

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: | 12/15/2021 <u>(Revised on June 22, 2022)</u> | | |
| SAR Requester | | | |
| Name: | Kun Zhu, MISO (NERC SPIDERWG Chair) Bill Quaintance, Duke Energy Progress (NERC SPIDERWG Vice-Chair) <u>(Revised by Project 2022-02 SAR Drafting Team)</u> | | |
| Organization: | NERC System Planning Impacts from DERs Working Group (SPIDERWG) | | |
| Telephone: | Kun – 317-249-5789 Bill – 919-546-4810 | Email: | kzhu@misoenergy.org william.quaintance@duke-energy.com |
| 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"/> Variance development or revision | <input type="checkbox"/> Other (Please specify) |
| <input checked="" type="checkbox"/> Revision to Existing Standard | | | |
| <input checked="" type="checkbox"/> Add, Modify or Retire a Glossary Term | | | |
| <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"/> Enhanced Periodic Review Initiated | <input checked="" type="checkbox"/> Industry Stakeholder Identified |
| <input checked="" type="checkbox"/> Emerging Risk (Reliability Issues Steering Committee) Identified | | | |
| <input type="checkbox"/> Reliability Standard Development Plan | | | |
| Industry Need (What Bulk Electric System (BES) reliability benefit does the proposed project provide?): | | | |
| <p>Many distribution systems connected both directly and indirectly areas-of-to the North American BES are experiencing increasing penetrations of distributed energy resources (DERs). NERC Reliability Standard TPL-001-5.1¹ was developed under a paradigm of predominantly BPS-connected generation, particularly synchronous generation, when penetrations of DERs were significantly lower than current and future projections.</p> <p>Considering current trends, the NERC SPIDERWG undertook a review of the TPL-001 standard considering the potential impact of DERs. This review is captured in the following RSTC-approved white paper and serves as the technical justification for the revisions suggested in this SAR:</p> | | | |

¹ The scope of recent modifications to TPL-001-5 did not include considering the impacts of DER on [BES/BPS](#) planning.

Requested information

- SPIDERWG: Assessment of DER impacts on NERC Reliability Standard TPL-001 ([here](#))

This SAR proposes to update TPL-001-5.1 to address some of the issues identified in the white paper.

TPL-001-5.1 does not currently require Planning Coordinators and Transmission Planners to complete Planning Assessments with adequate representation of the dynamic behavior of DERs. As the penetration of DERs increases, and based on the DER data and models available, Planning Assessments should include DERs that can potentially impact Transmission System performance assessment. NERC’s “Lesson Learned: Single Phase Fault Precipitates Loss of Generation and Load”, evaluating a 2019 frequency event in Southern England exacerbated by the unexpected reduction of 725 MW of IBR output and the unexpected loss of 350 MW of DER, highlights the critical importance of accurate Transmission System Planning Assessments.² In July 2020, a significant quantity of solar PV facilities across a large geographic area in Southern CA reduced about 1000 MW output due to a disturbance on the bulk power system³. Subsequent event analysis revealed that it was the consequence of momentary cessation and slow recovery of power. Standards enhancement has been one of the recommendations after the event analysis to ensure reliable operation of the bulk power system.

In general, the impact of DERs on the BES should be included in planning assessments if DER data and models are available. Any choice to exclude the consideration of the impact of DER on the BES should be supported by a technical rationale and/or justification.

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

The purpose of this SAR is to revise requirements to provide clarity or, in some cases, expand the scope of requirements when considering the performance of DERs to ensure the accuracy of Transmission System Planning Assessments.

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

As identified by SPIDERWG, [revision to](#) the following sections of TPL-001-5.1 should be ~~considered~~ revised to ensure the accuracy of Transmission System Planning Assessments:

- R2.1, [R2.2](#), and R2.4~~2~~, the use of phrase “System peak Load”
- R3.3.1.1 and R4.3.1.2, the “tripping of generators” in steady state and stability contingency analysis should include tripping of DER if data and models are available. The SDT can consider whether a threshold needs to be established.

