

Energy Assessment Technical Justification

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Introduction

Energy assurance is an increasingly important aspect of a reliable Bulk Electric System (BES) but has been inconsistently defined and measured without explicit standards, including energy assessments as part of bulk power system (BPS) operations, operational planning, and long-term planning procedures. While current standards and practices focus on capacity assessments to evaluate sufficient power to supply the BPS at peak demand, the interconnected nature of the electric power system with external supply chains (e.g., natural gas), the changing resource mix, and the increasing volatility of demand require analysis of energy sufficiency to understand BPS risks adequately. The *2021 ERO Reliability Risk Priorities Report*, produced by the Reliability Issues Steering Committee (RISC), and the *Ensuring Energy Adequacy with Energy-Constrained Resources*¹ whitepaper identify these issues as significant risks to reliability that require solutions to address and mitigate these risks. The Energy Reliability Assessment Task Force (ERATF) identified gaps in the standards through a review of NERC standards related to energy risks and a survey of industry stakeholders. These identified risks and gaps in standards highlight the need to revise Reliability Standards and/or to create new Reliability Standards to evaluate and mitigate energy risks.

The ERATF was formed to assess risks associated with unassured energy supplies. The task force was created to provide a formal process to analyze and collaborate with stakeholders to address the issues identified in the *Ensuring Energy Adequacy with Energy-Constrained Resources* whitepaper. This whitepaper identified energy sufficiency concerns related to operations, operations planning, and mid- to long-term planning time frames.

Based on the eleven questions formulated in the whitepaper, the task force created a survey questionnaire. The survey was distributed to the subgroups of the Reliability and Security Technical Committee (RSTC) and independent system operators/regional transmission organizations to gather feedback on energy assurance for three focus areas:

- Energy adequacy and flexibility for evolving resource mix
- Natural gas delivery assurance
- Metrics, procedures, and analysis

The goal of the survey was to better understand how stakeholders are evaluating their energy constraint issues and fuel availability issues by extension. The original 11 questions from the whitepaper were modified slightly to seek more specific answers that would inform the ERATF's recommendations. For example, sub questions were added to understand how specific assessment input assumptions were developed and how the impact of varying those assumptions was assessed.

¹[Energy Assurance White Paper \(nerc.com\)](https://www.nerc.com/energy-assurance-white-paper)

The survey questionnaire had 18 core questions, and NERC stakeholder groups, independent system operators, and individual utilities provided 12 responses. These responses provided a large amount of information (over 500 answers) to help evaluate the energy constraint issues.

NERC ERATF Energy Assessment Survey

In September 2021, the NERC ERATF formed a subgroup of volunteers to review all the survey responses and identify recommendations. The rigor and thoroughness of the responses was excellent, and it is clear that entities put a lot of work into their responses. On October 18, this subgroup presented high-level summaries of the responses to the 18 core questions and higher-level, generalized responses as described in the following:

- Across many of the responses, it was not always clear if entities were addressing current practices for capacity assessments or energy assessments. Many entities responded that they modify capacity assessments with higher forced outage rates and extreme scenarios to evaluate a range of operating conditions, but these are not well defined and are performed inconsistently across industry based on the energy assessment responses.
- The survey demonstrated differences in how energy assessments are performed in the three time frames (operations, operational planning, and mid- to long-term planning).
- It was unclear what operating entities do with low likelihood, high impact energy assessment results. Some provide the results publicly to stakeholders for awareness, but most do not. For predicted energy deficiencies in the operational planning time frame of one to three days, almost all entities do schedule additional capacity. Most do not provide energy assessments reflective of low likelihood, high impact events in seasonal assessments. Some respondents mentioned reviewing extreme contingencies in the longer-term planning time frame, but it is unclear if any planning actions are taken. The following contain more detail:
 - Most of the responses were focused on extreme weather scenarios. Very few comments on the evaluation criteria included other potential failure modes, including cyber-attacks or other disruptions that could impact energy assurance, specifically cyber-attacks that impact the fuel supply chain.
 - Many entities use 30 years of history to develop planning forecasts, but others responded that *"...the world climate and social policies (heating & transportation electrification) are changing fast..."* and that entities should focus and forecast the future based predicted future events more so than history, including worse case extreme weather.
- Many responded that developing forecasts and assumptions for the mid- and long-term assessments is very difficult, and it is challenging to assign levels of confidence in those forecasted assumptions. As an example, it is difficult to forecast fuel replenishment or renewable production in the 6–12 month time frame and more so in the long-term planning time frame.
- Some entities responded that the worst conditions could be in the fall or spring seasons in the future with low renewable generation rather than heat wave peak conditions if those peak conditions also included high renewable generation.

