

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:	EOP-004-4 Event Reporting Alignment with Inverter-Based Resource Performance Issues		
Date Submitted:	12/06/2022 04/27/2023		
SAR Requester			
Name:	Julia Matevosyan, ESIG (NERC IRPS Chair) Rajat Majumder, Orsted (NERC IRPS Vice Chair) Charlie Cook, Duke Energy (Project 2023-01 Chair)		
Organization:	NERC Inverter-Based Resource Performance Subcommittee (IRPS) As revised by Project 2023-01 IBR Event Reporting SAR Drafting Team		
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SAR Type (Check as many as apply)			
<input type="checkbox"/> New Standard <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		<input type="checkbox"/> Imminent Action/ Confidential Issue (SPM Section 10) <input type="checkbox"/> Variance development or revision <input type="checkbox"/> Other (Please specify)	
Justification for this proposed standard development project (Check all that apply to help NERC prioritize development)			
<input type="checkbox"/> Regulatory Initiation <input type="checkbox"/> Emerging Risk (Reliability Issues Steering Committee) Identified <input type="checkbox"/> Reliability Standard Development Plan		<input checked="" type="checkbox"/> NERC Standing Committee Identified <input type="checkbox"/> Enhanced Periodic Review Initiated <input checked="" type="checkbox"/> Industry Stakeholder Identified	
Industry Need (What Bulk Electric System (BES) reliability benefit does the proposed project provide?):			
NERC published the San Fernando disturbance report ¹ in November 2020, which identified a set of recommendations for industry. The NERC IRPS performed a follow-up analysis to identify any actions needed to address the recommendations laid out by NERC. The NERC Reliability and Security Technical Committee (RSTC) approved ² the IRPS follow-up white paper ³ at its June 2021 meeting. One of the			

¹ https://www.nerc.com/pa/rrm/ea/Documents/San_Fernando_Disturbance_Report.pdf

²

https://www.nerc.com/comm/RSTC/AgendaHighlightsandMinutes/RSTC_Day_1_June_8_2021_Agenda_Package_ATTENDEE_ONLY.pdf

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recommended actions in that white paper stated: “IRPWG should draft a SAR to address the outstanding recommendation by NERC to address the issue identified in EOP-004-4⁴ regarding the generation loss criteria so that it is applicable for inverter-based resources as well as synchronous generation.”

The proposed project will address the issue that reporting of generation loss events per the current EOP-004-4 uses relatively large size thresholds more suitable for synchronous generation; however, NERC and the Regional Entities have analyzed multiple widespread solar PV loss events (some also involving other generation losses as well) across a large number of resources that did not meet the EOP-004 criteria yet have highlighted systemic reliability risks posed by inverter-based resources that should be reported by applicable entities. This project will modify the existing generation loss criteria so it is more suitable and appropriate for reporting inverter-based resource events and so it aligns with past large-scale disturbances analyzed by the Electric Reliability Organization (ERO). Without these improvements, the ERO must lean on ad hoc reporting per the NERC Event Analysis Process, which is voluntary in nature and involves significantly longer reporting timelines. The EOP-004 standard should be aligned with this process from a reporting size criteria perspective. As reported in numerous ERO disturbance reports, access to data useful for event analysis and risk mitigation following large-scale disturbances has been challenging for inverter-based resources. This has resulted in data unavailability and overwriting by affected facilities since the ERO Enterprise is unable to send requests for information (RFIs) in a timely manner (i.e., must wait for the brief report to be submitted by the associated Reliability Coordinator first). Improved reporting will enable quicker response to widespread inverter-based resource loss events and ultimately lead to improved performance of the generation fleet through more detailed analysis and coordination with affected entities, where applicable.

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

This purpose of this SAR is to revise Attachment 1 of EOP-004-4 to ensure that generation loss events impacting many resources are included in event reporting. This has been highlighted in multiple ERO disturbance reports, and has included inverter-based resources as well as synchronous generation. EOP-004-4 does not presently include any event categorization of this nature since it focuses solely on a large generation loss criteria more suitable for forced outages of large synchronous generating resources. The proposed revisions to EOP-004-4 will help align mandatory event reporting with the updated NERC Event Analysis Categorized Events⁵ and will ensure that events involving a widespread reduction or loss of inverter-based generation is reported appropriately.