²

https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20201001_Single_Phase_Fault_Precipitates_Loss_of_Generation_and_Load.pdf

³ https://www.nerc.com/pa/rrm/ea/Pages/July_2020_San_Fernando_Disturbance_Report.aspx

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- c. R4.1.1 and 4.1.2, the stability performance criteria should be applicable to both synchronous and asynchronous generation, inclusive of DER.
- d. R4.3.2, the list of dynamic control devices should include DER so that the expected automatic operation of DER (e.g., DER tripping, dynamic voltage and frequency controls, momentary cessation, etc.) can be considered in stability analyses.
- ~~d.~~e. [Assuming that revisions to the MOD-032 standard ensure that DER model data is available, modification to the TPL-001 standard should give consideration to potential exclusions of explicit DER modeling based on technical rationale.](#)

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):

A detailed description of each Project Scope item is given below:

- a. R2.1 and R2.2, the use of phrase “System peak Load”

With increased penetration of DER, the load that transmission system supplies is the net load (net load = gross load – DER output) as seen at the T-D interface, which might reach its peak during operating conditions that are not at the peak gross load hour. As such, there is a need for individual TPs to be required to document and define their peak load conditions (e.g., gross or net) in their assessments. The SDT should consider adding the terms “Gross Load” and “Net Load” to the NERC Glossary of Terms and updating the term “System peak Load” in the standard to “System peak net Load”. In addition, a high gross load hour may be the most stressed load driven condition for contingencies that may trip large amounts of DER. High system peak gross load may be studied as additional scenarios as required by current standard under R2.1.3.

- b. R3.3.1.1 and R4.3.1.2, the “tripping of generators” in steady state and stability contingency analysis should include tripping of DER if data is available. The SDT can consider whether a threshold needs to be established.

The terms “generators” in Sub-requirements 3.3.1.1 and 4.3.1.2 should be clarified. DERs that are explicitly modeled as generators should be tripped where simulations show bus voltages that are less than known or assumed minimum DER steady-state or ride-through voltage limits. It is also recommended to consider inclusion in the assessment any assumptions made in estimating DER bus voltage.

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.

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- c. R4.1.1 and 4.1.2, the stability performance criteria should be applicable to both synchronous and asynchronous generation, inclusive of DER.

For example, the language referring to “pulls out of synchronism” is only relevant to synchronous generation and is not applicable to inverter-based generation (including inverter-based DER). However, large amounts of asynchronous DER tripping on low/high voltage/frequency conditions can also adversely affect BES performance and may pose a risk to system instability for conditions such as cascading, voltage instability, or uncontrolled islanding if not properly studied and identified ahead of real-time operations. It is recommended to expand the stability performance criteria to include both synchronous and asynchronous generation.

- d. R4.3.2, the standard should recognize that the list of dynamic control devices should consider the expected automatic operation of DER (e.g., DER tripping, dynamic voltage and frequency controls, momentary cessation, etc.) in stability analyses. The SDT can consider adding asynchronous generator related devices like inverter, plant controller, etc.

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

Although the cost impact is unknown, costs to Planning Coordinators and Transmission Planners will increase as Transmission System Planning Assessments reflect additional dynamic components and controls. It is anticipated that this cost will vary depending on training, tools, scenario development, and other factors in each Planning Coordinators and Transmission Planners’ area.

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 primarily impact Transmission System Planning Assessments, not any specific BES facilities, although as individual IBRs continue to increase in size (e.g. 14MW wind turbines), there may be some impact in the near future.

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 and Transmission Planners, i.e. the applicable entities for this standard. Additionally, Distribution Providers, Generator Owners, and DER aggregators participating in markets- i.e. not an applicable entity to this standard, would be useful to include.

| 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 the outcome of the following white paper that was developed by the NERC technical sub-group under the RSTC. <ul style="list-style-type: none"> • SPIDERWG: Assessment of DER impacts on NERC Reliability Standard TPL-001 (here) Deliverables, and the key findings and recommendations contained within, were thoroughly reviewed and approved by the 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. | |
| Among all the issues identified in the NERC SPIDERWG white paper, the ones included in this SAR cannot be addressed by any alternatives. Standard language change will ensure DER impacts being considered appropriately. NERC SPIDERWG will prepare a Reliability Guideline to address the rest of the findings from their white paper. | |
| 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 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. |

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.

| 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 |

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|---|-------------------|-----------------------------|-------------------------|
| 4 | February 25, 2020 | Standards Information Staff | Updated template footer |
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