.2 regarding the use of the term “pulls out of synchronism,” which is only applicable for synchronous generator technologies and is not suitable for BPS-connected inverter-based resources
- Modify Requirement 4.3.2 so that the list of devices that impact the study area are inclusive of BPS-connected inverter-based resource technologies
-

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 justification⁴ 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 following detailed description is copied verbatim from the IRPTF white paper that was approved by the NERC PC:

TPL-001-4 requires Planning Coordinators (PCs) and TPs to assess the reliability of their portion of the BES for various conditions across several specified future years and to plan Corrective Action Plans to address identified performance deficiencies. The requirements and sub-requirements include, among other things, certain simulation assumptions to be used by the planner and performance requirements.

Sub-requirements 3.3 and 4.3 describe simulation assumptions that the planner should use when performing contingency analysis for the steady-state and stability portion of the assessment, respectively. Sub-requirements 3.3.1.1 and 4.3.1.2 each require the planner to include the impact of the “tripping of generators where simulations show generator bus voltages or high side of the [GSU] voltages are less than known or assumed generator” low voltage ride-through capability.

The term GSU transformer can be confusing to GOs of IBR facilities because they will often refer to the transformer that steps the voltage up from the individual inverter (e.g., 600 V) to the collector system voltage (e.g., 34.5 kV). In this case, there is usually another transformer (i.e., the main power transformer (MPT)) to step the voltage up from the collector system voltage to transmission system voltage. It was likely the intent of the TPL-001-2 SDT to be referring to transmission system voltages when drafting the language that refers to known or assumed

⁴ 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.

Requested information

generator low voltage ride-through capability at the high-side of the GSU. Therefore, the language in these sub-requirements should be modified to provide clarity for inverter-based resources.

Sub-requirements 4.1.1 and 4.1.2 provide stability performance criteria when a generator “pulls out of synchronism” in system simulations. Although an inverter-based resource does synchronize with the grid, the phrase “pulls out of synchronism” is typically applicable only to synchronous generators, referring to when a synchronous machine has an angular separation from the rest of the grid. Therefore, these sub-requirements could be clarified by clearly stating that this performance criteria is for synchronous generators.

Sub-requirement 4.3.2 specifies that stability studies must “simulate the expected automatic operation of existing and planned devices designed to provide dynamic control of electrical system quantities when such devices impact the study area.” It then contains a list of example devices that have dynamic behavior. Not included in this list are power plant controllers and inverter controls, which often dominate the dynamic response of IBRs. While the sub-requirement does not preclude the simulation of plant-level controllers and inverter controls, it would add clarity if they were added to the list.

The suggested clarifications for sub-requirements 3.3, 4.3, 4.1.1, 4.1.2, and 4.3.2 should be considered by a future SDT when editing the standard. However, the IRPTF does not believe the clarifications by themselves warrant changing the standard at this time. It should be noted that the identified issues with TPL-001-4 also apply to the draft TPL-001-5 standard that is awaiting FERC approval as of the publication of this whitepaper.

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

The cost impacts for the proposed changes to TPL-001-5 are expected to be minimal. The changes being proposed are clarifications that will bring consistency and effectiveness industry related to how planning assessments are conducted and how planning engineers set up and conduct those assessments.

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

None. This SAR will impact Transmission System Planning Assessments, not any specific BES facilities.

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):

Planning Coordinators, Transmission Planners, and Generator Owners of inverter-based resources

Requested information	
Do you know of any consensus building activities ⁵ in connection with this SAR? If so, please provide any recommendations or findings resulting from the consensus building activity.	
This SAR is an outcome of the white paper produced by the NERC IRPTF and approved by the NERC PC, which can be found here: https://www.nerc.com/comm/PC/InverterBased%20Resource%20Performance%20Task%20Force%20IRPT/Review_of_NERC_Reliability_Standards_White_Paper.pdf	
The SAR is a follow-on to the recommendation contained within the white paper, developed by the NERC IRPWG under the NERC RSTC.	
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)?	
No	
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 NERC IRPWG (previously IRPTF) has published multiple technical reference documents, white papers, and reliability guidelines related to the performance, modeling, and studies of BPS-connected inverter-based resources. These technical materials are used widely by industry and have provided significant value for improving planning practices. However, those efforts do not address the larger issue related to the TPL-001 standards language being written predominantly for synchronous generation technology and not adequately considering or clarifying how the requirements relate to BPS-connected inverter-based resource technologies.	
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 checked="" 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.

⁵ 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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<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.

Market Interface Principles	
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	None

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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