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<https://www.nerc.com/comm/RSTC/IRPWG/IRPWG%20San%20Fernando%20Disturbance%20Follow-Up%20Paper.pdf>https://www.nerc.com/comm/RSTC/AgendaHighlightsandMinutes/RSTC_Day_1_June_8_2021_Agenda_Package_ATTENDEE_ONLY.pdf (Agenda item 12)

⁴ <https://www.nerc.com/pa/Stand/Reliability%20Standards/EOP-004-4.pdf>

⁵ https://www.nerc.com/pa/rrm/ea/ERO_EAP_Documents%20DL/ERO_EAP_v4.0_final.pdf

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

As described in detail below, the scope of this project includes the following revisions to EOP-004-4:

- Modify Attachment 1 to either revise the “Generation loss” row to be inclusive for inverter-based resources or add an additional row related to inverter-based resource loss events and clarify the existing row.
- Provide any necessary clarity around reporting “loss” events for inverter-based resources that account for the differences in their performance compared with synchronous generation ~~(e.g., momentary cessation, delayed power recovery, unexpected ramp rate interactions, and other factors that affect the overall resource loss value)~~, such as clarifying how the duration of generation loss impacts the aggregate loss calculation for inverter-based resources.
- Ensure that future events similar to past widespread loss of solar PV events analyzed by NERC would be captured by the event reporting thresholds specified in EOP-004-4.
- Consider whether number of affected facilities or resources should be a criteria for reporting, in addition to MW threshold values. Many affected facilities responding to BPS faults in an abnormal manner could pose risks to BPS reliability.
- Ensure that the criteria for reporting in Attachment 1 is inclusive of both Category 1i and Category 1j events in the NERC Event Analysis Process.

To ensure clarity, based on available SCADA data, BAs should report “generation loss” events of applicable sizes that are inclusive of any abnormal resource losses by solar PV, wind, battery energy storage ~~resources (defined as generating resources)~~ systems and hybrid plants.

-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 justification⁶ 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 *Background and Technical Basis* of this SAR (see attachment at end of document) provides key references from ERO disturbance reports highlighting the challenges of conducting adequate event analysis. This SAR is proposing to align the NERC Event Analysis Process reporting for Category 1i events with the reporting requirements in EOP-004 so that the ERO Enterprise is notified of widespread inverter-based resource loss events in a timely manner. This will facilitate more effective and efficient event analysis involving these resources, which will then help improve reliability and operational performance of the inverter-based resource fleet. The ERO Enterprise continues to observe and analyze widespread inverter-based resource loss events that include solar photovoltaic (PV), wind, battery energy storage, and hybrid plants. These events have also included

⁶ 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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additional loss of synchronous generating resources in addition to the inverter-based resources. It is important that these types of events are reported in a timely manner.

The proposed project seeks to modify Attachment 1 related to “Generation loss” events. Currently the loss thresholds are quite large, focused primarily on loss of large synchronous generation resources and does not capture widespread loss of many smaller resources such as those observed by the ERO Enterprise related to inverter-based resources.

It may be necessary to more clearly define what “loss” events are for inverter-based resources since the reduction of power output from these resources may not simply reflect the opening of a circuit breaker. This has been documented in many ERO disturbance reports and guidelines. Reductions that involve the protections and controls from the power electronics of inverter-based resources should be included in the “loss” accounting, and should not solely focus on opening of ac circuit breakers. This may need to be clarified and noted in the EOP-004 standard. The standard drafting team can leverage the work done by the NERC Event Analysis Process to articulate the Category 1i loss events.

This SAR also proposes that the standard drafting team also consider whether number of affected facilities should be a threshold for reporting, in addition to the size of the reduction. Number of affected facilities may be a useful indicator of possible systemic reliability issues and may provide faint signals to larger reliability issues that could occur in the future if not mitigated.

The standard drafting team should coordinate with the U.S. Department of Energy regarding alignment and updates to the DOE-417 form to help facilitate effective reporting of events.

The standard drafting team may need to modify an existing term or add a new term to the NERC Glossary Terms to help clarify changes to the standard. Therefore, the IRPS has included this option for the standard drafting team in the proposed SAR.

