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:	Energy Assessments with Energy– Constrained Resources in the Planning Time Horizon		
Date Submitted:	~~June 8, 2022~~ Revised on December 6, 2022		
SAR Requester			
Name:	Chair Peter Brandien on behalf of the Energy Reliability Assessment Task Force (ERATF)		
Organization:	~~The ERATF of the Reliability and Security Technical Committee (RSTC)~~ Revised by Project 2022-03 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?):			
Unassured deliverability of fuel supplies, coincident with inconsistent output from variable renewable energy resources and volatility in forecasted load, can result in insufficient amounts of energy available from the BES to serve electrical demand and ensure the reliable operation of the BES throughout each hour of the time period being evaluated[1]. Historically, analyses of energy available to the BES focused on capacity reserve levels across peak-demand time periods. Generating resources and the requisite fuel were assumed available. This was a logical assumption in the past as fuel availability was assured with either firm fuel contracts (commodity plus transportation capacity), or on-site storage (e.g., oil, coal, reservoir-based hydro), or required			

[1] The industry need is described in the *Ensuring Energy Adequacy with Energy-Constrained Resources* white paper, presented to the RSTC, December 2020.

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periodic and predictable fuel replacement (e.g., nuclear). The availability of dispatchable generation with diverse fuel types promoted flexibility in providing energy for the BES should one fuel type become unavailable.

Reserve margins are planned so that deficiency in capacity to meet daily peak demand (Loss of Load Expectation {LOLE}) did not exceed one day-in-ten-years. LOLE is calculated from probabilistic analysis, typically using generating unit forced outage rates based on random equipment failures derived from its historic performance. The targeted level of one event every ten years is traditionally based on daily peaks (rather than hourly energy obligations). Additional insights can be gained through these methods by calculating Loss-of-Load-Hours (LOLH) and expected unserved energy (EUE) based on the mean-time-to-repair (MTTR) unit averages.

Today, the transition to include more just-in-time energy ~~from coal and nuclear generation to wind, solar, natural gas (with and without oil back up), distributed energy resources, and hybrid (renewables plus energy storage)~~ resources is creating a more complex scenario and highlighting the need for energy assurance. Installed generating capacity analysis alone is not sufficient to ensure a reliable supply of energy for the BES. The proliferation of intermittent renewable generation in the resource mix increases the importance of having precisely controllable resources with sufficient fuel available, ready to respond when needed. The increasing prevalence of distribution-level resources and flexible load programs also introduces added volatility into energy forecasts, further complicating energy reliability assessments. Supply intermittency and demand volatility both require the dispatchable generation fleet to be available and flexible enough to respond when called upon. These factors can also lead to unexpected and unstudied energy issues in non-peak hours, a risk that would not be identified by traditional analyses focused on capacity reserve margins across peak demand periods.

The transition to more intermittent resources is increasing the reliance on natural gas as the fuel needed for dispatchable resources that can promote energy assurance; however, uncertainty is still an issue if the natural gas-fueled resources are subject to fuel curtailment or interruption (by virtue of fuel acquisition contracts) during peak fuel demands which often correspond with winter-peak electric demands. Additionally, the design of natural gas pipeline systems and the availability of back-up natural gas feeders can impact individual generators and the BES under pipeline disruption scenarios.

The intermittency of renewable generation, demand volatility, the need for sufficient flexibility from balancing generation resources, and the potential for natural gas supply interruptions all combine to highlight the need for energy reliability assessments that analyze all hours of a given study period rather than just across the peak hours.

Energy assurance and fuel assurance risks are becoming more apparent as extreme weather has resulted in energy deficits (as opposed to capacity deficits) in recent years. During the past 10 years, multiple extreme events that have jeopardized the BES.

