

***OPERATING PROCEDURE***

***MANUAL***

**Reliability Risk Desk**

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# 1. Introduction

## 1.1 Purpose

This procedure provides the System Operator assigned to the Reliability Risk Desk with detailed procedures required for performing the duties assigned to that position.

The Reliability Risk Operator is responsible for the safe and efficient operation of all Intermittent Renewable Resource (IRR) generation assets. The Reliability Risk Operator coordinates with the Reliability Unit Commitment, Real-Time, Transmission and Security, Resource, Operations Support Engineer, Shift Supervisor and other ERCOT Operators as necessary to maintain grid reliability. The Reliability Risk Desk also responds to QSE’s inquiries about intermittent generation dispatch, wind and solar forecast, operations, curtailments and other related tasks.

## 1.2 Scope

The instructions contained in these procedures are limited to those required for the Reliability Risk Desk. Instructions for other ERCOT control room positions are contained in separate procedures, one for each position. These procedures do not imply that the duties contained herein are the only duties to be performed by this position. The individual assigned to this position will be required to follow any other instructions and perform any other duties required or requested by appropriate ERCOT Supervision.

Although the steps within the procedures are numbered, the numbering is for indexing purposes and are not sequential in nature.  The System Operator will determine the sequence of steps, exclude steps, or take any additional actions required to ensure system security based on the information and situational awareness available during both normal and emergency conditions.

# 2. General

## 2.1 System Operator Responsibility and Authority

**Procedure Purpose:** To ensure the System Operators know their roles, responsibility and authority.

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| --- | --- | --- | --- | --- |
| **Protocol Reference** | **6.5.1.1** | **6.5.1.2(3)** | **6.5.2** | **6.5.3(1)** |
| **Guide Reference** | **4.5.2(1)** |  |  |  |
| **NERC Standard** |  |  |  |  |

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| **Version: 1** | **Revision: 3** | **Effective Date: October 1, 2020** |

ERCOT ISO as a Transmission Operator (TOP), the single Balancing Authority (BA), and only Reliability Coordinator (RC) registered within the ERCOT Interconnection shares all information between these roles simultaneously and acts concurrently as a single entity, satisfying coordination between the TOP, BA and RC.

The System Operator (SO) shall, in accordance with NERC Reliability Standards and ERCOT Protocols, have clear decision-making authority to act to address the reliability of its Reliability Coordinator Area by direct actions or by issuing Operating Instructions during both normal and emergency conditions. These actions shall be taken without delay and may include the shedding of firm load without obtaining approval from higher-level personnel.

The SO on duty is, in accordance with the ERCOT Protocols, Operating Guides, and NERC Reliability Standards, and acting as the Balancing Authority, Transmission Operator, and Reliability Coordinator shall request and receive information required to continually monitor the operating conditions which will assure the security and reliability of the ERCOT System.

The SO issues Dispatch Instructions / Operating Instructions for the Real-Time Operation of Transmission Facilities to a TO and to a QSE for the Real-Time Operation of a Resource.

The SO shall, on an ERCOT-wide basis, coordinate the ERCOT System Restoration (Black Start) Plan. The SO shall implement the Black Start Plan and shall direct the reconnection efforts of the islands, established by restoration activities.

The SO shall consider all equipment operating limits when issuing Dispatch Instructions / Operating Instructions. During Emergency Conditions, the SO may verbally request QSEs to operate its Resources outside normal operating parameters. If a Dispatch Instruction / Operating Instruction conflicts with a restriction placed on equipment by a TO or QSE to protect the integrity of equipment, ERCOT shall honor the restriction.

The SO performs security analyses on a Day Ahead and Real-Time basis and ensures that all Forced Outages are entered into the Outage Scheduler. The SO shall obtain or arrange to provide Emergency Energy over the DC Tie(s) on behalf of ERCOT.

The SO shall issue appropriate OCN’s, AAN’s, Advisories, Watches, and Emergency Notices, and coordinate the reduction or cancellation of clearances, re-dispatch of generation, and request, order, or take other action(s) that the SO determines necessary to maintain safe and reliable operating conditions on the ERCOT System in accordance with ERCOT Protocols, Operating Guides, and NERC Reliability Standards. The SO will implement and terminate ERCOT Time Corrections and will determine the need for and implement the operation of a QSE on Constant Frequency Control for loss of ERCOT’s Load Frequency Control System.

## 2.2 Communication

**Procedure Purpose:** To ensure proper communication is used to reduce the possibility of miscommunication that could lead to action or inaction harmful to the reliability of the grid.

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| **Protocol Reference** | **6.5.7.8** |  |  |  |
| **Guide Reference** | **3.1.3** |  |  |  |
| **NERC Standard** | **COM-002-4**  **R5, R7** |  |  |  |

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| **Version: 1** | **Revision: 2** | **Effective Date: December 31, 2021** |

| **Step** | **Action** |
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| Three-Part Communication | |
| **Note** | * Operating Instructions and Dispatch Instructions are synonymous, and both require ‘three-part communication’. * Refer to the Communications Protocols document for requirements. |
| **1** | When issuing Operating Instructions, use three-part communication:   * Issue the Operating Instruction * Receive a correct repeat back * Give an acknowledgement |
| **2** | Many scripts have been placed throughout the procedures as a reminder of three-part communication. However, a script cannot be provided for every scenario. Effective three-part communication skills are mandatory. |
| Hotline Call Communication | |
| **1** | When making Hotline calls, ensure one QSE repeats back the message.  **IF:**   * Time and circumstances allow;   **THEN:**   * Review the Consortium hotline attendance report to verify all QSEs were in attendance * Contact the QSE using their OPX line or LD line to provide them with the message * Inquire why they were not on the Hotline call * Open a Service ticket if ERCOT’s Telecommunications department is needed to investigate. |
| Master QSE | |
| **1** | Issue the VDI to the Master QSE of a Generation Resource that has been split to function as two or more Split Generation Resources as deemed necessary by ERCOT to effectuate actions for the total Generation Resource for instances when electronic Dispatch Instructions are not feasible. |
| **Log** | Log all actions. |

## 2.3 Suspected Sabotage or Sabotage Events

**Procedure Purpose:** To be aware of cyber intrusions and communicate concerning activity and any unusual occurrences.

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| **Protocol Reference** |  |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standard** |  |  |  |  |

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| **Version: 1** | **Revision: 0** | **Effective Date: March 1, 2022** |

| **Step** | **Action** |
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| **ERCOT**  **Event** | **Refer to Cyber Intrusion Guide and Cyber Security Incident Response Plan located in procedure binder.**  **IF:**   * Unusual system behavior is observed;   **THEN:**   * Notify Shift Supervisor |
| **Entity**  **Event** | **IF:**   * A TO or QSE reports an act of suspected sabotage or a sabotage event, including cyber;   **THEN:**   * Notify Shift Supervisor |

# 3.0 Resource Testing and Monitoring Intermittent Resources (IRR)

## 3.1 Resource Testing

**Procedure Purpose:** This procedure provides direction and guidelines for conducting various testing and approval processes for resources and transmission elements.

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| **Protocol Reference** | **3.3.1** | **6.5.7.8(1)** | **8.5.1.1** | **8.5.1.2** |
| **Guide Reference** | **3.3.2.2** |  |  |  |
| **NERC Standard** |  |  |  |  |

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| **Version: 1** | **Revision: 4** | **Effective Date:** October 1, 2024 |

| **Step** | **Action** | | |
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| **Note** | QSE’s will submit test requests through NDCRC. As requests for unit tests are received, make every reasonable effort to accommodate testing.  ERCOT will communicate with the QSE if a request is Rejected or cancelled. All rejections will be coordinated with the Shift Supervisor. | | |
| Unit Testing and Tracing | | | |
| **1** | | As requests for unit tests are received, make every reasonable effort to accommodate testing.  Reasons for not accommodating testing:   * Unit has best shift factor to manage congestion for an outage (Planned or Forced). * If the Unit creating unjustified congestion under normal conditions. * Without unit, contingency may reach max shadow price and become unsolvable, * If a pattern of repeated requests for the same unit(s) indicate that abuse of the testing privilege may be taking place. Verify the rejection with the Shift Supervisor and if the rejection is approved, the Shift Supervisor will notify the Control Room Operations management. |
| **Monitor** | | * All Resource tests that are approved shall be monitored in real time. * Dailey ONTEST approvals in NDCRC. |
| **Caution** | | The rejection of a testing unit is sometimes necessary to maintain system security, instruct the test be canceled and deploy as needed. |