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

Exact costs are unknown. However, this standard proposes to modify reporting thresholds for existing activities performed by the BA, resulting in an increase in number of reports provided. However, these reports are simple to provide and are aligned with the DOE OE-417 reporting activities. NERC is actively coordinating with DOE to ensure alignment with updates to OE-417 and the EOP-004 standard; dissimilarities between the OE-417 form and the reporting requirements of EOP-004 could have significant cost since the vast majority of entities reporting use the OE-417 reporting to meet the obligations of EOP-004. Hence, NERC is actively engaging early and believes coordination throughout the standards drafting team process can ensure an effective update and alignment between activities.

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

Requested information	
None. This SAR will impact Balancing Authorities, but these are entities and not 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):	
Balancing Authorities have direct applicability to the standard. Additional entities that may provide additional value to the standard drafting efforts include Transmission Operators, Reliability Coordinators, Generator Owners, and Generator Operators.	
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.	
This SAR is an outcome of the recommendations set forth in the white paper produced by the NERC IRPS and approved by the NERC RSTC regarding the San Fernando Disturbance Report Follow-Up: https://www.nerc.com/comm/RSTC/IRPWG/IRPWG%20San%20Fernando%20Disturbance%20Follow-Up%20Paper.pdf	
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)?	
SPIDERWG is also proposing a SAR related to EOP-004 that would specifically relate to DERs; however, this would not conflict (rather complement) this SAR. This can be coordinated during the creation of standards projects.	
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 IRPS has published many reports, 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 cannot ensure that widespread resource loss events related to inverter-based resources are reported to the ERO per EOP-004-4.	
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"/>	

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.

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	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.

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 checked="" type="checkbox"/> Draft SAR reviewed by NERC Staff	<input type="checkbox"/> Final SAR endorsed by the SC
<input checked="" type="checkbox"/> Draft SAR presented to SC for acceptance	<input type="checkbox"/> SAR assigned a Standards Project by NERC
<input type="checkbox"/> DRAFT <input checked="" 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

Background and Technical Basis

The following recommendation is copied from the San Fernando Disturbance Report:

Recommendation (Industry, NERC, FERC): Ad hoc reporting of events involving multiple generating resources and possible systemic performance issues should not be considered an acceptable level of reporting. NERC EOP-004-4 should be reviewed in terms of the thresholds used for generator tripping events and should also consider the extent of resources involved in the disturbance. A reasonable threshold for reporting would be around 500 MW of reduction in output (partial or full tripping across all affected resources). Updates to reporting these types of events (not necessarily with quick turnaround times) will help industry improve their situational awareness of abnormal inverter-based resource performance and possible issues needing mitigating action by facility owners to improve their performance.

The IRPWG white paper regarding the San Fernando disturbance follow-up stated the following:

Follow-Up: There is no known action to develop a SAR to address the issues raised by NERC regarding EOP-004-4 and the generation loss requirement it includes. Without addressing this issue, these types of events will not be reported on any uniform basis and will continue to be ad hoc in terms of initiating an analysis. BA and RC reporting helps ensure that the ERO Enterprise is apprised of widespread events and coordinated analyses can occur to support industry address possible reliability risks. NERC Event Analysis Process now includes Category 1i to capture the “non-consequential interruption of inverter type resources aggregated to 500 MW or more not caused by a fault on its inverters, or its ac terminal equipment.” The ERO Enterprise will continue to analyze these types of disturbances to identify any possible systemic causes of inverter tripping.

Recommended Action from IRPWG Follow-Up: IRPWG should draft a SAR to address the outstanding recommendation by NERC to address the issue identified in EOP-004-4 regarding the generation loss criteria so that it is applicable for inverter-based resources as well synchronous generation.

Timely reporting and analysis of affected inverter-based resource facilities for widespread loss or reduction of their output is critical for understanding the changing resource mix and for supporting the reliable operation of these new resources. ~~Port-mortem~~Post-mortem event analysis enables entities to learn about any abnormalities in their performance (which then can be assessed with their provided models for reliability studies) and develop corrective actions to address those issues. NERC and the Regional Entities continue to support industry in identifying possible systemic reliability issues, work with affected entities to develop corrections, and coordinate with equipment manufacturers to identify possible improvements to existing equipment and equipment being newly released to market.

