**ERCOT Nodal Protocols**

**Section 5: Transmission Security Analysis and Reliability Unit Commitment**

**December 5, 2025**

[5 Transmission Security Analysis and Reliability Unit Commitment 5-1](#_Toc214875148)

[5.1 Introduction 5-1](#_Toc214875149)

[5.2 Reliability Unit Commitment Timeline Summary 5-3](#_Toc214875150)

[5.2.1 RUC Normal Timeline Summary 5-3](#_Toc214875151)

[5.2.2 RUC Process Timing Deviations 5-4](#_Toc214875152)

[5.2.2.1 RUC Process Timeline After a Delay of the Day-Ahead Market 5-4](#_Toc214875153)

[5.2.2.2 RUC Process Timeline After an Aborted Day-Ahead Market 5-4](#_Toc214875154)

[5.3 ERCOT Security Sequence Responsibilities 5-4](#_Toc214875155)

[5.4 QSE Security Sequence Responsibilities 5-6](#_Toc214875156)

[5.4.1 Ancillary Service Positions 5-7](#_Toc214875157)

[5.5 Security Sequence, Including RUC 5-7](#_Toc214875158)

[5.5.1 Security Sequence 5-7](#_Toc214875159)

[5.5.2 Reliability Unit Commitment (RUC) Process 5-10](#_Toc214875160)

[5.5.3 Communication of RUC Commitments and Decommitments 5-17](#_Toc214875161)

[5.6 RUC Cost Eligibility 5-18](#_Toc214875162)

[5.6.1 Verifiable Costs 5-18](#_Toc214875163)

[5.6.1.1 Verifiable Startup Costs 5-23](#_Toc214875164)

[5.6.1.2 Verifiable Minimum-Energy Costs 5-24](#_Toc214875165)

[5.6.2 RUC Startup Cost Eligibility 5-24](#_Toc214875166)

[5.6.3 Forced Outage of a RUC-Committed Resource 5-25](#_Toc214875167)

[5.6.4 Cancellation of a RUC Commitment 5-26](#_Toc214875168)

[5.6.5 Settlement for Canceled or Delayed Outages for Outage Schedule Adjustments (OSAs) 5-26](#_Toc214875169)

[5.6.5.1 Make-Whole Payment for Canceled or Delayed Outages for OSAs 5-26](#_Toc214875170)

[5.6.5.2 RUC Make-Whole Payment and RUC Clawback Charge for Resources Receiving OSAs 5-27](#_Toc214875171)

[5.6.5.3 Timeline for Calculating RUC Clawback Charges for Resources Receiving OSAs 5-29](#_Toc214875172)

[5.7 Settlement for RUC Process 5-29](#_Toc214875173)

[5.7.1 RUC Make-Whole Payment 5-29](#_Toc214875174)

[5.7.1.1 RUC Guarantee 5-31](#_Toc214875175)

[5.7.1.2 RUC Minimum-Energy Revenue 5-36](#_Toc214875176)

[5.7.1.3 Revenue Less Cost Above LSL During RUC-Committed Hours 5-37](#_Toc214875177)

[5.7.1.4 Revenue Less Cost During QSE Clawback Intervals 5-40](#_Toc214875178)

[5.7.2 RUC Clawback Charge 5-43](#_Toc214875179)

[5.7.3 Payment When ERCOT Decommits a QSE-Committed Resource 5-45](#_Toc214875180)

[5.7.4 RUC Make-Whole Charges 5-48](#_Toc214875181)

[5.7.4.1 RUC Capacity-Short Charge 5-49](#_Toc214875182)

[5.7.4.1.1 Capacity Shortfall Ratio Share 5-50](#_Toc214875183)

[5.7.4.1.2 RUC Capacity Credit 5-64](#_Toc214875184)

[5.7.4.2 RUC Make-Whole Uplift Charge 5-64](#_Toc214875185)

[5.7.5 RUC Clawback Payment 5-65](#_Toc214875186)

[5.7.6 RUC Decommitment Charge 5-66](#_Toc214875187)

[5.7.7 Settlement of Switchable Generation Resources (SWGRs) Operating in a Non-ERCOT Control Area 5-67](#_Toc214875188)

[5.8 Annual RUC Reporting Requirement 5-67](#_Toc214875189)

# Transmission Security Analysis and Reliability Unit Commitment

5.1 Introduction

(1) Transmission security analysis and Reliability Unit Commitment (RUC) are used to ensure ERCOT System reliability and to ensure that enough Resource capacity and qualified Ancillary Service capacity are committed in the right locations to reliably serve the forecasted Load and Ancillary Service needs on the ERCOT System including Direct Current Tie (DC Tie) Load that has not been curtailed.

(2) ERCOT shall conduct at least one Day-Ahead Reliability Unit Commitment (DRUC) and at least one Hourly Reliability Unit Commitment (HRUC) before each hour of the Operating Day. ERCOT, in its sole discretion, may conduct a RUC at any time to evaluate and resolve reliability issues.