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| Approved Resources to be ONTEST | | |
| **Approval** | | * As Resource tests are submitted into NDCRC, Review the request and Approve the test if there are no reliability concerns. * All operators will be able to view NDCRC to determine which resources are approved to use the status of ONTEST. |
| Managing Unit testing in TCM | | |
| **Monitor** | | **VERIFY:**   * Active Constraint’s in TCM at =/>100%. Compare the unit shift factors with the units that are ONTEST. |
| **2** | | **IF:**   * A constraint in TCM is =/>100% and a Unit is ONTEST and creating congestion and the unit can solve the congestion.   **THEN:**   * Notify the Shift Supervisor and Transmission Security, give the QSE an Operating instruction change units resource status from ONTEST to ON and follow it’s SCED Basepoint. Reject the UNIT Test request in NDCRC. |
| **Logs** | | Log all actions. |
| Coordinated Reactive Tests | | |
| **Note** | The Resource Entity requesting to perform a Coordinated Test will provide ERCOT Operations and the TO with notice of the proposed test date before 1500 on the day prior to the day of the test. Requests shall be made between 0800 and 1700 on Business Days. Upon receipt of a request for test, ERCOT Operations and the TO will evaluate the expected conditions and determine whether ERCOT System conditions are conducive to a valid test can be created through coordinated network switching, modification of the generation reactive dispatch of nearby Generation Resources, or by some other means. Having established that suitable ERCOT System conditions exist or can be created, ERCOT Operations, and the TO shall confirm with the Resource Entity and the QSE the agreed upon test time and date or a rejection of the test time and date before 1700 on the day prior to the day of the test. | |

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| **1** | Coordinated Reactive Tests will be done in coordination with System Operations, Resource Integration Department, the Transmission Operator (TO), and the Qualified Scheduling Entity (QSE).  **WHEN:**   * A QSE makes a request for a Coordinate Reactive Test;   **VERIFY:**   * Date/Time of Testing * MVAR Leading and/or Lagging expected during the test * CURL/D-Curve is attached * Estimated MW output   If all information is included in the test request, proceed to step 2. If not, verify with the shift supervisor and reject the request with a reason why. |
| **2** | The coordination of the testing times will be between System Operations, Resource Integration Department and the Transmission Operator (TO).  **WHEN:**   * All information above is received;   **VERIFY:**   * TO has approved the test,   + TO can approve verbally on a recorded line or by email.   Once the TO has approved and all information is accurate, approve the QSE test request. There will be a email automatically generated with the approval to the following:   * Resource Integration Department * 1Ercot System Operators |
| **Not OK**  **to Test** | If the request cannot be accommodated, Reject the test with the reasons why and follow up a call with the QSE: |
| **Log** | Log all actions. |

## 3.2 Reliability and Non-Spin Adequacy Assessment

**Procedure Purpose:** To monitor and detect possible reliability issues that may occur due to over-forecasting wind and/or under-forecasting of load/demand.

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| **Protocol Reference** | **6.4.9.1(1)** |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standard** |  |  |  |  |

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| **Version: 1** | **Revision: 0** | **Effective Date: January 30, 2017** |

| **Step** | | | **Action** |
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| **Note** | | Monitor and evaluate the impact of the uncertainties from wind and load forecasts over the adequacy of available reserves and identify hours when scheduled generation may not be sufficient to meet the expected demand (i.e., decreased online room). (See Desktop Guide Reliability Risk Desk Section 2.2).  Evaluate the following:   * Expected load/demand (i.e., active load forecast), * Potential increase in load/demand in the next 6 hours due to under-forecast errors in load forecast, * Scheduled generation, * Potential reduction in scheduled generation in the next 6 hours due to under-forecast errors in wind/STWPF, * Procured Regulation-Up reserves, * Procured Non-Spin reserves and * Online room.   An insufficiency situation occurs during hours when the online room is negative. The insufficiency situation could be severe if the magnitude is expected to be larger than the total capacity of regulation and non-spinning reserve procured/available. The insufficiency situation could be more severe when the available generation/capacity that can be brought online to mitigate isn’t adequate to cover the negative online room.  Most insufficiency scenarios noticed in the future hours can be handled via updated COP submissions and regular market tools. Hence, for insufficiency scenarios noticed in the future hours, QSEs should be contacted to update their COPs to reflect proper HSL/Resource status of wind units, Day-Ahead ancillary service obligations etc. COP submission timing hours prohibit the same approach applied for the near-term hours (1-3 hours away). Should an insufficiency scenario be noticed in the future hours, continue to manifest in the near-term hours (1-3 hours ahead), as time progresses, then there is a higher potential for reliability issues and actions may need to be taken to bring additional capacity online. |
| Capacity and Reserve Monitoring during Real-Time Conditions | |
| **Note** | The purpose of this section is to provide recommendations for assessing and detecting possible reliability issues that may occur due to over-forecasting wind and/or under-forecasting of load/demand. |
| **Monitor** | | (See Desktop Guide Reliability Risk Desk Section 2.2). |
| **Note** | | Selection of Uncertainty margins:   * If uncertainty in wind forecast is consistent with average errors for the time of day and month, lower STWPF uncertainty margins can be used for assessments. If conditions are expected to be volatile, use higher STWPF uncertainty margins. * Similarly, if uncertainty in load forecast is consistent with average errors for the time of day and month, lower and/or no load forecast uncertainty can be used for conducting assessments. If conditions are expected to be volatile, use higher load forecast uncertainty margins.   If an insufficiency scenario occurs during hours when the online room is negative (i.e., insufficient capacity):   * The insufficiency scenario could be severe if its magnitude is expected to be larger than the total capacity of regulation and non-spinning reserve procured/available (i.e., insufficient reserves). * The insufficiency scenario could be more severe when the available generation/capacity that can be brought online to mitigate this is not adequate to cover the negative online room (i.e., insufficient capacity and reserves). |
| 1 | | **IF:**   * Insufficiency scenario noticed in the future hours (4-6 hours away)   **THEN:**   * Contact wind QSEs with large errors in COP HSLs for these hours and continue to monitor for updates. * Determine if override of wind forecast is needed and engage the on-call Operations Analysis Engineer. * Consult with Shift Supervisor and RUC operator to determine if;   + load forecast is reasonable or if forecast accuracy could be improved by switching the load forecast model.   + Determine if any QSEs with Ancillary Service Obligations has Ancillary Service shortage in their COPs. |
| **2** | | **IF:**   * Insufficiency capacity scenario noticed for the future hours (4-6 hours away) continues in the near-term hours (1-3 hours away),AND * Net import from DC Ties based on their schedules is inadequate to cover the insufficiency magnitude.   **THEN:**   * Monitor for Ancillary Service shortages in Real-time and contact QSEs if shortages are detected. * Verify that the uncertainty selections for wind forecast and load forecast are reasonable, and the insufficiency scenario is viable.   **IF:**   * The projected insufficiency capacity scenario is expected,   **THEN:**   * In consultation with the Shift Supervisor and Real-Time Desk Operator determine if it is necessary to make a market Notification for Diminishing Reserves and/or implement steps in Real-Time Desk Operating Procedure 5.2. |
| **3** | | **IF:**   * Insufficiency capacity scenario noticed for the future hours (4-6 hours away) continues in the near-term hours (1-3 hours away),AND * Net import from DC Ties based on their schedules is inadequate to cover the insufficiency magnitude, AND * Available reserves are projected to be insufficient. AND * The projected insufficiency scenario in reserves is expected,   **THEN:**   * Discus with the Shift Supervisor if additional Ancillary Services may need to be procured (SASM) or if additional resources may need be committed (RUC). |
| **4** | | **IF:**   * Insufficiency capacity scenario noticed for the future hours (4-6 hours away) continues in the near-term hours (1-3 hours away),AND * Net import from DC Ties based on their schedules is inadequate to cover the insufficiency magnitude, AND * Available reserves are projected to be insufficient, AND * Available generation/capacity that can be brought online is expected to be insufficient, AND * The projected insufficiency scenario in reserves is expected,   **THEN:**   * Discuss with the Shift Supervisor and Real-Time Desk Operator if it is necessary to make a market Notification for Diminishing Reserves and/or implement steps in Real-Time Desk Operating Procedure 5.2. |
| **Log** | | Log all actions. |

## 3.3 Responsive Reserve and System Inertia Sufficiency Monitoring

**Procedure Purpose:** Monitor and detect possible time periods when procured Responsive Reserve (RRS) may be inadequate based on expected online inertia with recommended actions.

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| **Protocol Reference** | **6.4.9.1(1)** |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standard** | **IRO-001-4**  **R1** | **TOP-001-6 R2, R11** |  |  |