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In February 2011[2], an arctic cold front in the southwest United States resulted in generation outages and natural gas facility outages. In January 2014[3], a polar vortex affected the central and eastern United States and Texas. Another event in 2014 triggered generation outages and natural gas availability issues. In January 2018[4], the south-central United States experienced many generation outages resulting in emergency measures. In 2021, the Oroville hydroelectric facility was shut down when reservoir levels, due to drought conditions, dropped below its minimum operating elevation. Finally, the cold weather event of February 2021[5] impacted Mississippi, Louisiana, Arkansas, Oklahoma, and Texas. Events like these highlight the need for a new approach to reliability planning that considers the extreme conditions and variability the BES is increasingly experiencing. As part of ongoing near and long-term planning, many entities have started incorporating some limited energy reliability assessments (e.g., uncertainty around renewable output) into reliability studies that produce key metrics: LOLE, LOLH, and EUE. However, there is inconsistency among entities in whether and how the assessments are performed. TPL-001-4 calls out the loss of a large natural gas pipeline as an extreme event that should be studied for areas with significant natural gas generation, but beyond this mention, identifying and mitigating risks identified by energy reliability assessments are not addressed in existing NERC Reliability Standards. To achieve the level of consistency needed across the industry, energy reliability assessments for the planning (> one year) time horizon and the mitigation of identified risks must be mandated and codified in NERC Reliability Standard requirements.
Purpose or Goal (How does this proposed project provide the reliability-related benefit described above?):
The goal of the SAR is to address energy assurance rather than resource adequacy. This project will enhance reliability by requiring industry to perform energy reliability assessments to evaluate energy assurance and when predefined criteria are not met, ~~potentially~~ develop Corrective Action Plan(s), Operating Plans, or other mitigating ~~actions. to~~actions to address identified risks. Energy reliability assessments evaluate energy assurance across the Near-Term Transmission Planning and Long-Term Transmission Planning or equivalent[6] time horizon by analyzing the expected resource mix availability (flexibility) and the expected availability of fuel during the study period.
Project Scope (Define the parameters of the proposed project):
The project scope is to create or modify NERC Reliability Standards to address the following: • Create defined terms (e.g., energy reliability assessment, energy assurance, extreme event analysis) as needed (refer to Appendix B for proposed definitions to key terms). • Create requirement(s) and identify functional entities to accomplish the following:

[2] Outages and Curtailments During the Southwest Cold Weather Event of February 1-5, 2011 - FERC and NERC
[3] Polar_Vortex_Review
[4] 2019 FERC and NERC Staff Report: The South Central United States Cold Weather Bulk Electric System Event of January 17, 2018
[5] February 2021 Cold Weather Grid Operations: Preliminary Findings and Recommendations - FERC, NERC and Regional Entity Joint Staff Inquiry
[6] The phrases "Near-Term Transmission Planning" and "Long-Term Transmission Planning" are NERC Glossary terms. The drafting team may consider adding definitions to the NERC Glossary that are independent of transmission.

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~~Create defined terms (e.g., energy reliability assessment, energy assurance, extreme event analysis) as needed (refer to Appendix B for proposed definitions to key terms).~~

- Conduct an energy reliability assessment:
  - Define a period of time to be studied within planning time horizons that appropriately considers the specific characteristics of the resources in the area being evaluated, including such properties as the logistics involved in the replenishment of fuel and the ability to accurately forecast or assume system conditions. Time periods are expected to differ between areas due to the notable differences in electric systems, interconnected fuel delivery systems, weather, climate, operating philosophies, and other contributing factors.
  - Include an evaluation of the unique characteristics of variable resources and their impact(s) on non-variable resources.
  - Account for uncertainty related to both supply and demand across all hours of the studied period, probabilistically when appropriate. Potential sources of uncertainty to be considered include but are not limited to:
    - ~~Time-coupled restrictions on the availability of fuel, including the limited capability to replenish fuel at or above the rate at which it is consumed. This includes transportation of stored fuels, such as oil and coal, as well as the delivery of fuels with continuous delivery, such as natural gas. Where relevant, incorporate potential contractual limitations on fuel availability.~~
      - ~~Outage duration informed by potential failure modes.~~Time-coupled restrictions on the availability of fuel, including the limited capability to replenish fuel at or above the rate at which it is consumed. This includes transportation of stored fuels, such as oil and coal, as well as the delivery of fuels with continuous delivery, such as natural gas. Where relevant, incorporate potential contractual limitations on fuel availability.
      - Outage duration informed by potential failure modes.
      - Flexibility/operational constraints of resources.
      - Disruptions to fuel delivery supply chains (e.g., pipeline outages, constraints on natural gas availability due to extreme cold).
      - Coincident outages of multiple independent resources.
      - Common mode outages not connected to fuel supply.
      - Variability of potential resource ~~renewable~~ profiles/availability.