(3) The DRUC must be run after the close of the Day-Ahead Market (DAM).

(4) The DRUC uses Three-Part Supply Offers, capped at the maximum of generic or verifiable minimum energy and Startup Costs, submitted before the DAM by Qualified Scheduling Entities (QSEs) that were considered in the DAM but not awarded in the DAM. A QSE may not submit a Three-Part Supply Offer to be considered in the DRUC unless the offer was also submitted for consideration in the DAM.

(5) ERCOT must initiate the HRUC process at least one hour before the Operating Hour to fine-tune the Resource commitments using updated Load forecasts and updated Outage information.

(6) The RUC Study Period for DRUC is the next Operating Day. The RUC Study Period for HRUC is the balance of the current Operating Day plus the next Operating Day if the DRUC for the Operating Day has been solved.

(7) HRUC may decommit Resources only to maintain the reliability of the ERCOT System.

(8) For each RUC Study Period, the RUC considers capacity requirements for each hour of the RUC Study Period with the objective of minimizing costs based on logic described in Section 5.5.2, Reliability Unit Commitment (RUC) Process.

(9) The calculated Resource commitments arising from each RUC process, and a list of Off-Line Available Resources having a start-up time of one hour or less, must be reviewed by ERCOT before issuing Dispatch Instructions to QSEs to commit, extend, or decommit Resources.

(10) The Security Sequence is a set of prerequisite processes for RUC that describes the key system components and inputs that are required to support the RUC process, the RUC process itself, and the ERCOT review of the Resource commitment recommendations made by the RUC process.

(11) After the use of market processes to the fullest extent practicable without jeopardizing the reliability of the ERCOT System, any ERCOT Dispatch Instructions for additional capacity that order a QSE to commit a specific Generation Resource to be On-Line shall be considered a RUC Dispatch for the purpose of the Settlement of payments and charges related to the committed Generation Resource. An Operating Condition Notice (OCN), Advisory, Watch, or Emergency Notice requesting the available capacity of any currently available Generation Resources but not naming specific Generation Resources is not considered a RUC Dispatch for purposes of Settlement.

(12) ERCOT shall post on the Market Information System (MIS) Certified Area, for each Off-Line Generation Resource that may be selected by an HRUC process, the current time since the Generation Resource last went Off-Line (in hours) and the corresponding start-up times ERCOT is using for each such Off-Line Generation Resource. The time since the Generation Resource last went Off-Line and start-up times shall be updated at least hourly.

(13) Prior to 1330 in the Day-Ahead, ERCOT may issue a Weekly Reliability Unit Commitment (WRUC) Verbal Dispatch Instruction (VDI) to inform a QSE that a Resource is required to be On-Line for all or part of a future Operating Day. Following the receipt of a WRUC:

(a) The QSE may self-commit the Resource for the WRUC-instructed hours by updating the Resource’s Current Operating Plan (COP) to reflect the appropriate On-Line Resource Status for the WRUC-instructed hours prior to the DRUC process execution for the associated Operating Day. Resources that have been self-committed by a QSE in accordance with a WRUC:

(i) May have a Three-Part Supply Offer submitted into the DAM, and any of the WRUC-instructed hours in which the Three-Part Supply Offer is awarded in the DAM become DAM-Committed Intervals for the Resource and are settled accordingly; and

(ii) Will not be issued a RUC commitment for the WRUC-instructed hours that were self-committed or DAM-committed.

(b) ERCOT will commit the Resource as part of the DRUC process for the relevant Operating Day for all WRUC-instructed hours not DAM-committed or QSE self-committed. For all purposes, including RUC Settlement, the Resource will be considered as committed by the DRUC for these hours.

(14) If ERCOT issues an Outage Schedule Adjustment (OSA) pursuant to Section 3.1.4.6, Outage Coordination of Potential Transmission Emergency Conditions, or Section 3.1.6.9, Withdrawal of Approval and Rescheduling of Approved Planned Outages of Resource Facilities, QSEs with Resources that received an OSA shall be made whole to their actual costs incurred due to delaying or canceling and rescheduling the Outage as described in Section 5.6.5.1, Make-Whole Payment for Canceled or Delayed Outages for OSAs.

5.2 Reliability Unit Commitment Timeline Summary

***5.2.1 RUC Normal Timeline Summary***

(1) The following Reliability Unit Commitment (RUC) Timeline Summary describes the normal timeline for RUC activities that occur in the Day-Ahead and Adjustment Periods.







***5.2.2 RUC Process Timing Deviations***

**5.2.2.1 RUC Process Timeline After a Delay of the Day-Ahead Market**

(1) If the Day-Ahead Market (DAM) execution is delayed in accordance with Section 4.1.2, Day-Ahead Process and Timing Deviations, ERCOT shall conduct a Day-Ahead Reliability Unit Commitment (DRUC) after 1430 in the Day-Ahead and no earlier than one hour following the posting of DAM awards information on the ERCOT website as set forth in Section 4.5.3, Communicating DAM Results. In this event, ERCOT will use the RUC Snapshot taken just prior to the execution of the DRUC to settle RUC charges.