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| **Version: 1** | **Revision: 3** | **Effective Date: May 6, 2021** |

| **Step** | **Action** | |
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| Day Ahead RRS Sufficiency Monitoring | | |
| **Note** | Monitor the adequacy of available RRS reserves based on expected grid operating conditions and identify hours when procured RRS may not be sufficient.   * Monitor RRS computed using the expected online inertia based on the most recent COPs for resources, * Posted RRS computed using studies based on TAC approved A/S Methodology, * Scheduled RRS computed using obligations in COPs of generation & load resources and the estimated online inertia, * Actual RRS available computed based on telemetry and actual online inertia and * Shortfall in posted/procured RRS in comparison to estimated RRS computed using expected online inertia.   Once DAM and DRUC have completed (after 1600) observe the next day for RRS shortages. If you have small shortages of ~2% or less, it is recommended that you monitor those hours as you get closer to Real-Time. If the anticipated insufficiency continues and the PRC is expected to be low during those hours, then additional RRS reserves may be needed. Discuss and coordinate with Shift Supervisor, Real-Time and Resource Desk all necessary actions.  (See Desktop Guide Reliability Risk Desk Section 2.4) | |
| **Log** | Log all actions. | |
| Look Ahead Monitoring of Responsive Reserve Service | | |
| **Note** | | The purpose of this section is to provide recommendations for  assessing and detecting possible insufficiencies in RRS reserves that may be detected in several hours ahead of Real-Time hours due to changes in wind forecast and thus changes in estimated online inertia. |
| **Monitor** | | (See Desktop Guide Reliability Risk Desk Section 2.4) |
| **1** | | **IF:**   * DAM & DRUC have finished execution, AND * Shortfall is noticed in posted/procured RRS in comparison to the estimated RRS needed based on expected online inertia computed using the most recent COPs from resources.   **THEN:**   * Contact wind QSEs with large errors in COP HSLs for these hours and continue to monitor the Worksheet/Chart for updates. * Determine if any QSEs with Ancillary Service Obligations have Ancillary Service shortage in their COPs and if so ask them to research this issue. * Continue monitoring conditions closer to Real-Time. If shortfall persists, if PRC is expected to be low during these hours, determine in consultation with Shift Supervisor if additional RRS may need to be procured (via Supplemental Ancillary Service Market (SASM) or if additional resources may need be committed (via Reliability Unit Commitment (RUC). |
| **Log** | | Log all actions. |
| Real-time RRS Sufficiency Monitoring | | |
| **Note** | Constantly monitor the grid operating conditions & the adequacy of available RRS and identify hours when procured RRS & Physical Responsive Capability (PRC) may not be sufficient. If there is a shortfall in the procured/available RRS obligations and the reserves required exceed RRS procured/available based on actual grid conditions and online inertia but during those same hours, there was adequate PRC and primary frequency responsive capacity available to arrest frequency decline during a sudden loss of generation no action is necessary.   * Monitor RRS needed based on grid operating conditions & online inertia, * Monitor RRS available computed based on telemetry and online inertia, * If Shortfall in procured/available RRS in comparison to actual RRS required is identified as well as actual PRC and Primary Frequency Responsive (PFR) capability computed using actual PRC capability is determined to be insufficient to arrest frequency decline during a sudden loss of generation then necessary actions must be discussed and coordinated with Shift Supervisor, RUC, Real-Time, and Resource Desks.   (See Desktop Guide Reliability Risk Desk Section 2.4) | |
| **Note** | The purpose of this section is to provide recommendations for monitoring adequacy of RRS in Real-Time. | |
| **1** | **IF:**   * Shortfall is noticed in procured/available RRS in comparison to the estimated RRS needed based on actual grid conditions and online inertia AND * Shortfall is noticed in available PFR capability computed based on PRC in comparison to actual RRS needed AND * Analysis determines shortfall in posted/procured RRS in the hours immediately following the current Operating Hour. * If PRC is expected to be low during these hours,   **THEN:**   * Determine in consultation with Shift Supervisor if additional RRS may need to be procured via SASM or if additional resources may need be committed via RUC. | |
| **Log** | Log all actions. | |
| Look Ahead Critical Inertia Level Sufficiency Monitoring | | |
| **Note** | Monitor the adequacy of Critical Inertia Level based on expected grid operating conditions and identify hours when Critical Inertia Level may not be sufficient. Critical Inertia Level for ERCOT is 100 GW-s. | |
| **1** | **IF:**   * DAM & DRUC have finished execution, AND * Shortfall is noticed in Critical Inertia Level needed based on expected online Critical Inertia Level computed using the most recent COPs from resources.   **THEN:**   * Determine the need for additional generation to be RUC committed for future hours to maintain Critical Inertia Level above 105 GW-s * Discuss results with shift supervisor. | |
| **Log** | Log all actions. | |
| Real-time Critical Inertia Level Sufficiency Monitoring | | |
| **Note** | Monitor the adequacy of Critical Inertia Level based on expected grid operating conditions and identify hours when Critical Inertia Level may not be sufficient. Critical Inertia Level for ERCOT is 100 GW-s. | |
| **1** | **IF:**   * Critical Inertia Level alarm comes in at 120 GW-s.   **THEN:**   * Verify accuracy of the Critical Inertia Level monitoring display * Determine the need for additional generation to be RUC committed for future hours to maintain Critical Inertia Level above 105 GW-s * Discuss results with shift supervisor and RUC desk | |
| **2** | **IF:**   * Critical Inertia Level alarm comes in at 110 GW-s.   **THEN:**   * Verify accuracy of the Critical Inertia Level monitoring display * Determine the need for additional generation to be RUC committed for future hours to maintain Critical Inertia Level above 105 GW-s * Discuss results with shift supervisor and RUC desk | |
| **3** | **IF:**   * Critical Inertia Level declines to 105 GW-s.   **THEN:**   * Take action immediately by notifying Shift Supervisor, RUC, and Resource desks. Actions may include:   + Resource operator deploying off-line Non-Spin   + RUC operator deploying off-line short start   + RUC operator giving Operating instruction to bring on OFFQS generation AND   + Follow up OFFQS EDI from RUC operator | |
| **Log** | Log all actions. | |

## 3.4 Monitor Curtailed Intermittent Renewable Resource Performance

**Procedure Purpose:** To monitor intermittent resources to confirm units are responding and following curtailments properly.

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| **Protocol Reference** | **6.4.9.1(1)** |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standard** |  |  |  |  |

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| --- | --- | --- |
| **Version: 1** | **Revision: 1** | **Effective Date: February 28, 2020** |

| **Step** | **Action** |
| --- | --- |
| Wind or Solar Unit Curtailments | |
| **Note** | An Intermittent Renewable Resource (IRR) must comply with Dispatch Instructions when receiving a flag signifying that the IRR has received a Base Point below the HDL used by SCED. When the SBBH (SCED Basepoint Below HDL) flag is set this will assist the intermittent resources in recognizing the need to reduce generation output due to transmission network constraint violations. |
| **Note** | IRRs with a telemetered resource status equal to OFF, OUT or ONTEST should ignore the SBBH flag. If a curtailment is necessary  for an IRR that is telemetering a Unit status of ONTEST ERCOT Operations will verbally communicate the necessary Dispatch instructions to the resource’s QSE. |
| **ONTEST** | Resources with a Resource Status of ONTEST, may not be issued dispatch instructions except:   * For Dispatch Instructions that are a part of the testing; or * During conditions when the Resource is the only alternative for solving a transmission constraint (would need QSE to change Resource Status); or * During Force Majeure Events that threaten the reliability of the ERCOT System.   **THEN:**   * Discuss with Shift Supervisor and Coordinate with the Transmission & Security Operator |
| **Note** | HSL should remain at the forecasted output capability for the IRR.  If HSL is observed decreasing with the curtailed SCED dispatch instructions, then notify the resource’s QSE to investigate. |
| **Base Point**  **Deviation** | **IF:**   * A QSE has an Intermittent Renewable Resource (IRR) with a   large Base Point deviation AND the resource is not curtailed   * Their generation is not moving in the proper direction to correct their Base Point Deviation;   **THEN:**   * Possible reasons, if known (Base Point deviation, large forecast errors, failed telemetry, icing conditions, down or up ramp event, unit trip, etc.) * Notify the QSE of the issue. |
| **Log** | Log all actions. |

# 4.0 Wind and Solar Forecasting

## 4.1 Responding to Wind Forecast Errors

**Procedure Purpose:** Make corrections to errors in the weather forecast data (in FPP Tool) and/or switch between two wind forecasts needed to contribute to reliable system performance.

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| --- | --- | --- | --- | --- |
| **Protocol Reference** |  |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standard** |  |  |  |  |

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| --- | --- | --- |
| **Version: 1** | **Revision: 6** | **Effective Date: September 1, 2022** |

| **Step** | **Action** |
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| **Note** | The wind forecasts produced provide enhanced situational awareness by additional means of validating the expected wind conditions. The selected wind forecast between two is sent to Wind QSEs to update their COP and used by the downstream EMS applications. |
| **Note** | Do not continuously switch between two wind forecasting services for a small gain in accuracy (i.e., “chasing the forecast”) |
| **STWPF Selection Change due to forecast vs. output deviation** | **IF:**   * The end of adjustment period selected wind forecast which is currently in use has been greater than the actual wind HSL for more than 2000 MW for at least three hours or 3000 MW for at least one hour or reliability concern and the other vendor forecast has been more accurate;   **THEN:**   * Log the period of time for which the forecast has been underperforming and the accuracy of both forecasts. Inform the Shift Supervisor and potentially switch forecast selection to alternative wind forecast which has been more accurate, * E-mail the information to:   + Operations Analysis   + 1 ERCOT Shift Supervisors   **Reference Display:**  **FPP (Taylor or Bastrop) Desktop Icon>Hourly Wind**  FPP (Taylor or Bastrop) and other necessary displays. |
| **Note** | The projected wind ramp rate (PWRR) calculation is such that it will revert to using persistence (PWRR=0) if the actual wind HSL has been ramping in the opposite direction of the PWRR value for more than 25 minutes (5 intervals). RLC will set the PWRR to 0 to minimize the impact and then cancel the flag after the PWRR is forecasting the ramp to be the same as the actual ramp again. |
| **Intra-Hour wind Forecast** | **IF:**   * Alarmed, make sure frequency isn’t rapidly declining and wind hasn’t turned direction and is ramping very fast (only need to be concerned when getting above 300-400 MW per 5 minutes and causing frequency to decline below 59.95 Hz). If frequency does drag and regulation is exhausted, the Real-Time Desk should follow their procedure for manually running SCED. Watch the PWRR and wind ramp to help inform the Real-Time Desk;   **THEN:**   * Notify an Operations Analysis Engineer to do further analysis, * E-mail the information to:   + Operations Analysis   + 1 ERCOT Shift Supervisors |
| **Log** | Log all actions. |

## 4.2 Override during Normal Operations

**Procedure Purpose:** To monitor wind forecasts during normal operations. It is presumed that under normal operating conditions that the wind forecast override will very rarely be used. However, there are certain scenarios that might dictate an override.