- Some entities responded that there are regional differences that may result in energy assessment reliability issues. More specifically, some operating entities have wider ranges in peak loads for extreme temperatures, some have significant fuel risks, some have extreme storm risks, some have significant forest fire risks, and some have drought risks. The reliability implications can vary regionally, so risks can vary regionally. Most responded that it is important across all of the BES industry to “...develop common and consistent energy assessment methods...”
- A few responded on the need to assess sufficient energy flexibility, including dispatch energy, reserves, and regulation.
- Some offered that transitioning from capacity adequacy to energy assurance can initially be performed by considering more conservative assumptions with fuel, wind, and solar as well as modeling higher probabilities of derates and extreme weather. However, more sophisticated techniques need to be developed.
- Some entities offered that, based on the February 2021 extreme cold weather events, it is clear that extreme peaks can be coincident with loss of fuel.
- Many respondents indicated that energy assessments should be performed throughout the year, not just during peak conditions, to capture the risk for fuel unavailability.
- Classic forced outage rate measurements, such as effective force outage rates demand metrics and unforced capacity constructs, are poor for assessing renewable energy assurance as they assume randomness for failures rather than coincidences. Many existing capacity valuation constructs, especially for longer term resource adequacy, do not value capacity that might support energy deficits that result from multiday loss of resources, such as loss of fuel for over a week, especially for common mode loss of regional fuel.
- Some entities offered that significant issues in the planning horizon are the assumptions regarding retirements of legacy fossil fuel resources with flexibility.
- Developing mid- to long-term assumptions is very important, like “*what to assume for non-ICAP imports*” or “*what to assume for fuel replenishment*” in seasonal time frames.
- Some use 90–10 for extreme scenario assessments while others do not.

NERC Reliability Standards Review

A set of sub-teams of the ERATF was formed to review the existing NERC Reliability Standards from the viewpoint of energy assurance and identify any gaps. The perspective of this review was addressing the assumption Reliability Standards may have that energy is always available. This assumption is now under review with the new resource mix and may not be always true without having performed an energy assessment and without monitoring the resource’s ability to deliver. One team reviewed the operations planning time frame, and a second team assessed at the mid- and long-term planning time frame.

The comments from the operations planning sub-team were the following observations:

- The existing Reliability Standards do not explicitly define or require energy assessments.

- A number of the Reliability Standards depend on resources to deliver energy to adhere to the requirements, such as operating within system operating limits and interconnection reliability operating limits, contingency reserves to regulate the system, and energy characteristics—such as large ramps that may constrict or be limited by available energy. The timing of deploying energy resources to meet the demand is crucial.
- There is little understanding of critical infrastructure interdependencies and their potential impacts on power generation.
- Currently, there are insufficient tools to model and forecast wind, solar, etc. for energy assessments. Also mentioned was to consider power system modeling to create more accurate predictive tools and include dynamic modeling of the natural gas system.
- As the majority of fuel infrastructure exists beyond a single area, there is a need to understand and model the fuel infrastructure on a larger basis (i.e., effects from events outside of a specific area that can have impact on that area), so the impacts can be understood.
- Considering that NERC Reliability Standards that require the use of generation assume that fuel is available, situational awareness was mentioned. The emergency operations and transmission operations Reliability Standards and transmission operational requirements should require energy assessments. With the current Reliability Standards, an adequate analysis of the transmission system can be conducted while still not meeting the energy requirements needed for the reliable operations of the BES. It is unclear whether or not the standards are assuming that there is adequate situational awareness and it is possible to maintain sufficient energy supply. There is an energy aspect of situational awareness that is missing from the current set of Reliability Standards.
- Consider moving some elements of the NERC reliability and security guidelines² into NERC's Reliability Standards.