**5.2.2.2 RUC Process Timeline After an Aborted Day-Ahead Market**

(1) If ERCOT aborts all or part of the Day-Ahead process in accordance with Section 4.1.2, Day-Ahead Process and Timing Deviations, for any reason not due to a Market Suspension, then ERCOT shall use the Hourly Reliability Unit Commitment (HRUC) process described in this Section in lieu of the DRUC process. If ERCOT aborts the Day-Ahead process due to a Market Suspension, it shall act in accordance with Section 25.3, Market Restart Processes.

5.3 ERCOT Security Sequence Responsibilities

(1) ERCOT shall start the Day-Ahead Reliability Unit Commitment (DRUC) process at 1430 in the Day-Ahead.

(2) For each DRUC, ERCOT shall use a snapshot of Resource commitments taken at 1430 in the Day-Ahead for Reliability Unit Commitment (RUC) Settlement. For each Hourly Reliability Unit Commitment (HRUC), ERCOT shall use a snapshot of Resource commitments from each Qualified Scheduling Entity’s (QSE’s) most recently submitted Current Operating Plan (COP) before HRUC execution for RUC Settlement.

(3) For each RUC process, ERCOT shall:

(a) Execute the Security Sequence described in Section 5.5, Security Sequence, Including RUC, including:

(i) Validating Three-Part Supply Offers, defined in Section 4.4.9.1, Three-Part Supply Offers, Energy Bid/Offer Curves, defined in Section 4.4.9.7, Energy Bid/Offer Curve, and Ancillary Service Offers, defined in Section 4.4.7.2, Ancillary Service Offers;

(ii) Reviewing the Resource commitment recommendations made by the RUC algorithm; and

(iii) Reviewing the list of Off-Line Available Resources having a start-up time of one hour or less;

(b) Post to the Market Information System (MIS) Secure Area all Resources that were committed or decommitted by the RUC process including verbal RUC commitments and decommitments and Weekly Reliability Unit Commitment (WRUC) instructions;

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| ***[NPRR1239: Replace paragraph (b) above with the following upon system implementation:]***  (b) Post to the ERCOT website all Resources that were committed or decommitted by the RUC process including verbal RUC commitments and decommitments and Weekly Reliability Unit Commitment (WRUC) instructions; |

(c) Post to the ERCOT website all active and binding transmission constraints (contingency and overloaded element pair information where available) used as inputs to the RUC;

(d) Issue Dispatch Instructions to notify each QSE of its Resource commitments or decommitments; and

(e) Post to the MIS Secure Area all Resources that were committed by the RUC process, including verbal RUC commitments, but were subsequently cancelled by the ERCOT Operator.

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| ***[NPRR1239: Replace paragraph (e) above with the following upon system implementation:]***  (e) Post to the ERCOT website all Resources that were committed by the RUC process, including verbal RUC commitments, but were subsequently cancelled by the ERCOT Operator. |

(4) ERCOT shall provide each QSE with the information necessary to pre-validate their data for DRUC and HRUC, including publishing validation rules for offers, bids, and trades.

5.4 QSE Security Sequence Responsibilities

(1) During the Security Sequence, each Qualified Scheduling Entity (QSE) must:

(a) Submit its Current Operating Plan (COP) and update its COP as required in Section 3.9, Current Operating Plan (COP);

(b) Submit any Three-Part Supply Offers, Energy Bid/Offer Curves, and Ancillary Service Offers before:

(i) 1000 in the Day-Ahead for the Day-Ahead Market (DAM) and Day-Ahead Reliability Unit Commitment (DRUC) being run in that Day-Ahead, if the QSE wants the offer to be used in those DAM and DRUC processes; and

(ii) The end of the Adjustment Period for each Hourly Reliability Unit Commitment (HRUC), if the QSE wants the offer to be used in the HRUC process;

(c) Submit any Capacity Trades before 1430 in the Day-Ahead for the DRUC and before the end of the Adjustment Period for each HRUC, if the QSE wants those Capacity Trades included in the calculation of Reliability Unit Commitment (RUC) Settlement;

(d) Submit any Energy Trades, Ancillary Service Trades, and Direct Current Tie (DC Tie) Schedules corresponding to Electronic Tags (e-Tags) before 1430 in the Day-Ahead for the DRUC and by the end of the Adjustment Period for each HRUC; if the QSE wants those Energy Trades and DC Tie Schedules included in the calculation of RUC Settlement;

(e) Submit an updated COP before 1430 in the Day-Ahead; and

(f) Acknowledge receipt of Resource commitment or decommitment Dispatch Instructions by submitting an updated COP.