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| **Protocol Reference** |  |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standard** |  |  |  |  |

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| --- | --- | --- |
| **Version: 1** | **Revision: 3** | **Effective Date: April 7, 2022** |

| **Step** | **Action** |
| --- | --- |
| Wind Farm Forecast not Matching Output | |
| **Note** | ERCOT can override the forecast:  **IF:**   * Forecasts are deviating from the actual output of a unit/region and have been consistently deviated for an extended period of time, or * A large over-forecast error is expected due to the unusual weather pattern which has not been captured in the past, or * Criteria has been met to determine a root cause for the deviation. |
| **STWPF Override due to forecast vs. output deviation** | Contact the Operations Analysis Engineer to do further analysis and potentially override the forecast given the description above after checking the following:   * Number of turbines online * Number of turbines offline * Outage scheduler * Telemetered wind speed (MPH) * E-mail the information to:   + Operations Analysis   + 1 ERCOT Shift Supervisors   Example A: If there is a high MPH and a high forecast, but low MW output.  Example B: If there is a high output, but a low forecast and low HSL in outage scheduler. |
| **Manually Override Short Term Wind Power Forecast** | Contact the Operations Analysis Engineer to do further analysis override system:  **IF:**   * A severe weather-related de-rate has occurred at a given wind farm, and * The telemetry, Outage Scheduler and COP have not been correctly updated by the QSE. * E-mail the information to:   + Operations Analysis   + 1 ERCOT Shift Supervisors   The Operations Analysis Engineer will do further analysis and potentially override the forecast given the description above after checking the following:   * Number of turbines online * Number of turbines offline * Outage scheduler * Telemetered wind speed (MPH) |
| **Log** | Log all actions. |

## 4.3 Operations in the Rio Grande Valley Region

**Procedure Purpose:** To monitor the wind forecast in the instance of a capacity shortage potential in the Lower Rio Grande Valley (RGV).

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| --- | --- | --- | --- | --- |
| **Protocol Reference** |  |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standard** |  |  |  |  |

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| --- | --- | --- |
| **Version: 1** | **Revision: 1** | **Effective Date: February 28, 2020** |

| **Step** | **Action** |
| --- | --- |
| Load in capacity short area is high and wind is also forecasted to be above 75% of regional capacity. | |
| **Review** | **IF:**   * The RGV wind forecast seems invalid, OR * IRR generation is not meeting the RGV wind forecast that could cause a reliability concern,   **THEN:**   * Notify an Operations Analysis Engineer for adjustments, * E-mail the information to:   + Operations Analysis   + 1 ERCOT Shift Supervisors |
| **Manually Override Short Term Wind Power Forecast** | Contact the Operations Analysis Engineer to do further analysis and to possible override the Forecast. |
| **Action** | Further analysis could potentially reduce the forecasted value of the region in question to the WGRPP value or another lower output that should allow the system to have adequate reserves given an under forecast. |
| **Log** | Log all actions. |

## 4.4 Operations in the Panhandle region

**Procedure Purpose:** To monitor the wind forecast in the instance of a capacity shortage in the Panhandle region.

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| **Protocol Reference** |  |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standard** |  |  |  |  |

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| --- | --- | --- |
| **Version: 1** | **Revision: 2** | **Effective Date: February 28, 2020** |

| **Step** | **Action** |
| --- | --- |
| Panhandle region is high export and wind is also forecasted to be above 75% of regional capacity. | |
| **Review** | **IF:**   * The Panhandle wind forecast seems invalid, OR * IRR generation is not meeting the Panhandle wind forecast that could cause a reliability concern,   **THEN:**   * Notify an Operations Analysis Engineer for adjustments, * E-mail the information to:   + Operations Analysis   + 1 ERCOT Shift Supervisors |
| **Manually Override Short Term Wind Power Forecast** | Contact the Operations Analysis Engineer to do further analysis and to possible override the Forecast. |
| **Action** | Further analysis could potentially reduce the forecasted value of the region in question to the WGRPP value or another lower output that should allow the system to have adequate reserves given an under forecast. |
| **Log** | Log all actions. |

## 4.5 Solar Forecast

**Procedure Purpose:** To monitor solar forecasts during normal and abnormal operations. Make corrections to errors in the solar forecast data (in FPP Tool) and/or switch between two solar forecasts needed to contribute to reliable system performance.

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| --- | --- | --- | --- | --- |
| **Protocol Reference** |  |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standard** |  |  |  |  |

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| --- | --- | --- |
| **Version: 1** | **Revision: 4** | **Effective Date: March 31, 2023** |

| **Step** | **Action** |
| --- | --- |
| Solar Forecast | |
| **Note** | The solar forecasts produced provide enhanced situational awareness by additional means of validating the expected solar conditions. The selected solar forecast between two is sent to Solar QSEs to update their COP and used by the downstream EMS applications. |
| **Note** | Do not continuously switch between two solar forecasting services for a small gain in accuracy (i.e., “chasing the forecast”) |
| **Note** | If the solar forecast is invalid or appears to have other discrepancies;   * Contact Operations Analysis Engineer to do further analysis and determine if it is necessary to override Solar forecast; * Solar Forecast can only be overwritten by Maxar |
| **STWPF Selection Change due to forecast vs. output deviation** | **IF:**   * The selected solar forecast which is currently in use has been greater than the actual solar HSL causing a reliability concern and the other vendor forecast has been more accurate;   **THEN:**   * Log the period of time for which the forecast has been underperforming and the accuracy of both forecasts. Inform the Shift Supervisor and potentially switch forecast selection to alternative solar forecast which has been more accurate, * E-mail the information to:   + Operations Analysis   + 1 ERCOT Shift Supervisors   **Reference Display:**  **FPP (Taylor or Bastrop) Desktop Icon>Hourly Wind**  FPP (Taylor or Bastrop) and other necessary displays. |
| **Note** | The projected solar ramp rate (PSRR) calculation is such that it will revert to using persistence (PSRR=0) if the actual solar HSL has been ramping in the opposite direction of the PSRR value for more than 35 minutes (7 intervals). RLC will set the PSRR to 0 to minimize the impact and then cancel the flag after the PSRR is forecasting the ramp to be the same as the actual ramp again. |
| **Intra-Hour solar Forecast** | **IF:**   * Alarmed, make sure frequency isn’t rapidly declining and solar hasn’t turned direction and is ramping very fast (above 300-400 MW per 5 minutes and causing frequency to decline below 59.95 Hz). If frequency does drag and regulation is exhausted, notify the Real-Time Desk for manually running SCED. Watch the PSRR and solar ramp to help inform the Real-Time Desk;   **THEN:**   * Notify an Operations Analysis Engineer to do further analysis, * E-mail the information to:   + Operations Analysis   + 1 ERCOT Shift Supervisors |
| **Log** | Log all actions. |

## 4.6 Weather Forecast Errors

**Procedure Purpose:** Make corrections to errors in the weather forecast data (in EMS) to contribute to reliable system performance.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Protocol Reference** |  |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standard** |  |  |  |  |

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| --- | --- | --- |
| **Version: 1** | **Revision: 2** | **Effective Date: March 31, 2023** |

| **Step** | **Action** |
| --- | --- |
| Weather Forecast | |
| **Weather**  **Forecast** | **IF:**   * The weather forecast seems invalid;   **THEN:**   * Notify the ERCOT Meteorologist and/or Load Forecasting team, * E-mail the information to:   + 1 ERCOT EMMS Production   + Load Forecasting Department   + 1 ERCOT Shift Supervisors |
| **Log** | Log all actions. |

# 5.0 Future

## 5.1 Blank

**Procedure Purpose:**

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| --- | --- | --- | --- | --- |
| **Protocol Reference** |  |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standand** |  |  |  |  |

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| --- | --- | --- |
| **Version:** | **Revision:** | **Effective Date:** |

| **Step** | **Action** |
| --- | --- |
|  | | |
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# 6. Telemetry Requirements