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* Impact of energy storage resources.
* Transmission capacity and deliverability to the load centers, including imports.
* Correlated impact of weather and other significant events on load and generation7.
* ~~Extreme weather~~Low probability/high impact weather events.

- Energy reliability assessments should be required to:
  - ~~Include an evaluation of the unique characteristics of variable resources and their impact(s) on non-variable resources (probabilistically).~~
  - Be coordinated between areas to synchronize interchange assumptions.
  - Be conducted on a clearly defined periodic basis and performed in each of the NERC defined planning time horizons.
  - Be periodically validated and updated, and updated when changes to assumptions and input data nullifies an existing assessment.
    - ~~Be conducted on a clearly defined periodic basis and performed in each of the NERC defined[8] planning time horizons.~~
    - ~~Be periodically validated and updated, and updated when changes to assumptions and input data nullifies an existing assessment.~~
- For energy reliability assessments, measurements and observations should be compared to predefined criteria, and results should be in terms of impact on the BES. The predefined criteria do not need to be specifically defined within the Standard. Alternatively~~Instead~~, the standard would require each entity ~~could will~~ to establish and document criteria as part of complying with the Standard.~~.~~ The predefined criteria may be set specifically within the Standard or established and documented by each applicable entity as part of complying with the Standard.
- When predefined criteria are not met, ~~require~~ the responsible entity shall develop ~~development of~~ the Corrective Action Plans, Operating Plans or other mitigating actions.
- ~~Coordinate with the drafting team that is working on the "*Energy Assessments with Energy-Constrained Resources in the Operations and Operations Planning Time Horizons*" SAR.~~
- Coordinate with the NERC Electric-Gas Working Group, the North American Energy Standards Board, ~~and~~ the *Project 2021-07 Extreme Cold Weather Grid Operations, Preparedness, and Coordination* drafting team and other groups to minimize duplication of efforts and ensure that non-conflicting requirements are developed.

[7] For example, cascading series of issues including an extreme cold weather event across a significant portion of the NERC footprint, multiple forced outages early in the morning (when there is a lack of solar resources), and inadequate availability of natural gas. A wide area impact makes depending on imports less available.

[8] ~~https://www.nerc.com/files/glossary_of_terms.pdf~~

Requested information
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[9] 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 detailed description and requirements of proposed standards are included in the previous section of this SAR as part of the scope. Energy assurance is an increasingly important aspect of a reliable BPS, but it is inconsistently defined and measured, and energy reliability assessments to evaluate energy assurance as part of BPS long-term planning procedures are not included in existing NERC Reliability Standards. Current ~~standards and~~ practices focus on capacity assessments to evaluate whether sufficient power is available to supply the BPS at peak demand; however, an analysis of energy sufficiency is required to effectively identify BES risks because of the changing resource mix, the increasing volatility of demand, and the interconnected nature of the electric power system (with external supply chains, e.g., natural gas). The *2021 ERO Reliability Risk Priorities Report* (produced by the Reliability Issues Steering Committee) and the *Ensuring Energy Adequacy with Energy-Constrained Resources* whitepaper identified these issues as significant risks to reliability for which solutions to evaluate and mitigate are required. Through a gap analysis of NERC Reliability Standards and a survey of industry stakeholders, the NERC ERATF more specifically identified the energy-related risks that need to be addressed through the Standards development process. Refer to the ERATF Technical Justification document (Appendix A) for additional information and a more detailed description of the justification. The following Reliability and Security Guidelines (available at nerc.com) and technical reference documents can serve as guides to develop standards by expanding upon the work of the EGWG to energy assurance standards: • Reliability Guideline: Fuel Assurance and Fuel-Related Reliability Risk Analysis • Reliability Guideline: Generating Unit Winter Weather Readiness • Reliability Guideline: Gas and Electrical Operational Coordination Considerations • Data Collection: Approaches for Probabilistic Assessments • 2020 Probabilistic: Regional Risk Scenarios Sensitivity Case • Probabilistic Adequacy and Measures Report Additionally, the ERATF, Probabilistic Assessment Working Group (PAWG), Reliability Assessment Subcommittee (RAS), and other committees as well as their work can be consulted to facilitate the development of standards requirements.