***5.4.1 Ancillary Service Positions***

(1) A QSE’s Ancillary Service Position is the net amount of Ancillary Service capacity to which the QSE has financially committed in the ERCOT market, by hour and service type, from self-arrangement, trades, and awards. The Ancillary Service Position is the difference in MW, by hour and service type, between the amounts specified in items (a) and (b) defined as follows:

(a) The sum of:

(i) The QSE’s Self-Arranged Ancillary Service Quantity; plus

(ii) The total (in MW) of Ancillary Service Trades for which the QSE is the seller; plus

(iii) Awards to the QSE of Ancillary Service Offers in the DAM; and

(b) The sum of:

(i) The total Ancillary Service Trades for which the QSE is the buyer.

5.5 Security Sequence, Including RUC

***5.5.1 Security Sequence***

(1) The figure below highlights the key computational modules and processes that are used in the Security Sequence:



(2) The Security Sequence uses computational modules functionally similar to those used in Real-Time Sequence, however, the inputs into the Security Sequence are based on a snapshot of projected hourly system conditions and constraints rather than Real-Time data.

(3) The Security Sequence uses the status of all transmission breakers and switches (current status for the first hour and normal status for all other hours of Hourly Reliability Unit Commitment (HRUC) and normal status for all hours of Day-Ahead Reliability Unit Commitment (DRUC)), updated for approved Planned Outages for equipment out of service and returned to service for building a representation of the ERCOT Transmission Grid for each hour of the Reliability Unit Commitment (RUC) Study Period. The Network Topology Processor constructs a network model for each hour that must be used by the Bus Load Forecast to estimate the hourly Load for each transmission bus.

(4) The weather forecast obtained by ERCOT must be provided to the Dynamic Rating Processor to create weather-adjusted MVA limits for each hour of the RUC Study Period for all transmission lines and transformers that have Dynamic Ratings.

(5) ERCOT shall analyze base configuration, select n-1 contingencies and select n-2 contingencies under the Operating Guides. The Operating Guides must also specify the criteria by which ERCOT may remove contingencies from the list. ERCOT shall post to the Market Information System (MIS) Secure Area the standard contingency list, including identification of changes from previous versions before being used in the Security Sequence. ERCOT shall evaluate the need for Resource-specific deployments during Real-Time operations for management of congestion consistent with the Operating Guides.

(6) ERCOT shall also post to the MIS Secure Area any contingencies temporarily removed from the standard contingency list by ERCOT immediately after successful execution of the Security Sequence. ERCOT shall include the reason for removal of any contingency as soon as practicable but not later than one hour after removal.

(7) As part of the Network Security Analysis (NSA), for each hour of the RUC Study Period, ERCOT shall analyze all selected contingencies and perform the following:

(a) Perform full AC analysis of all contingencies;

(b) Monitor element and bus voltage limit violations; and

(c) Monitor transmission line and transformer security violations.

(8) As part of the NSA, if there is an approved Remedial Action Plan (RAP) available, it must be used before considering a Resource commitment.

(9) ERCOT shall review all security violations prior to RUC execution.

(10) All Remedial Action Schemes (RASs), Automatic Mitigation Plans (AMPs) and RAPs modeled in the Network Operations Model shall be included in the contingency analysis. The computational modules must enable ERCOT to analyze contingencies, including the effects of all RASs and AMPs included in the Network Operations Model.

(11) ERCOT may deselect certain contingencies known to cause errors or that otherwise result in inconclusive study output in the RUC. On continued de-selection of contingencies, ERCOT shall prepare an analysis to determine the cause of the error. ERCOT may use information from the Day-Ahead processes as decision support during the Hour-Ahead processes. ERCOT shall post to the MIS Secure Area any contingencies deselected by ERCOT and must include the reason for removal as soon as practicable, but not later than one hour after deselection.

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| ***[NPRR1239: Replace paragraph (11) above with the following upon system implementation:]***  (11) ERCOT may deselect certain contingencies known to cause errors or that otherwise result in inconclusive study output in the RUC. On continued de-selection of contingencies, ERCOT shall prepare an analysis to determine the cause of the error. ERCOT may use information from the Day-Ahead processes as decision support during the Hour-Ahead processes. ERCOT shall post to the ERCOT website any contingencies deselected by ERCOT and must include the reason for removal as soon as practicable, but not later than one hour after deselection. |

***5.5.2 Reliability Unit Commitment (RUC) Process***

(1) The RUC process recommends commitment of Generation Resources, to match ERCOT’s forecasted Load including Direct Current Tie (DC Tie) Schedules and RUC Ancillary Service Demand Curves (ASDCs), subject to all transmission constraints and Resource performance characteristics. The RUC process takes into account Resources already committed in the Current Operating Plans (COPs), Resources already committed in previous RUCs, and Off-Line Available Resources having a start-up time of one hour or less. For On-Line Energy Storage Resources (ESRs), using RUC duration requirements for energy and Ancillary Services, RUC-projected dispatch for energy and Ancillary Service in one interval shall respect the ESR’s minimum and maximum State of Charge (SOC) values from the COP, while incorporating any adjustments under paragraph (20)(d) below. In addition, using the Ancillary Service Deployment Factors and their respective deployment duration requirements, the SOC required to support these dispatch levels for energy and Ancillary Services will match as closely as possible the difference between the adjusted COP values of the next interval’s Hour Beginning Planned SOC (HBSOC) and the current interval’s HBSOC. The formulation of the RUC objective function must employ penalty factors on violations of security constraints and violations of ESR COP HBSOC. The objective of the RUC process is to minimize costs based on the Resource costs described in paragraphs (12) through (16) below. ESR energy dispatch costs and Ancillary Service Offer costs are not included in the RUC objective function.