## 6.1 Respond to Failed Telemetry

**Procedure Purpose:** To minimize telemetry issues that could have an impact on LMPs, SCED, meteorological data, voltage control, reliability, missing data on the ERCOT Website, etc.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Protocol Reference** | **4.2.2(1)** |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standard** | **IRO-018-1(i)**  **R1, R1.3** |  |  |  |

|  |  |  |
| --- | --- | --- |
| **Version: 1** | **Revision: 1** | **Effective Date: December 31, 2020** |

| **Step** | **Action** |
| --- | --- |
| Telemetry Issues that could affect SCED and/or LMPs | |
| **Note** | Intermittent Renewable Resources (IRR) are required to telemeter the following data:   * Net Real Power, * Gross Real Power, * Net & Gross Reactive Power (MVAr), * Generator Breaker Status at the High Side of the Generator Step-Up (GSU) transformer, * Resource Status, * HSL/LSL, * Up & Down Ramp Rates, * Number of Available, Unavailable and Unknown Status Turbines, * Wind Speed (mph), * Wind Direction (degrees), * barometric pressure (mbar), * Temperature (ºC). |
| Monitor Resource Status for Discrepancies | | | |
| **Telemetered Status** | | **REVIEW REFERENCE DISPLAY:**  Market Participation>Physical Market>Market Operator Data>Consistency Checks  **IF:**   * Discrepancy is identified between a COP and telemetered Resource Status;   **THEN:**   * Call the QSE representing Resource to determine the correct resource status and have them make the necessary correction.   **NOTE: It is not necessary to make calls for inconsistent telemetry/COP for quick start units.** | |
| **Log** | | Log all actions. | |
| **ON**  **TEST** | | Review the list of “Approved Unit Tests” and “New Units Currently in Commissioning Process” on the System Operations SharePoint; compare this list to the units showing a unit status of ONTEST.  **WHEN:**   * A unit with a status of ONTEST without an approved unit test exists or the unit is not in the commissioning process;   **THEN:**   * Notify the QSE that they do not have an approved unit test and cannot use the ONTEST status. | |
| **Log** | | Log all actions. | |
| Monitor Resource Telemetry for Stale Values | | | |
| **Telemetered Status** | | **REVIEW REFERENCE DISPLAY:**  EMS Applications>Generation Control>Resource Limit Calculation>RLC Unit Input Data and RLC Unit Output Data and <https://picorp.ercot.com/OpsTools/#!/curtailmentSummary>  **IF:**   * Stale telemetry is identified;   **THEN:**   * Call the QSE representing the Resource to determine the cause and request them to make the necessary correction. | |
| **Log** | | Log all actions. | |

# 7. Emergency Operations

## 7.1 Market Notifications

**Procedure Purpose:** Guidelines for issuing Emergency Conditions and the four possible levels: Operating Condition Notices (OCN), Advisories, Watches, and Emergency Notices.

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| --- | --- | --- | --- | --- |
| **Protocol Reference** | **6.5.9.3** | **6.5.9.3.1** | **6.5.9.3.2** | **6.5.9.3.3** |
| **6.5.9.3.4** |  |  |  |
| **Guide Reference** | **4.2.1** | **4.2.2** | **4.2.3** | **4.2.4** |
| **NERC Standard** |  |  |  |  |

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| --- | --- | --- |
| **Version: 1** | **Revision: 4** | **Effective Date: December 31, 2021** |

| **Step** | **Action** |
| --- | --- |
| **Note** | * ERCOT is in an Emergency Condition whenever ERCOT Transmission Grid status is such that a violation of security criteria presents the threat of uncontrolled separation or cascading Outages and/or large-scale service disruption to Load (other than Load being served from a radial transmission line) and/or overload of a Transmission Element, and no timely solution is obtainable through SCED or CMPs. * Consider the severity of the potential Emergency Condition prior to the issuance of a notification. The severity of the Emergency Condition could be limited to an isolated local area, or the condition might cover large areas affecting several entities, or the condition might be an ERCOT-wide condition potentially affecting the entire ERCOT System. * The sequence of notifications issued may vary due to changing system conditions or other operational issues and it may be necessary to skip certain notifications due to the severity of the situation. |
| Operating Condition Notice (OCN) | |
| **Note** | OCN’s are used to inform Market Participants of a possible future need for more Resources due to conditions that could affect ERCOT System reliability. OCNs are for informational purposes only and may solicit additional information to determine whether the issuance of an Advisory, Watch, or Emergency Notice is warranted. OCNs serve as a reminder to QSEs and TSPs that some attention to the changing conditions may be warranted. |
| **1** | As instructed by the Shift Supervisor or when appropriate, issue an (OCN. The OCN can be issued for any of the following reasons:   * Insufficient Resources to meet forecasted conditions * There is a projected reserve capacity shortage in DRUC that could affect reliability and may require more Resources * When extreme cold weather is developing and forecasted to impact the ERCOT Region * When extreme hot weather is forecasted to impact the ERCOT Region * When a Hurricane or Tropical Storm is developing and forecasted to impact the ERCOT Region * Unplanned transmission Outages that may impact reliability   When anticipated adverse weather conditions are forecasted, ERCOT may confer with TOs and QSEs regarding the potential for adverse reliability impacts and contingency preparedness |
| Advance Action Notice (AAN) | |
| **Note** | Outage Schedule Adjustment (OSA)  Outage Adjustment Evaluation (OAE)  An AAN is a type of OCN, ERCOT may issue an AAN in anticipation of a possible future Emergency Condition. An AAN will identify actions ERCOT expects to take to address the condition unless the need for ERCOT action is alleviated by QSE and/or (TSP actions or by other system developments. |
| **1** | As instructed by the Shift Supervisor and in coordination with Outage Coordination and Operations Support, issue an AAN. The AAN can be issued for any of the following reasons:   * Insufficient Resources to meet forecasted conditions * There is a projected reserve capacity shortage in DRUC that could affect reliability and may require more Resources * When extreme cold weather is developing and forecasted to impact the ERCOT Region * When extreme hot weather is forecasted to impact the ERCOT Region * When a Hurricane or Tropical Storm is developing and forecasted to impact the ERCOT Region * Unplanned transmission Outages that may impact reliability   When anticipated adverse weather conditions are forecasted, ERCOT may confer with TOs and QSEs regarding the potential for adverse reliability impacts and contingency preparedness. |
| ADVISORY | |
| **1** | As instructed by the Shift Supervisor or when appropriate, issue an Advisory. The Advisory can be issued for any of the following reasons:   * When the probability of an approaching Hurricane or Tropical Storm impacting the ERCOT Region increases, and concerns exist to escalate awareness * When the probability of extreme cold weather impacting the ERCOT Region increases, and concerns exist to escalate awareness * When the probability of extreme hot weather impacting the ERCOT Region increases, and concerns exist to escalate awareness * When conditions are developing or have changed and more Ancillary Services will be needed to maintain current or near-term reliability * ERCOT exercises its authority to increase Ancillary Service requirements above the quantities originally specified in the Day-Ahead Market (DAM) in accordance with ERCOT Procedures * When extreme weather or ERCOT System conditions require more lead-time than the normal Day-Ahead Market (DAM) allows * Transmission system conditions are such that operations within security criteria are not likely or possible because of Forced Outages or other conditions unless a CMP exists * Loss of communications or control condition is anticipated or significantly limited * ERCOT may require information from QSEs representing Resources regarding the Resources’ fuel capabilities. Requests for this type of information shall be for a time period of no more than seven days from the date of the request |
| WATCH | |
| **1** | As instructed by the Shift Supervisor or when appropriate, issue a Watch. The Watch can be issued for any of the following reasons:   * A reserve capacity shortage is projected with no market solution available that could affect reliability * When an approaching Hurricane or Tropical Storm is imminent and anticipated to have an adverse impact on the ERCOT Region * When impacts from extreme cold weather is imminent and anticipated to have an adverse impact on the ERCOT Region * When extreme hot weather is imminent and anticipated to have an adverse impact on the ERCOT Region * Conditions have developed such that additional Ancillary Services are needed in the Operating Period * Insufficient Ancillary Services or Energy Offers in the DAM * Market-based congestion management techniques embedded in SCED will not be adequate to resolve transmission security violations * Forced Outages or other abnormal operating conditions have occurred, or may occur that require ERCOT to operate with active transmission violations of security criteria as defined in the Operating Guides unless a CMP exists * The SCED process fails to reach a solution, whether or not ERCOT is using one the measures in Failure of the SCED Process. * The need to immediately procure Ancillary Services from existing offers * ERCOT may instruct TOs to reconfigure transmission elements as necessary to improve the reliability of the system |
| EMERGENCY NOTICE | |
| **1** | As instructed by the Shift Supervisor or when appropriate, issue an Emergency Notice. The Emergency Notice can be issued for any of the following reasons:   * Loss of Primary Control Center functionality * Load Resource deployment for North-Houston voltage stability * ERCOT cannot maintain minimum reliability standards (for reasons including fuel shortages) during the Operating Period using every Resource practically obtainable from the market * Immediate action cannot be taken to avoid or relive a Transmission Element operating above its Emergency Rating * ERCOT forecasts an inability to meet applicable reliability standards and it has exercised all other reasonable options * A transmission condition has been identified that requires emergency energy from any of the DC-Ties or curtailment of schedules * The Transmission Grid is such that a violation of security criteria as defined in the Operating Guides presents the threat of uncontrolled separation or cascading outages, large-scale service disruption to Load (other than Load being served from a radial transmission line) and/or overload of Transmission Elements and no timely solution is obtainable through SCED or CMP * When extreme cold weather is beginning to have an adverse impact on the ERCOT System * When extreme hot weather is beginning to have an adverse impact on the ERCOT System * When Hurricane or Tropical Storm is beginning to have an adverse impact on the System |
| Operating Condition Script | |
| **Hotline** | Notify QSEs of Notice  **#46 - Typical Hotline Script for Operating Condition [OCN/Advisory/Watch/Emergency]**  . |
| **Post** | * All notices must be posted on the ERCOT Website. * For “free form” messages, the “Notice Priority” will be specified as follows:   + Operational Information/OCN type messages – low priority   + Advisory/Watch type messages – medium priority   + Emergency type messages – high priority |
| **Hotline Cancellation** | **#47 - Typical Hotline Script to Cancel Operating Condition [OCN/Advisory/Watch/Emergency]** |
| **Log** | Log all actions. |