The comments and recommendations from the mid- to long-term planning sub-team include the following observations:

- The existing Reliability Standards do not explicitly require energy assessments. In a new or revised standard, consider the following attributes:
 - Add requirement(s) for extreme weather or environmental³ events
 - Determine how much time is required to recover and prepare for the next stress event
 - Create an approach to support assessments of the impact of decarbonization plans
 - Consider the risk to natural gas supply disruption, such as natural gas being unavailable due to high demand
 - Ensure that there is adequate coordination between the operations and planning teams

² <https://www.nerc.com/comm/Pages/Reliability-and-Security-Guidelines.aspx>

³ Extreme environmental events includes long-duration environments, such as cloud cover, smoke, no wind, etc.

- When writing transmission planning studies, consider including other transmission equipment along with transformers
- Studies need to account for additional characteristics (e.g., ramp rate, start/stop of units)
- Consideration is needed for dynamic load model studies
- It was noted that the transmission planning Reliability Standards are potentially the most appropriate location to add an energy assurance requirement or that a new class of standards would need to be created.

RISC Recommendations

The [2021 ERO Reliability Risk Priorities Report](#)⁴ developed by the RISC identifies risks related to energy security as a significant risk to the BES that needs to be managed,⁵ and energy assurance metrics and standards that require energy assessment would help to mitigate these risks. The report also makes recommendations for the RSTC to address these risks.

Based on survey results of emerging risk, three of the top four ranked risks are connected to energy security and assessment issues (i.e., changing resource mix, resource adequacy and performance, and critical infrastructure interdependencies).⁶ These identified risks are consistent with the risks highlighted by the ERATF's survey and standards review. The RISC's conclusions explicitly recommend the following:

“The RSTC should develop methods, processes, tools, metrics, and/or standard authorization requests that are needed to address energy security. Recent experiences have demonstrated that capacity alone, given the grid transformation, is not sufficient to ensure sufficient energy is available to serve consumer needs. Capacity analysis is vital but now must be buttressed with energy assessments to ensure that the system is planned and operated in a way that provides sufficient energy during widespread, long-duration extreme conditions.”

This recommendation points out that capacity analysis is insufficient for planning and operational energy assurance and the need for energy assessment to fill in gaps.

Recent Reliability Events

Energy assurance and fuel assurance risks are becoming more apparent as extreme weather has resulted in deficits in energy (rather than capacity) in recent years. During the past 10 years, there have been multiple extreme events that jeopardized the BES where energy assessments could have helped identify and mitigate them. In February 2011, there was an arctic cold front in Southwest United States that resulted in generation outages and natural gas facility outages. In January 2014, there was a polar vortex that affected Central and Eastern United States and Texas. Again, the 2014 event triggered generation outages and natural gas availability issues. In January 2018, South central United States experienced many generation outages that resulted in emergency measures. Due to drought conditions, the Oroville

⁴ [2021 ERO Reliability Risk Priorities Report Source.](#)

⁵ 2021 ERO Reliability Risk Priorities Report classifies risks to “manage” as risks that “are emerging, imminent, and pose significant threats and where thorough strategic planning and industry collaboration are needed for risk mitigation.”

⁶ See figure on page 15 of the 2021 ERO Reliability Risk Priorities Report.

hydroelectric facility was shut down when reservoir levels dropped below its minimum operating elevation in 2021. In addition, load service on the Gulf and Atlantic Coasts were also disrupted by flooding and high winds generated by Hurricane Katrina (2005) and Hurricane Sandy (2012). Finally, the February 2021 event resulted from a cold air mass that impacted Mississippi, Louisiana, Arkansas, Oklahoma, and Texas. Events like these highlight the need for a new approach to reliability planning that sufficiently considers the extremes and variability that the BES is increasingly subject to.

Recommendations

Based on the review of the questionnaire and the NERC Reliability Standards gap review by the ERATF sub-teams #1 and #2 as well as the RISC recommendations,⁷ standard authorization requests shall be submitted to the RSTC. The standard authorization requests for the operations and planning horizons should request new standards or revised standards to require the following:

- Energy assessments should be conducted at regular intervals.
- Energy assessments should meet set target criteria.
- If energy assurance targets are not met, impacted entities should submit corrective action plans.

⁷ 2021 RISC Report:

https://www.nerc.com/comm/RISC/Documents/RISC%20ERO%20Priorities%20Report_Final_RISC_Approved_July_8_2021_Board_Submitted_Copy.pdf