[9] 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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Cost Impact Assessment, if known (Provide a paragraph describing the potential cost impacts associated with the proposed project):
It is not the ERATF's intention to require specific solutions to the energy-related issues identified in the assessments. This SAR is intended to propose modifications to NERC's suite of Reliability Standards to require that responsible entities further evaluate risks related to energy availability. In addition, the SAR proposes revisions to Reliability Standards that would require responsible entities to create Corrective Action Plans, Operating Plans, or other mitigating actions to address risks related to energy availability. Using a performance-based approach would allow entities to take local, state, and regional needs, as well as federal regulations and other factors as appropriate into consideration. The costs associated with this assessment are expected to be comparable to those associated with the responsible entity's activities to evaluate and address potential reliability risks to the System. The cost impact is unknown and will be considered during drafting team meetings.
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 characteristics of the BES facilities impacted by this project include: fuel type, delivery logistics (e.g., the ability to access additional fuel, sufficient road and rail networks, barges for waterway-based plants, liquefied natural gas deliveries), design, construction, and operational characteristics, etc.
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):
Primary: Planning Coordinator and Resource Planner. Impacted: Reliability Coordinator, Distribution Provider, Balancing Authority, Transmission Operator, Transmission Owner, Generator Operator, Transmission Service Provider, Transmission Planner, and Generator Owner.
Do you know of any consensus building activities[10] in connection with this SAR? If so, please provide any recommendations or findings resulting from the consensus building activity.
The ERATF's SAR development process is a consensus building activity and includes input from its members and observers. Previous drafts of the SAR have been presented to and commented on by the Reliability and Security Technical Committee and the Member Representatives Committee members. Those comments are incorporated into the updated SAR. On February 16, 2022, the ERATF conducted an industry workshop that outlined the challenges and considerations concerning solutions for performing energy reliability assessments. On May 19, 2022, the ERATF conducted a follow up industry webinar to provide an update on how the SAR comments have been addressed.
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)?

[10] 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.

Requested information
Project 2022-02 Modifications to TPL-001-5.1 and MOD-032-1, Project 2021-07 Extreme Cold Weather Grid Operations, Preparedness, and Coordination and work to coordinate with any further projects that might impact this effort:~~;~~ consider the impact to the TPL, EOP and TOP standards.
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.
Three reliability guidelines and three reference documents have been published in recent years that provide valuable tools for industry to assess and manage energy risks, particularly risks related to fuel assurance. However, the continued reoccurrence of extreme events and resulting impacts on fuel and energy supplies have demonstrated that Reliability Standard(s) are needed to provide consistency across the industry in performing energy reliability assessments and mitigating identified reliability risks. Reliability and Security Guidelines (nerc.com) • Reliability Guideline: Fuel Assurance and Fuel-Related Reliability Risk Analysis • Reliability Guideline: Generating Unit Winter Weather Readiness • Reliability Guideline: Gas and Electrical Operational Coordination Considerations Probabilistic Assessment Working Group (PAWG) (nerc.com) • Data Collection: Approaches for Probabilistic Assessments • 2020 Probabilistic: Regional Risk Scenarios Sensitivity Case • Probabilistic Adequacy and Measures Report

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.

Reliability Principles	
☐	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.

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
e.g., NPCC	

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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