## 7.2 Implement EEA Levels

**Procedure Purpose:** To provide for maximum possible continuity of service while maintaining the integrity of the ERCOT system to reduce the chance of cascading outages. If required to assist other Desk during an EEA event refer to appropriate Operating Procedures.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Protocol Reference** | **6.5.7.6.2.2(1)(b) & (13)** | **6.5.9.4** | **6.5.9.4.2** |  |
| **Guide Reference** | **4.5.3** | **4.5.3.1** | **4.5.3.2** | **4.5.3.3** |
| **4.5.3.4** |  |  |  |
| **NERC Standard** |  |  |  |  |

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| --- | --- | --- |
| **Version: 1** | **Revision: 9** | **Effective Date: November 1, 2023** |

| **Step** | | **Action** |
| --- | --- | --- |
| **Note** | | * ERCOT may immediately implement EEA Level 2 when clock-minute average system frequency falls below 59.91 Hz for 15 consecutive minutes. * ERCOT may immediately implement EEA Level 3 any time the clock-minute average system frequency falls below 59.91 Hz for 20 consecutive minutes or when steady-state frequency falls below 59.8 Hz for any duration of time. * ERCOT shall immediately implement EEA Level 3 any time the steady-state frequency is below 59.5 Hz for any duration. |
| **TCEQ** | | When increased generation is requested during EEA events, Texas Commission on Environmental Quality (TCEQ) will exercise enforcement discretion for exceedances of emission limits as well as operational limits for power generating plants for Generators who exceed air permit limits in order to maximize generation for the duration of the EEA event.  ERCOT General Council will send out a Market Notice each time ERCOT enters an EEA with this reminder. |
| Implement EEA Level 1 | | | | |
| **1** | | **IF:**   * PRC < 2500 MW and is not projected to be recovered above 2500 MW within 30 minutes; | | |
| **2** | | Assist Control Room as needed and continue monitoring IRRs. | | |
| **Log** | | Log all actions. | | |
| Implement EEA Level 2 | | | | |
| **Note** | | ERCOT may immediately implement EEA Level 2 when the clock-minute average system frequency falls below 59.91 Hz for 15 consecutive minutes. |
| **1** | | **IF:**   * PRC < 2000 MW or unable to maintain system frequency at 59.91 Hz and is not projected to be recovered above 2000 MW within 30 minutes without the use of EEA Level 2; |
| **2** | | Assist Control Room as needed and continue monitoring IRRs. |
| **Log** | | Log all actions. |
| Implement EEA Level 3 | | | | |
| **Note** | | ERCOT may immediately implement EEA Level 3 any time the clock-minute average system frequency falls below 59.91 Hz for 20 consecutive minutes or when steady-state frequency falls below 59.8 Hz for any duration of time.  ERCOT shall immediately implement EEA Level 3 any time the steady-state frequency is below 59.5 Hz for any duration. |
| **Note** | | Confirm instructions were made for ESRs to suspend charging. For ESRs, ERCOT shall issue the suspension instruction via a SCED Base Point instruction, or, if otherwise necessary, via a manual Dispatch Instruction. An ESR shall suspend charging unless it is providing Primary Frequency Response, has received a charging instruction via SCED Base Point, or is carrying Reg-Down and has received a charging instruction from LFC. However, an ESR co-located behind a POI with onsite generation that is incapable of exporting additional power to the ERCOT System may continue to charge as long as maximum output to the ERCOT System is maintained. |
| **EEA3**  **PRC <1500 MW** | | ERCOT will declare an EEA Level 3 when PRC cannot be maintained above 1500 MW. |
| **EEA3**  **Unable to**  **Maintain**  **59.91 Hz or PRC <1500 MW** | | **IF:**   * PRC <1500 MW or Unable to maintain system frequency at 59.91 Hz and is not projected to be recovered above 1500 MW or 59.91 Hz within 25 minutes without the use of EEA Level 3;   **THEN:**   * Assist Control Room as needed and continue monitoring IRRs. |
| **Log** | | Log all actions. |

## 7.3 Restore EEA Levels

**Procedure Purpose:** To restore the ERCOT grid to normal state as system conditions warrant while recovering from an EEA event.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Protocol Reference** | **6.5.9.4.3** |  |  |  |
| **Guide Reference** | **4.5.3.5** |  |  |  |
| **NERC Standard** |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| **Version: 1** | **Revision: 3** | **Effective Date: November 1, 2023** |

| **Step** | **Action** |
| --- | --- |
| **Reserves** | 1430 MW of PRC must be restored within 90 minutes. |
| Restore Firm Load | |
| **1** | **IF:**   * Sufficient Regulation Service exist to control to 60 Hz, **AND** * PRC – Regulation Up Responsibility ≥ 1500 MW for the last 15 minutes;   **THEN:**   * Transmission Operator will restore firm load. * Assist Control Room as needed and monitor Intermittent Renewable Resources (IRR). |
| Move from EEA Level 3 to EEA Level 2 | |
| **1** | **IF:**   * Sufficient Regulation Service exist to control to 60 Hz, **AND** * PRC is ≥ 2000 MW, **AND** * All firm loads have been instructed to be restored; * Assist Control Room as needed and monitor Intermittent Renewable Resources (IRR). |
| Move from EEA Level 2 to EEA Level 1 | |
| **1** | **IF:**   * The system can maintain PRC ≥ 2500 MW, **AND** * All Load Resources have been instructed to be restored; * Assist Control Room as needed and monitor Intermittent Renewable Resources (IRR). |
| Move from EEA Level 1 to EEA 0 | |
| **1** | **IF:**   * The system can maintain PRC ≥ 2500 MW, **AND** * All RUC committed units secured in EEA 1 can be released, **AND** * Emergency energy from the DC Ties is no longer needed; * Assist Control Room as needed and monitor Intermittent Renewable Resources (IRR). |
| **Log** | Log all actions. |

## 7.4 Restoration of Primary Control Center Functionality

**Procedure Purpose:** To be performed once Reliability Risk Desk Operator has arrived at ACC.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Protocol Reference** |  |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standard** |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| **Version: 1** | **Revision: 0** | **Effective Date: January 30, 2017** |

| **Step** | **Action** |
| --- | --- |
| **Note** | * Assist the Control Room as needed * Follow procedure manual as normal operation returns |
| **Log** | Log all actions. |

# 8. Weather Events

## 8.1 Significant Weather Events

**Procedure Purpose:** To monitor the wind forecast during operations with severe weather conditions.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Protocol Reference** |  |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standard** | **EOP-011-2**  **R2, R2.1, R2.2, R2.2.9, R2.2.9.1, R2.2.9.2** |  |  |  |

|  |  |  |
| --- | --- | --- |
| **Version: 1** | **Revision: 5** | **Effective Date: December 29, 2023** |

| **Step** | **Action** |
| --- | --- |
| Loss of Wind Farm Turbines due to Severe Weather | |
| **Note** | Significant weather events can consist of, but are not limited to the following:   * Tornados * Strong straight-line winds * Flooding * Freezing precipitation * Wild Fires |
| **Manually Override Short Term Wind Power Forecast** | The ERCOT Operator will contact the Operations Analysis Engineer to conduct further analysis and to override system:  **IF:**   * A severe weather-related de-rate has occurred at a given wind farm, and * The telemetry, Outage Scheduler and COP have not been correctly updated by the QSE.   Contact Operations Analysis Engineer to do further analysis and potentially override the forecast given the description above after checking the following:   * Number of turbines online * Number of turbines offline * Outage scheduler * Telemetered wind speed (MPH) |
| **Note** | **The QSE should:**   * Update wind generating unit’s telemetry to reflect the number of turbines lost.   + NTON – number of turbines online   + NTOF – number of turbines offline   + NTUN – number of turbines unknown * Update ERCOT Outage Scheduler for updated HSL information that correctly reflects the number of turbines lost. This follows procedure for forced outages and should be done immediately. * Update unit’s COP in relation to the most recent forecast for the next hour(s) that pertains to the duration the turbines will be lost and accurately reflects the number of turbines lost.   Notification to the QSE may be necessary if the above are not complete within the designated time frame. |
| **Post** | Coordinate with the Real-Time Operator for making hotline calls and the posting of the notices on the ERCOT Website. |
| **Cancel Posting** | Coordinate with the Real-Time Operator for the cancelation of the postings on the ERCOT Website and making hotline calls. |
| **Log** | Log all actions. |
| High Wind Output Forecast with Forecasted Severe Weather in a Region | |
| **Manually Override Short Term Wind Power Forecast** | The ERCOT Operator will contact the Operations Analysis Engineer to conduct further analysis and to override the system if all the following conditions are met:   * The wind forecast is persistently higher than the actual output (the over-forecast error will exceed **20%** of installed capacity of wind farms affected or 1000 MW in a region) for a future period of time. * Weather forecasts from multiple sources indicate a winter/tropical storm will occur at the same timeline as the high forecasted output. |
| **Action** | Further analysis could potentially reduce the forecasted value of the region in question to a lower output. |
| **Example** | Below is an example of the STWPF being much higher due to turbines freezing. You will see the light blue line much lower than the multiple-colored lines that are forecasts. When the actual output begins to dip away from the forecast and icing conditions exist, it is likely an override is needed. |

