NERC
NORTH AMERICAN ELECTRIC RELIABILITY CORPORATION

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:	Revisions to PRC-019-2 to address dispersed power producing resources		
Date Submitted:	11/01/2021		
SAR Requester			
Name:	Jason Eruneo & Steven Barnes		
Organization:	Project 2021-01 SAR DT		
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SAR Type (Check as many as apply)

- ☒ New Standard
- ☒ Revision to Existing Standard
- ☒ Add, Modify or Retire a Glossary Term
- ☐ Withdraw/retire an Existing Standard
- ☐ Imminent Action/ Confidential Issue (SPM Section 10)
- ☐ Variance development or revision
- ☐ Other (Please specify)

Justification for this proposed standard development project (Check all that apply to help NERC prioritize development)

- ☐ Regulatory Initiation
- ☒ Emerging Risk (Reliability Issues Steering Committee) Identified
- ☐ Reliability Standard Development Plan
- ☒ NERC Standing Committee Identified
- ☐ Enhanced Periodic Review Initiated
- ☒ Industry Stakeholder Identified

Industry Need (What Bulk Electric System (BES) reliability benefit does the proposed project provide?):

Reliability Standard PRC-019-2 addresses the reliability issue of miscoordination between generator capability, control systems, and protection functions. However, this standard was developed with a bias toward synchronous generation and does not sufficiently outline the requirements for all generation resource types.

The purpose statement of the standard requires modification to be inclusive of all generation resource types. While this class of resources are currently included in the applicability of PRC-019-2, additional clarity is needed in specifying the aspects of dispersed power producing resources that should be coordinated. There are also issues within PRC-019-2 regarding synchronous generation that need to be corrected or clarified to remove ambiguity. These comprehensive updates align with the intent and spirit of the standard.

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Dynamic reactive resources used to provide essential reliability services (ERS) in the BES include generation resources (rotating machine and inverter-based) as well as transmission connected dynamic reactive resources (power-electronics based). Existing reliability standards for verifying the capability and performance of dynamic reactive resources are only applicable to Facilities comprising generation resources. Augmenting the applicability of these standards 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 and performance is verified and validated for all varieties of dynamic reactive resources utilized in providing ERS in the BES.
Purpose or Goal (How does this proposed project provide the reliability-related benefit described above?):
This project will enhance reliability by maximizing a generator's capability and its ability to support grid stability during system disturbances by requiring the coordination of control systems with equipment capabilities and protection functions of all generation resource types.
Project Scope (Define the parameters of the proposed project):
The SDT should develop language that is relevant to all generation resource types. This will include modifications to the purpose statement, the applicability, and requirements. Additionally, the SDT should consider modifying Inclusion I4 of the Bulk Electric System (BES) definition and the associated diagrams in the BES Reference Document. In addition, augment the "Applicability – Facilities" and "Applicability-Functional Entities" section in PRC-019 reliability standard to address (non-generation) transmission-connected dynamic reactive resources. Also modify Requirements (including applicable attachments) as needed, to ensure they continue to address the additional Facilities. As needed, also define new Glossary Terms for all or some of the transmission-connected dynamic reactive devices noted in the 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[1] 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 SDT will consider and address the following items: 1. **Applicable Facilities** – Clarification of applicable facilities. a. Clarify Section 4.2.3.1 to state that it pertains to both the individual resources and the plant level voltage controls. [This section indicates that the individual generating units identified through Inclusion I4 of the Bulk Electric System (BES) definition are included only if voltage

[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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control for the facility is performed solely at the individual generator; thus, it is ambiguous as to whether this excludes the individual resources from the standard when the plant/facility level or park controller is being used for voltage control.][2]

b. Verify that static or dynamic reactive compensating devices (i.e., capacitor banks, static VAR compensators, STATCOMs, etc.) and synchronous condensers within BES generating facilities should be subject to the standard since they must be coordinated for protection and plant capability. [The language in footnote 1[3] for Requirement R1 implies that reactive compensating devices are not applicable since they are not installed or activated on a generator. These devices are system level voltage regulators and have no effect on an individual inverter capability or limiter functions within an inverter control system; however, they are important to system VAR support and reliability. For example, Type 1 and Type 2 wind turbine generators (WTG) typically employ reactive compensating devices on the collector side of the generator step-up (GSU) transformer. In this case, reactive compensating devices are integral to supporting the systems reactive needs and enhances the reliability of the BES. These devices are not captured by the BES definition because they typically connect at voltages less than 100 kV; however, they should be applicable to the standard for asynchronous and non-rotating resources.]