(2) ERCOT shall create an ASDC for each Ancillary Service for use in RUC. The ASDCs for each Ancillary Service for use in RUC shall be substantively the same as the ASDCs defined in Section 4.4.12, Determination of Ancillary Service Demand Curves for the Day-Ahead Market and Real-Time Market. Specific to RUC, the ASDC for Non-Spinning Reserve (Non-Spin) shall not extend beyond the Ancillary Service Plan for Non-Spin for the relevant Operating Hour. ERCOT shall post the ASDCs for RUC to the ERCOT website following each execution of the RUC process.

(3) ERCOT shall post the following Ancillary Service Deployment Factor data on the ERCOT website:

(a) Following each execution of RUC, ERCOT shall post the Ancillary Service Deployment Factors used by that RUC process for each hour in the RUC Study Period;

(b) No later than 0600 in the Day-Ahead for each Operating Day, ERCOT shall post the Ancillary Service Deployments Factors that are projected to be used in the RUC process for that Operating Day; and

(c) Following each month, ERCOT shall post the average, minimum, and maximum Ancillary Service Deployment Factors used in the RUC process by type of Ancillary Service and hour of the day for the month.

(4) For all hours of the RUC Study Period within the RUC process, Quick Start Generation Resources (QSGRs) with a COP Resource Status of OFFQS shall be considered as On-Line with Low Sustained Limit (LSL) at zero MW. QSGRs with a Resource Status of OFFQS shall only be committed by ERCOT through a RUC instruction in instances when a reliability issue would not otherwise be managed through Dispatch Instructions from Security-Constrained Economic Dispatch (SCED).

(5) In addition to On-Line qualified Generation Resources and ESRs, the RUC engine shall consider a COP Resource status of OFFQS for QSGRs that are qualified for ERCOT Contingency Reserve Service (ECRS), as being eligible to provide ECRS constrained by the Ancillary Service capability in the COP.

(6) In addition to On-Line qualified Generation Resources and ESRs, the RUC engine shall consider a COP Resource Status of OFFQS for QSGRs that are qualified for Non-Spin, as being eligible to provide Non-Spin constrained by the Ancillary Service Capability in the COP. The RUC engine shall also consider a COP Resource Status of OFF (Off-Line but available for commitment in the DAM and RUC) for a Resource that is qualified for Non-Spin, as being eligible to provide Non-Spin constrained by the Ancillary Service capability in the COP.

(7) In addition to On-Line qualified Generation Resources and ESRs, the RUC engine shall consider a COP Resource Status of ONL for Load Resources that are qualified for Ancillary Services, as being eligible to provide Ancillary Services constrained by the Ancillary Service Capability in the COP. The RUC engine will not consider any Load Resources for dispatch of energy.

(8) The RUC constraints in the RUC engine shall use 60 minutes as the duration for energy and Ancillary Services, excluding Responsive Reserve (RRS) provided using Fast Frequency Response (FFR), for which duration shall be 15 minutes. These same duration requirements will be used to enforce a constraint on each ESR’s dispatch for energy and Ancillary Services using Ancillary Service deployment factors for a given hour such that the calculated SOC at the end of that hour is equal to the next hour’s COP value of HBSOC.

(9) The RUC process can recommend Resource decommitment. ERCOT may only decommit a Resource to resolve transmission constraints that are otherwise unresolvable. Qualifying Facilities (QFs) may be decommitted only after all other types of Resources have been assessed for decommitment. In addition, the HRUC process provides decision support to ERCOT regarding a Resource decommitment requested by a Qualified Scheduling Entity (QSE).

(10) ERCOT shall review the RUC-recommended Resource commitments and the list of Off-Line Available Resources having a start-up time of one hour or less to assess feasibility and shall make any changes that it considers necessary, in its sole discretion. During the RUC process, ERCOT may also review and commit, through a RUC instruction, Combined Cycle Generation Resources that are currently planned to be On-Line but are capable of transitioning to a configuration with additional capacity. ERCOT may deselect Resources recommended in DRUC and in all HRUC processes if in ERCOT’s sole discretion there is enough time to commit those Resources in the future HRUC processes, taking into account the Resources’ start-up times, to meet ERCOT System reliability. After each RUC run, ERCOT shall post the amount of capacity deselected per hour in the RUC Study Period to the MIS Secure Area. A Generation Resource shown as On-Line and available for SCED dispatch for an hour in its COP prior to a DRUC or HRUC process execution, according to Section 5.3, ERCOT Security Sequence Responsibilities, will be considered self-committed for that hour. For purpose of Settlement, snapshot data will be used as specified in paragraph (2) of Section 5.3.