|  |  |
| --- | --- |
| **Log** | Log all actions. |

## 8.2 Extreme Hot Weather

**Procedure Purpose:** Ensure when ERCOT issues extreme hot weather OCN, Advisory, Watch, or Emergency Notice, System Operators utilize the Extreme Weather Capacity Monitor as a check against QSE’s COP to verify accuracy of weather limitations for Resources during event.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Protocol Reference** |  |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standard** | **EOP-011-2**  **R2, R2.1, R2.2.9, R2.2.9.2** |  |  |  |

|  |  |  |
| --- | --- | --- |
| **Version: 1** | **Revision: 1** | **Effective Date: December 29, 2023** |

| **Step** | **Action** |
| --- | --- |
| **Note** | The purpose of this section is to monitor Resource COPs for accuracy against their submitted temperature limitations any time an extreme hot weather notice is in effect. |
| **Note** | A high risk Resource is any Resource shown to be operating in forecasted temperatures that are 3 degrees Fahrenheit higher than the highest maximum operating value submitted for weather limitations. |
| **1** | **IF:**   * ERCOT issues an OCN, Advisory, Watch, or Emergency Notice due to forecasted or actual extreme hot weather;   **THEN:**   * For the timeframe an extreme hot weather Notice is issued, prior to DRUC execution, monitor the Extreme Weather Capacity Monitor for any Resources considered at high risk with COPs that are exceeding their extreme hot weather operating limits daily.   **IF:**   * The Extreme Weather Capacity Monitor displays 3000 MW or more of high risk generation due to Resources’ COP exceeding their hot weather operating limits;   **THEN:**   * Inform the Shift Supervisor, * Coordinate with the Real-time operator for Hotline calls and Resource operator for posting message, and * Confirm message on ERCOT Website for large amount of high risk generation.   **Q#66/67/68/69 - Typical Hotline Script for Extreme Hot Weather [OCN/Advisory/Watch/Emergency]**  **Typical ERCOT Website Posting for Large Amount of Generation At Risk:**  At [time] ERCOT has [XXXX MW] shown to be at risk due to temperature limitations, for operating day [date]. All QSEs are instructed to update their COP to reflect known planned or forced outages of Resources due to the extreme hot weather. |
| **Log** | Log all actions, including when notification to QSE’s are made. |

## 8.3 Extreme Cold Weather

**Procedure Purpose:** When ERCOT issues an extreme cold weather OCN, Advisory, Watch, or Emergency Notice, System Operations will utilize the Extreme Weather Capacity Monitor as a check against QSE’s COP to verify accuracy of weather limitations for Resources during event.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Protocol Reference** |  |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standard** | **EOP-011-2**  **R2, R2.1, R2.2, R2.2.9, R2.2.9.1** |  |  |  |

|  |  |  |
| --- | --- | --- |
| **Version: 1** | **Revision: 1** | **Effective Date: December 29, 2023** |

| **Step** | | **Action** | | |
| --- | --- | --- | --- | --- |
| **Note** | | The purpose of this section is to monitor Resource COPs for accuracy against their submitted temperature limitations any time an extreme cold weather notice is in effect. |
| **Note** | | A high risk Resource is any Resource shown to be operating in forecasted temperatures that are 3 degrees Fahrenheit lower than the lowest minimum operating value submitted for weather limitations. |
| **Extreme Weather Capacity Monitor** | | **IF:**   * ERCOT issues an OCN, Advisory, Watch, or Emergency Notice due to forecasted or actual extreme cold weather;   **THEN:**   * For the timeframe an extreme cold weather Notice is issued, prior to DRUC execution, monitor the Extreme Weather Capacity Monitor for any Resources considered at high risk with COPs that are exceeding their extreme cold weather operating limits daily.   **IF:**   * The Extreme Weather Capacity Monitor displays 3000 MW or more of high risk generation due to Resources’ COP exceeding their cold weather operating limits;   **THEN:**   * Inform the Shift Supervisor, * Coordinate with the Real-time operator for Hotline calls and Resource operator for posting message, and * Confirm message on ERCOT Website for large amount of at-risk generation.   **Q#62/63/64/65 - Typical Hotline Script for Extreme Cold Weather [OCN/Advisory/Watch/Emergency]**  **Typical ERCOT Website Posting for Large Amount of Generation At Risk:**  At [time] ERCOT has [XXXX MW] shown to be at risk, due to temperature limitations, for operating day [date]. All QSEs are instructed to update their COP to reflect known planned or forced outages of Resources due to the extreme cold weather. |
| **Log** | | Log all actions, including when notification to QSE’s are made. |

# 9. Communication Testing

## 9.1 Monthly Testing of Satellite Phone Conference Bridge

**Procedure Purpose:** To ensure ERCOT maintains communication capability via the Satellite Phone System.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Protocol Reference** |  |  |  |  |
| **Guide Reference** |  |  |  |  |
| **NERC Standard** |  |  |  |  |

|  |  |  |
| --- | --- | --- |
| **Version: 1** | **Revision: 4** | **Effective Date: March 31, 2023** |

| **Step** | **Action** |
| --- | --- |
| Primary Control Center | |
| **Note** | When a participant dials into the conference bridge before the moderator dials in, they will hear music and be placed on hold. |
| **Note** | On the first weekend of each month, between the hours of 0000 Saturday and 0500 Monday, the **Satellite Phone System Conference Bridge** will be tested with the TOs. As the Shift Supervisor makes the call to the individual TO, they will set a time that the ERCOT Operator will call the **Satellite Phone System Conference Bridge** and establish communication with the appropriate TO. |
| **Note** | Use the ERCOT Satellite Phone User Guide **(See Desktop Guide Common to Multiple Desks Section 2.7)** for a list of the TOs that will be contacted by the ERCOT Operator and instructions on how to place a Satellite Phone System Conference Bridge call. |
| **Note** | The numbers for the ERCOT Operator to call into the Conference Bridge are Desk specific.  **Select:**  SATELLITE directory or go to page 41 to view the programmed numbers on the Turret phone for each Bridge:   * BLACKSTRT RUC – RUC Desk * BLACKSTRT RRD – Reliability Risk Desk * BLACKSTRT RES – Resource Desk * BLACKSTRT REAL – Real-Time Desk * BLACKSTRT TS#1 – Transmission Desk (Island Coordination) * BLACKSTRT TS#2 – Transmission Desk |
| **1** | **IF:**   * Open a Service Desk ticket and cc “shiftsupv” * The preprogrammed number does not function correctly,   **THEN:**   * Refer to the ERCOT Satellite Phone User Guide **(See Desktop Guide Common to Multiple Desks Section 2.7.2)** for the appropriate conference number and continue with this procedure. |
| **2** | **When prompted:**   * Enter the Moderator Pass Code * If necessary, allow five minutes for Participants to dial in * As each Participant connects, record the following:   + Name of Participant   + Company Name   + Any problems identified with the connection process |
| **3** | **IF:**   * One or more of the TOs fails to connect to the Bridge call;   **THEN:**   * Follow up with the TO to determine the cause:   + Reason for inability to connect   + Establish a time for a retest of the TOs not able to connect in the initial test. |
| **4** | Inform the Shift Supervisor when test is complete indicating any issues identified. |
| **Log** | Log the test date and results in the Operations Log. |

# 10. Perform Miscellaneous

## 10.1 Responding to QSE Issues

**Procedure Purpose:** To provide a mutually agreed process for resolving Real-Time data issues between ERCOT and the Entities that provide data to ERCOT. Also, to record when a QSE is operating from their backup Control Center and to notify the ERCOT Transmission Operator when a QSE notifies ERCOT of a change in status with any PSS or AVR.