c. Review, and revise as necessary, Inclusion I4 of the BES definition and Figures I4-1, I4-2, I4-3, and I4-4 in the BES Reference Document to accurately depict all generation resources.

d. The "Applicability – Facilities" and "Applicability-Functional Entities" section in PRC-019 will be revised to address the transmission-connected dynamic reactive resources listed below. Also modify Requirements (including applicable attachments) as needed, to ensure they continue to address the additional Facilities. As needed, also define new Glossary Terms for all or some of the transmission-connected dynamic reactive devices noted below.
   i. Static VAR Compensator (SVC)
   ii. Static Compensators (STATCOM)
   iii. Line-commutated converter (LCC) HVDC
   iv. Voltage source converter (VSC) HVDC

2. **Requirement(s)** – Ensure the language is clear and inclusive of all generation resource types with respect to coordinating control systems, protection functions, and equipment capabilities. The following topics will reviewed at a minimum:

   a. **Controllers specific to dispersed power producing resources** – The standard is currently biased toward automatic voltage regulating (AVR) control systems used in conjunction with synchronous generation. The standard should address other control systems associated with dispersed power producing resources that are essential to reliability. Typically, inverters have a control system and the facility has a plant controller with a separate control system. The inverter has a control system that may operate in VAR control, Power Factor control, reactive

[2] Reference Section 4.10.10 of the White Paper from Project 2014-01 Standards Applicability for Dispersed Generation Resources
[3] "Limiters or protection functions that are installed and activated on the generator or synchronous condenser."

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power priority, or active power priority. The plant controller has a control system that may operate in Power Factor or Voltage Control modes. Coordination between any plant/park controller with individual resource control systems must be achieved to prevent unnecessary reduction of the resource.

b. **Momentary cessation** – "Momentary cessation" is a function within an Inverter-Based Resource (IBR) control system that reduces active and reactive current to zero when voltage is outside of a defined band.[4] A reduction in active and/or reactive current can negatively impact reliability, especially during system perturbations, since the function prohibits the IBR from providing support to the BPS during these events.[5] Ensuring clear language in this standard will ensure that BES generators are not unnecessarily ceasing current injection during abnormal conditions, that any cessation of current is coordinated with equipment capability, and that these functions do not pose a risk to BPS reliability.[6] Revisions to the standard should consider methods or parameters to eliminate momentary cessation where possible, otherwise ensure it is coordinated with equipment capabilities of the inverter where it cannot be eliminated (for legacy equipment).

c. **Controller upgrades and/or changes (e.g., software, firmware, etc.)** – Review language of Requirement R2 and determine whether firmware upgrades are considered "system, equipment or setting changes" under Requirement R2 since these may impact dispersed power producing resource voltage control(s), protection, and limiters.

d. **Steady State Stability Limit (SSSL)** – Determine whether the "stability limits" language in Requirement R1.1.2 should be removed from the standard. [Manual SSSL theory is only applicable when a generator AVR is in manual operation mode; however, the standard specifically instructs an entity to assume the AVR is in automatic mode. This assumption is identified because it is industry standard to coordinate the underexcitation limiter with the SSSL since that is the most conservative approach for AVR operation. However, the protection settings typically coordinate with the machine capabilities and not the manual SSSL.]

e. **Synchronous condensers** – If SSSL language remains in the standard, determine whether SSSL should be considered for synchronous condensers. [A synchronous condenser operates in a manner similar to a synchronous generator in terms of voltage regulation and the associated excitation control system. The electrical quantities for a synchronous condenser match the quantities specified in the manual SSSL methodology; however, the machine does not have a prime mover and cannot output real power. This drastically reduces the machines operating region since the unit will only be able to absorb or generate reactive power.]

[4] The voltage settings that cause momentary cessation are considered voltage protection settings within the inverter. Other functions within the inverter can cause momentary cessation to operate in a manner similar to a protective function. However, the focus for PRC-019 is on voltage-related functions.