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| ***[NPRR1239: Replace paragraph (10) above with the following upon system implementation:]***  (10) ERCOT shall review the RUC-recommended Resource commitments and the list of Off-Line Available Resources having a start-up time of one hour or less to assess feasibility and shall make any changes that it considers necessary, in its sole discretion. During the RUC process, ERCOT may also review and commit, through a RUC instruction, Combined Cycle Generation Resources that are currently planned to be On-Line but are capable of transitioning to a configuration with additional capacity. ERCOT may deselect Resources recommended in DRUC and in all HRUC processes if in ERCOT’s sole discretion there is enough time to commit those Resources in the future HRUC processes, taking into account the Resources’ start-up times, to meet ERCOT System reliability. After each RUC run, ERCOT shall post the amount of capacity deselected per hour in the RUC Study Period to the ERCOT website. A Generation Resource shown as On-Line and available for SCED dispatch for an hour in its COP prior to a DRUC or HRUC process execution, according to Section 5.3, ERCOT Security Sequence Responsibilities, will be considered self-committed for that hour. For purpose of Settlement, snapshot data will be used as specified in paragraph (2) of Section 5.3. |

(11) ERCOT shall issue RUC instructions to each QSE specifying its Resources that have been committed as a result of the RUC process. ERCOT shall, within one day after making any changes to the RUC-recommended commitments, post to the MIS Secure Area any changes that ERCOT made to the RUC-recommended commitments with an explanation of the changes.

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| ***[NPRR1239: Replace paragraph (11) above with the following upon system implementation:]***  (11) ERCOT shall issue RUC instructions to each QSE specifying its Resources that have been committed as a result of the RUC process. ERCOT shall, within one day after making any changes to the RUC-recommended commitments, post to the ERCOT website any changes that ERCOT made to the RUC-recommended commitments with an explanation of the changes. |

(12) ERCOT shall use the RUC process to evaluate the need to commit Resources for which a QSE has submitted Three-Part Supply Offers and other available Off-Line Resources in addition to Resources that are planned to be On-Line during the RUC Study Period. All of the above commitment information must be as specified in the QSE’s COP. For available Off-Line Resources with a cold start time of one hour or less that have not been removed from special consideration under paragraph (17) below pursuant to paragraph (3) of Section 8.1.2, Current Operating Plan (COP) Performance Requirements, the Startup Offers and Minimum-Energy Offer from a Resource’s Three-Part Supply Offer shall not be used in the RUC process.

(13) ERCOT shall create Three-Part Supply Offers for all Resources that did not submit a Three-Part Supply Offer, but are specified as available but Off-Line, excluding Resources with a Resource Status of EMR, in a QSE’s COP. For such Resources, excluding available Off-Line Resources with a cold start time of one hour or less that have not been removed from special consideration under paragraph (16) below pursuant to paragraph (3) of Section 8.1.2, ERCOT shall use in the RUC process 100% of any approved verifiable Startup Cost and verifiable minimum-energy cost or if verifiable costs have not been approved, the applicable Resource Category Generic Startup Offer Cost and the applicable Resource Category Generic Minimum-Energy Offer Cost as described specified in Section 4.4.9.2.3, Startup Offer and Minimum-Energy Offer Generic Caps, registered with ERCOT. Also, for Settlement purposes, ERCOT shall use any approved verifiable Startup Costs and verifiable minimum-energy cost for such Resources, or if verifiable costs have not been approved, the applicable Resource Category Generic Startup Offer Cost and Generic Minimum-Energy Offer Cost.

(14) A QSE shall notify the ERCOT Operator of any physical limitation that impacts its Resource’s ability to start that is not reflected in the Resource’s COP or the Resource’s startup time, minimum On-Line time, or minimum Off-Line time. The following shall apply:

(a) If a Resource receives a RUC Dispatch Instruction that it cannot meet due to a physical limitation described in paragraph (5) above, the QSE representing the Resource shall notify the ERCOT Operator of the inability to fully comply with the instruction and shall comply with the instruction to the best of the Resource’s ability. If the QSE has provided the ERCOT Operator notice of that limitation at least seven days prior to the Operating Day in which the instruction occurs, the QSE shall be excused from complying with the portion of the RUC Dispatch Instruction that it could not meet due to the identified limitation.

(b) If a QSE provides notice pursuant to paragraph (a) above of a physical limitation that will delay the RUC-committed Resource’s ability to reach its LSL in accordance with a RUC Dispatch Instruction, ERCOT shall extend the RUC Dispatch Instruction so that the Resource’s minimum run time is respected. However, if the Resource will not be available in time to address the issue for which it received the RUC instruction, ERCOT may instead cancel the RUC Dispatch Instruction.

(15) A QSE shall be excused from complying with any portion of a RUC Dispatch Instruction that it could not meet due to a physical limitation that was reflected, at the time of the RUC Dispatch Instruction, in the Resource’s COP, startup time, minimum On-Line time, or minimum Off-Line time.

