

Inverter-Based Resource Working Group (IBRWG):

**Considerations for Root Cause Analysis**

**Version 1.0**

Document Revisions

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### DISCLAIMER: ERCOT provides this document as a convenience to Market Participants in meeting certain Nodal Operating Guides requirements. The actual language in the Nodal Operating Guides takes precedence over this document.

Background and Purpose

Background

### When an Apparent Performance Failure (APF) occurs in connection with an Inverter-Based Resource (IBR), Type 1 Wind-Powered Generation Resource (WGR), or Type 2 WGR, ERCOT Nodal Operating Guide (NOG) § 2.13(3) requires Resource Entities (REs) to:

#### Investigate the APF

#### Report to ERCOT the cause of the APF; and

#### Perform model validation and report the results to ERCOT.

### In turn, NOG § 2.13(5) requires REs to:

#### Develop a plan to ensure the IBR, Type 1 WGR, or Type 2 WGR meets the applicable ride-through performance requirements;

#### Submit the plan to ERCOT for approval within 90 days; and

#### If ERCOT approves the plan, implement the plan within 180 days, unless ERCOT approves a longer timeline.

## Purpose

#### This document provides advice to REs in fulfilling the NOG requirements. The methods suggested and factors to consider are not intended to be a list of requirements or an exhaustive list. ERCOT provides this document to assist REs in meeting NOG requirements.

Performing a Root Cause Analysis (RCA)

### North American Electric Reliability Corporation (NERC) defines RCA as “the process of discovering the underlying factors or fundamental reasons for the occurrence of issues and is an important step in identifying appropriate solutions to a problem.”

### Conducting a typical RCA involves a systematic approach to identifying the underlying causes of a problem, rather than just addressing its symptoms:

### Define the Problem Clearly

### Gather Data and Evidence

### Identify Possible Causal Factors

### Some useful techniques include:

### Five Whys: Ask “why?” repeatedly (typically five times) to drill down to the root cause. Additional guidance on performing this methodology and an introduction to RCA can be found on the NERC Event Analysis [website](https://trn.nerc.com/Video/NERC%20-%20An%20Introduction%20to%20Cause%20Analysis%20-%20web/story.html).

### Event and Causal Factors Charting: A method of producing a sequential description of an incident that accounts for the logical relationships between the facts presented. Additional guidance on performing this method of RCA can be found in NERC Lesson Learned [LL20241201](https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20241201_RCA_Tools_Events_Causal_Factors_Charting.pdf).

### Barrier Analysis: Determine how a hazard came into contact with a target (item of value), and then determine what role missing or inadequate barriers might have had in allowing the event to occur. Additional guidance on performing this method of RCA can be found in NERC Lesson Learned [LL20210202](https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20210202_RCA_Tools_Barrier_Analysis.pdf).

### Change Analysis: Analyze for differences and then determine if those differences had a role in causing the event. Additional guidance on performing this method of RCA can be found in NERC Lesson Learned [LL202102021](https://www.nerc.com/pa/rrm/ea/Lessons%20Learned%20Document%20Library/LL20210201_RCA_Tools_Change_Analysis.pdf).

### Identify the Root Cause(s)

### Develop and Implement Corrective Actions

### Monitor and Verify Effectiveness

### Document and Share Lessons Learned

### In connection with the activities associated with the NOG requirements, consider the following:

### Investigate the Resource’s field settings and compare them to the dynamic model.

### Settings to review include but are not limited to: A/C over-current; A/C over-voltage; over-frequency; volt phase jump; ride-through parameters; DVC k-factor; software updates; firmware updates; phase angle jump; rate of change of frequency; momentary cessation; feeder breaker; and DC-bus voltage imbalance protection.

### If the Resource is commissioned and operational, determine if settings are not reflected in the model you submitted to ERCOT.

### If settings are correct but not reflected in the submitted model, Planning Guide § 6.2(7) requires you to submit a corrected model accurately representing the dynamic characteristics of the Resource along with a plant verification report (as described in Planning Guide § 6.2(5)(c)).

### If settings must be changed to address the APF cause, follow the requirements in Planning Guide Section 5.5(6) prior to make those changes.

### If the Resource is in the commissioning phase (i.e., not yet Part 3 approved) and fails to meet performance requirements (e.g., voltage ride-through) during a real-time event, re-evaluation of model performance and/or re-study may need to be conducted.

### Note: The model review process prior to Resource Commissioning is outlined in PG Section 5.5(4).

### If the same equipment exists at other Resources owned and/or operated by the Resource Entity, perform an Extent of Condition analysis and include the results in the RCA.

### An Extent of Condition analysis proactively investigates whether a similar condition exists at other sites that may be vulnerable to similar performance issues.

### If individual units at a site responded to the system disturbance differently, identify settings or physical differences between the units that could have caused the inconsistent performance.

### If an RE cannot identify a root cause (as required by NOG § 2.13(3)(b)), it must clearly explain why it could not do so.

### Actions to remedy the cause of an incomplete RCA should be taken by the Resource Entity. For example, if a lack of individual unit data recording makes the Resource Entity unable to determine a root cause, then explain what kind of recorders will be set up to ensure data necessary for future RCAs is completed.

Other Nodal Operating Guides § 2.13 Considerations

### Provide definitive date(s) on when implementation of corrective actions will be completed. If corrective actions cannot be completed within 180 days of Corrective Action Plan (CAP) submittal, provide an explanation. (See, NOG § 2.13(5)(a).)

### As stated in NOG § 2.13 (3)(c), the RE must perform model validation and report the results to ERCOT.

### Ensure the CAP has either model validation results included or an estimate of when the RE will submit the model validation results to ERCOT.