[5] Including dynamic active power-frequency control and reactive power-voltage control.

[6] Momentary cessation has been observed in BPS solar PV facilities in all disturbances analyzed by NERC, including but not limited to the Blue Cut Fire, Canyon 2 Fire, Palmdale Roost, and Angeles Forest disturbances.

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f. **Stability limits for other types of generation resources** – If SSSL language remains in the standard, verify whether a SSSL must be considered for asynchronous and non-rotating generation resources. [Current references to stability limits are all relevant to synchronous machines (AVR in manual mode, fixed excitation voltage, etc.). If consideration of stability is necessary, provide a methodology or implementation guidance for the industry to use (e.g. small signal stability, etc.)]. g. **Voltage drop across dispersed power producing resource collector system** – Determine whether the voltage drop across the collector system, bus, generator step-up (GSU) transformer, or other facilities should be considered for coordination. h. **Time frame to perform coordination** – Review and revise the language in Requirement R2 to remove ambiguity surrounding the timeframe for performing coordination. [The current language can be interpreted as allowing the coordination to be performed 90 days after the "implementation of systems, equipment, or setting changes." This would allow an entity to put a unit back into service without performing coordination; thus, jeopardizing reliability. The original SDT has confirmed that the 90-day time frame was for scenarios in which an entity discovered a miscoordination.] Review and revise the 5-year calendar cycle in Requirement R1 relative to PRC-005 cycle and other PRC standards. Clarify when the coordination calendar is reset for Requirement R1 when a coordination study is completed for Requirement R2. 3. **Project 2021-01 MOD-025-2 SAR** – There are additional suggested revisions to PRC-019-2 outlined in the MOD-025-2 SAR. The Project 2021-01 SDT will consider both SARs as they make revisions to PRC-019-2.
Cost Impact Assessment, if known (Provide a paragraph describing the potential cost impacts associated with the proposed project):
Costs may include updating firmware on dispersed power producing resources, individual IBRs, park/plant controllers, and other associated equipment, and will vary depending on the approach taken to address the reliability-related risks stated above.
Please describe any unique characteristics of the BES facilities that may be impacted by this proposed standard development project (*e.g.*, Dispersed Generation Resources):
Synchronous generation and dispersed power producing resources may be impacted by the revisions.
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):
Generator Owner and Transmission Owner. The team should be made up predominantly by protection engineers with a background in generation protection (synchronous/dispersed power producing resources); preferably industry experts in this field. Additionally, IBR manufacturers and Engineering, Procurement and Construction firms familiar with dispersed power producing resources should be included because of their inherent knowledge of the capabilities and limitations of dispersed power

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producing resources. Team members should have extensive understanding of generation protection concepts/schemes. In addition, they should have some knowledge of control systems (AVR, IBR's, etc.)
Do you know of any consensus building activities[7] in connection with this SAR? If so, please provide any recommendations or findings resulting from the consensus building activity.
No
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)?
Project 2021-01 MOD-025-2 SAR scope revisions will be coordinated with this SAR. There are additional suggested revisions to PRC-019-2 outlined in the MOD-025-2 SAR. The Project 2021-01 SDT will consider both SARs as they make revisions to PRC-019-2.
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 SPCS initially attempted to develop Implementation Guidance (IG); however, while developing the IG, the group determined that the standard required additional clarity for IBRs.

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.	
☒	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.
☒	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.
☒	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.
☐	4. Plans for emergency operation and system restoration of interconnected bulk power systems shall be developed, coordinated, maintained and implemented.
☐	5. Facilities for communication, monitoring and control shall be provided, used and maintained for the reliability of interconnected bulk power systems.
☐	6. Personnel responsible for planning and operating interconnected bulk power systems shall be trained, qualified, and have the responsibility and authority to implement actions.
☐	7. The security of the interconnected bulk power systems shall be assessed, monitored and maintained on a wide area basis.
☐	8. Bulk power systems shall be protected from malicious physical or cyber attacks.

[7] 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).	
☒ Draft SAR reviewed by NERC Staff ☒ Draft SAR presented to SC for acceptance ☒ DRAFT SAR approved for posting by the SC	☐ Final SAR endorsed by the SC ☐ SAR assigned a Standards Project by NERC ☐ 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