(16) To determine the projected energy output level of each Resource and to project potential congestion patterns for each hour of the RUC, ERCOT shall calculate proxy Energy Offer Curves based on the Mitigated Offer Caps (MOCs) for the type of Resource as specified in Section 4.4.9.4, Mitigated Offer Cap and Mitigated Offer Floor, for use in the RUC. Proxy Energy Offer Curves are calculated by multiplying the MOC by a constant selected by ERCOT from time to time that is no more than 0.10% and applying the cost for all Generation Resource output between High Sustained Limit (HSL) and LSL. The intent of this process is to minimize the effect of the proxy Energy Offer Curves on optimization. For ESRs, energy dispatch costs are not considered in determining projected energy output levels.

(17) ERCOT shall calculate proxy Ancillary Service Offer Curves for use in RUC based on validated Ancillary Service Offers as specified in Section 4.4.7.2, Ancillary Service Offers. For all Resources that do not have a valid Ancillary Service Offer but are qualified to provide an Ancillary Service, ERCOT shall create an Ancillary Service Offer Curve for use in RUC as described in Section 6.5.7.3, Security Constrained Economic Dispatch. Proxy Ancillary Service Offer Curves for use in RUC are calculated by multiplying the Ancillary Service Offer by a constant selected by ERCOT from time to time that is no more than 0.1%, and are extended between the HSL and LSL. Notwithstanding the presence or absence of a proxy Ancillary Service Offer, Ancillary Service provision in RUC shall be limited by the Resource’s Ancillary Service capabilities as reflected in the COP. For ESRs, Ancillary Service Offer costs are not considered in determining projected Ancillary Service awards.

(18) For all available Off-Line Resources having a cold start time of one hour or less and not removed from special consideration pursuant to paragraph (3) of Section 8.1.2, ERCOT shall scale any approved verifiable Startup Cost and verifiable minimum-energy cost or if verifiable costs have not been approved, the applicable Resource Category Generic Startup Offer Cost and the applicable Resource Category Generic Minimum-Energy Offer Cost as specified in Section 4.4.9.2.3 for use in the RUC process.

The above parameter is defined as follows:

|  |  |  |
| --- | --- | --- |
| **Parameter** | **Unit** | **Current Value\*** |
| 1HRLESSCOSTSCALING | Percentage | Maximum value of 100% |
| \* The current value for the parameter(s) referenced in this table above will be recommended by the Technical Advisory Committee (TAC) and the ERCOT Board and approved by the Public Utility Commission of Texas (PUCT). ERCOT shall update parameter value(s) on the first day of the month following PUCT approval unless otherwise directed. ERCOT shall provide a Market Notice prior to implementation of a revised parameter value. | | |

(19) Factors included in the RUC process are:

(a) ERCOT System-wide hourly Load forecast allocated appropriately over Load buses;

(b) ERCOT’s Ancillary Service Plans in the form of ASDCs;

(c) Transmission constraints – Transfer limits on energy flows through the electricity network;

(i) Thermal constraints – protect transmission facilities against thermal overload;

(ii) Generic constraints – protect the transmission system against transient instability, dynamic instability or voltage collapse;

(d) Planned transmission topology;

(e) Energy sufficiency constraints, including RUC duration requirements for energy and Ancillary Services;

(f) Inputs from the COP, as appropriate;

(g) Inputs from Resource Parameters, including a list of Off-Line Available Resources having a start-up time of one hour or less, as appropriate;

(h) Each Generation Resource’s Minimum-Energy Offer and Startup Offer, from its Three-Part Supply Offer;

(i) Any Generation Resource that is Off-Line and available but does not have a Three-Part Supply Offer;

(j) Forced Outage information;

(k) Inputs from the eight-day look ahead planning tool, which may potentially keep a unit On-Line (or start a unit for the next day) so that a unit minimum duration between starts does not limit the availability of the unit (for security reasons); and

(l) Ancillary Service Deployment Factors.

(20) The HRUC process and the DRUC process are as follows:

(a) The HRUC process uses current Resource Status for the initial condition for the first hour of the RUC Study Period. All HRUC processes use the projected status of transmission breakers and switches starting with current status and updated for each remaining hour in the study as indicated in the COP for Resources and in the Outage Scheduler for transmission elements.

(b) The DRUC process uses the Day-Ahead forecast of total ERCOT Load including DC Tie Schedules for each hour of the Operating Day. The HRUC process uses the current hourly forecast of total ERCOT Load including DC Tie Schedules for each hour in the RUC Study Period.

|  |
| --- |
| ***[NPRR1032: Replace paragraph (b) above with the following upon system implementation:]***  (b) The DRUC process uses the current hourly forecast of total ERCOT Load including DC Tie Schedules up to the physical rating of the DC Tie for each hour of the Operating Day. The HRUC process uses the current hourly forecast of total ERCOT Load including DC Tie Schedules up to the physical rating of the DC Tie for each hour in the RUC Study Period. |

(c) The DRUC process uses the Day-Ahead weather forecast for each hour of the Operating Day. The HRUC process uses the weather forecast information for each hour of the balance of the RUC Study Period.