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Protocol Reference** | **6.5.7.1.13(4)** |  |  |  |
| **Guide Reference** | **7.3.3** | **7.3.4** | **7.3.5** | **7.3.6** |
| **NERC Standard** | **IRO-018-1(i)**  **R1, R1.3** | **TOP-010-1 (1)**  **R1, R1.3, R2, R2.3** |  |  |

|  |  |  |
| --- | --- | --- |
| **Version: 1** | **Revision: 4** | **Effective Date: March 31, 2023** |

| **Step** | **Action** | |
| --- | --- | --- |
| Real-Time Data Issues known by the QSE | | | | | |
| **Note** | | | Manually replaced telemetry data is data entered by a QSE on their systems that is transmitted to ERCOT via ICCP in place of the normal points experiencing an issue. If Reliability issues can’t be resolved in a timely manner, ERCOT reserves the right to order the Resource off-line until the problem is resolved.  **Refer to Desktop Guide Common to Multiple Desks 2.27 Quality of Real-time Data** | | |
| **Notification of Telemetry**  **Data**  **Issue** | | | **IF:**   * Notified of a telemetry data issue (telemetry data will not be available or is unreliable for operational purposes);   **THEN:**   * The QSE should correct the telemetry data as soon as practicable, or, * Manually replace the data, if available. | | |
| **Cannot**  **Resolve** | | | **IF:**   * The QSE cannot resolve the telemetry data issue within two Business Day, fix the issue in a timely manner;   **THEN:**   * The QSE shall provide an estimated time of resolution. | | |
| Backup/Alternate Control Center Transfer | | | | | |
| **1** | | | When notified by a QSE that they will be transferring to or from their backup/alternate control center,   * Identify the [QSE] in the email notification   Send e-mail to “1 ERCOT System Operators” | | |
| **Log** | | | Log all actions. | | |
| QSE Issues | | | | | |
| **1** | | If a QSE is not satisfied with ERCOT Operations responses to their issues, refer them to their Wholesale Client Representative for clarification/resolution. | | |
| **2** | | If the System Operator believes the issue is with ERCOT systems applications (ICCP down, etc.), notify the ERCOT Service Desk. | | |
| **3** | | If a QSE is having an issue with ERCOT system applications (unable to access the portal, outage scheduler, etc.), instruct them to call the ERCOT Service Desk. | | |
| **4** | | As time permits, notify the Shift Supervisor of any actions taken and unresolved issues. | | |
| **Log** | | Log all actions. | | |
| Missing Data from ERCOT Website Postings | | | | |
| **1** | | **IF:**   * A call is received about data missing or data being incorrect,   **THEN:**   * Transfer call to the Service Desk, and * Notify the Shift Supervisor and Operations Support Engineer. | | |
| **Log** | Log the information. | |
| Courtesy Hotline calls for ERCOT Application Issues | | | | |
| **1** | | **WHEN:**   * Notified from IT support of application(s) issues that are causing Market Participants an inability to submit data to ERCOT;   **THEN:**   * Make a courtesy hotline to inform them.   **Q#76 - Typical Hotline script for Application Issues** | | |
| Power System Stabilizers (PSS) & Automatic Voltage Regulators (AVR) | | | | |
| **1** | | **WHEN:**   * Notified by a QSE of a change in status with any PSS or AVR;   **THEN:**   * Transfer call to the ERCOT Transmission Operator. | | |

**Document Control**

*Preparation*

| **Prepared by** | **Role** | **Date Completed** |
| --- | --- | --- |
| Hartmann, Gaddy, Self, and Frosch | Preparers | January 24, 2017 |
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| Hartmann, Cyphers, Luker and Smith | Procedure writers and editors | December 20, 2024 |

*Manual Change History*

|  |  |  |  |
| --- | --- | --- | --- |
| **Procedure** | **Ver/Rev** | **Reason for Issue** | **Effective Date** |
| All | 1.0 / 0 | New procedures | January 30, 2017 |
| 2.1  3.1  4.4  5.1  7.1  7.2  9.1 | 1.0 / 1  1.0 / 1  1.0 / 1  1.0 / 1  1.0 / 1  1.0 / 1  1.0 / 1 | Updated System Operator Responsibility and Authority  Updated Up Ramp Event step 2  Updated Panhandle Region  Updated Reliability Risk Desk performs STNET Study  Updated title and all 1st steps  Updated Implement EEA Level 3 steps  Updated Title | March 31, 2017 |
| 3.1 | 1.0 / 2 | Updated Down Ramp Event step 1, 2 & 3  Updated Up Ramp Event step 1 & 2 | June 1, 2017 |
| 3.1  7.2 | 1.0 / 3  1.0 / 2 | Updated Down Ramp Event step 2  Updated 1st note, step 1 changed to EEA Level 3 | June 30, 2017 |
| 7.2 | 1.0 / 3 | Added note Implement EEA Level 2 and Level 3 | July 28, 2017 |
| 7.2 | 1.0 / 4 | Updated Implement EEA Level 3 | September 29, 2017 |
| 8.1 | 1.0 / 1 | All procedures in this manual have been reviewed  Updated Primary Control Center 4th note | December 28, 2017 |
| 3.3 | 1.0 / 1 | Updated Day Ahead RRS Sufficiency Monitoring, moved Real-time RRS Sufficiency Monitoring down, added Look Ahead Critical Inertia Level Sufficiency Monitoring and Real-time Critical Inertia Level Sufficiency Monitoring | February 28, 2018 |
| 9.1 | 1.0 / 2 | Updated Note | March 30, 2018 |
| 2.2 | 1.0 / 1 | Updated procedure purpose | May 1, 2018 |
| 5.1 | 1.0 / 2 | Added Phase Angles steps | May 31, 2018 |
| 5.1 | 1.0 / 3 | Updated and named step to Voltage contingencies | August 31, 2018 |
| 4.1  4.2 | 1.0 / 1  1.0 / 1 | Updated procedure purpose, added note and updated step  Updated procedure purpose, added note and updated step  All procedures in this manual have been reviewed | December 28, 2018 |
| 4.2 | 1.0 / 2 | Updated steps | January 31, 2019 |
| 3.1  4.1 | 1.0 / 3  1.0 / 2 | Deleted all steps Monitor Large Ramp Events  Added Intra-Hour Wind Forecast and added Note  Updated STWPF Selection Change due to forecast vs. output deviation and added Note | August 1, 2019 |
| 4.1  4.7  5.1 | 1.0 / 3  1.0 / 0  1.0 / 4 | Removed Weather Forecast  Created section Weather Forecast Errors  Updated Voltage Contingencies | November 1, 2019 |
| 7.2  7.3 | 1.0 / 5  1.0 / 1 | Updated MSSC  Updated MSSC  All procedures in this manual have been reviewed | January 1, 2020 |
| 3.3  5.1  7.3  8.1 | 1.0 / 2  1.0 / 5  1.0 / 2  1.0 / 2 | Clarified RUC-commits/decommits  Clarified RUC-commits/decommits  Clarified RUC-commits/decommits  Updated Primary Control Center steps 1 & 3 | January 31, 2020 |
| 3.4  4.1  4.3  4.4  4.5  4.6  8.1 | 1.0 / 1  1.0 / 4  1.0 / 1  1.0 / 2  1.0 / 1  1.0 / 1  1.0 / 3 | Updated 3rd Note  Updated 1st Note  Updated Procedure Purpose & steps  Updated Procedure Purpose & steps  Updated Procedure Purpose  Updated Procedure Purpose, Title & steps  Updated Title and removed Alternate Control Center | February 28, 2020 |
| 2.1  7.1 | 1.0 / 2  1.0 / 2 | Added Advance Action Notice per NPRR930  Added Advance Action Notice section per NPRR930 | July 1, 2020 |
| 2.1 | 1.0 / 3 | Updated System Operator Responsibility and Authority | October 1, 2020 |
| 4.5  6.1  7.1  9.1 | 1.0 / 2  1.0 / 1  1.0 / 3  1.0 / 3 | Updated for NPRR1039  Updated for NPRR1039  Updated for NPRR1039 & added Note  Updated for NPRR1039  All procedures in this manual have been reviewed | December 31, 2020 |
| 3.3 | 1.0 / 3 | Updated Real-time Critical Inertia Level Sufficiency Monitoring step 3 | May 6, 2021 |
| 4.6  4.7 | 1.0 / 2  1.0 / 1 | Updated for SCR 811  Updated Load Forecast email | June 16, 2021 |
| 7.2 | 1.0 / 6 | Updated 1st Note | September 1, 2021 |
| 2.2  7.1  7.2 | 1.0 / 2  1.0 / 4  1.0 / 7 | Updated step 1  Updated all steps  Updated steps 1 & 2  All procedures in this manual have been reviewed | December 31, 2021 |
| 4.5 | 1.0 / 3 | Updated Note | February 1, 2022 |
| 2.3 | 1.0 / 0 | New procedure section | March 1, 2022 |
| 4.1  4.2 | 1.0 / 5  1.0 / 3 | Updated Note  Updated Note | April 7, 2022 |
| 4.1  4.6 | 1.0 / 6  1.0 / 3 | Updated section  Updated section | September 1, 2022 |
|  |  | All procedures in this manual have been reviewed | December 30, 2022 |
| 4.5  4.6  8.1  8.2  8.3  9.1  10.1 | 1.0 / 4  1.0 / 2  1.0 / 4  1.0 / 0  1.0 / 0  1.0 / 4  1.0 / 4 | Updated section number  Updated section number  Section 4.5 moved to section 8.1 and updated title  New procedure  New procedure  Updated section number  Updated section number | March 31, 2023 |
| 7.2 | 1.0 / 8 | Updated Note for NPRR1143 | August 1, 2023 |
| 7.2  7.3 | 1.0 / 9  1.0 / 3 | Updated For NPRR1176  Updated For NPRR1176 | November 1, 2023 |
| 8.0  8.1  8.2  8.3 | 1.0 / 1  1.0 / 5  1.0/ 1  1.0 / 1 | Updated Title to Weather Events  Updated first Note  Updated step Log  Updated step Log  All procedures in this manual have been reviewed | December 29, 2023 |
| 5.0 | 1.0 / 5 | Remove procedure and Added to Transmission | August 1, 2024 |
| 3.0 | 1.0 / 1 | Added new section NDCRC Resource testing  (This entry made in error, 3.0 is a section header and no changes were made to this section in the August 30, 2024 release). | August30, 2024 |
| 3.1 | 1.0 / 4 | Added new section NDCRC Resource testing | October 1, 2024 |
|  |  | All procedures in this manual have been reviewed | December 31, 2024 |