(d) For the HRUC, DRUC, and Weekly Reliability Unit Commitment (WRUC) processes, a feasibility check on the COP submitted HBSOC will be performed. This check may adjust the HBSOC used in the RUC process. The feasibility check looks sequentially across all intervals in the RUC Study Period to validate whether a particular interval’s COP HBSOC is achievable from the previous interval. If it is not feasible, then RUC will adjust the HBSOC to the closest achievable value.

(21) A QSE with a Resource that is not a Reliability Must-Run (RMR) Unit or has not received an Outage Schedule Adjustment (OSA) that has been committed in a DRUC or HRUC process may opt out of the RUC Settlement (or “buy back” the commitment) by setting the COP status of the RUC-committed Resource to ONOPTOUT for the first hour of a contiguous block of RUC-Committed Hours in the Opt Out Snapshot. All the configurations of the same Combined Cycle Train shall be treated as the same Resource for the purpose of creating the block of RUC-Committed Hours. A RUC-committed Combined Cycle Generation Resource may opt out of the RUC Settlement by setting the COP status of any Combined Cycle Generation Resource within the same Combined Cycle Train as the RUC-committed Resource to ONOPTOUT for the first hour of a contiguous block of RUC-Committed Hours in the Opt Out Snapshot. A Combined Cycle Generation Resource that is RUC-committed from one On-Line configuration in order to transition to a different configuration with additional capacity may opt out of the RUC Settlement following the same rule for RUC-committed Combined Cycle Generation Resources described above. A QSE that opts out of RUC Settlement forfeits RUC Settlement for the affected Resource for a given block of RUC Buy-Back Hours. A QSE that opts out of RUC Settlement treatment must make the Resource available to SCED for all RUC Buy-Back Hours. All hours in a contiguous block of RUC-Committed Hours that includes the RUC Buy-Back Hour shall be considered RUC Buy-Back Hours. If a contiguous block of RUC-Committed Hours spans more than one Operating Day and a QSE wishes to opt out of RUC Settlement for the RUC-Committed Hours in the second or subsequent Operating Day, the QSE must set its COP status to ONOPTOUT for the first hour of that the first Operating Day in the Opt Out Snapshot of the first Operating Day.

(22) ERCOT shall, as soon as practicable, post to the MIS Secure Area a report identifying those hours that were considered RUC Buy-Back Hours, along with the name of each RUC-committed Resource whose QSE opted out of RUC Settlement.

|  |
| --- |
| ***[NPRR1239: Replace paragraph (22) above with the following upon system implementation:]***  (22) ERCOT shall, as soon as practicable, post to the ERCOT website a report identifying those hours that were considered RUC Buy-Back Hours, along with the name of each RUC-committed Resource whose QSE opted out of RUC Settlement. |

(23) A Resource that has a Three-Part Supply Offer cleared in the Day-Ahead Market (DAM) and subsequently receives a RUC commitment for the Operating Hour for which it was awarded will be treated as if the Resource Status was ONOPTOUT for purposes of Section 6.5.7.3 and Section 6.5.7.3.1, Determination of Real-Time Reliability Deployment Price Adders.

(24) A Resource that has self-committed for an Operating Hour after the RUC Snapshot was taken but before the RUC commitment has been communicated through an XML message for that RUC process and that Operating Hour is included in a block of RUC-committed hours for that RUC process will be treated as if the Resource Status was ONOPTOUT for purposes of Section 6.5.7.3, Section 6.5.7.3.1, and RUC Settlement for the entire block of RUC-committed hours. A QSE that has a Resource that meets these conditions must make the Resource available to SCED for the entire block of RUC-committed hours. ERCOT will send the QSE a notification stating the Operating Day and block of hours for which this occurred.

***5.5.3 Communication of RUC Commitments and Decommitments***

(1) The output of the RUC process is the cleared Resource commitments and decommitments, and a list of the Off-Line Available Resources having a start-up time of one hour or less.

(2) ERCOT shall notify each QSE in the Day-Ahead of the DRUC Resource commitments and advisory decommitments that have been cleared by the RUC for the Resources that QSE represents. ERCOT shall notify each QSE of the HRUC Resource commitments and decommitments that have been cleared by the RUC for the Resources that QSE represents. Resource commitments must include the start interval and duration for which the Resource is required to be at least at LSL. Resource decommitments must include the interval in which the Resource is required to be Off-Line, duration, and reason for the decommitment. ERCOT shall notify each QSE representing an RMR Unit if that unit has been cleared by the DRUC or HRUC process at the same time that the DRUC and HRUC participants are notified of the results of each such process.

(3) If ERCOT communicates HRUC commitments and decommitments verbally to a QSE, then the same Resource attributes communicated programmatically must be communicated when ERCOT gives a verbal Resource commitment or decommitment.

(4) The QSE shall acknowledge the notice or commitment or decommitment by changing the Resource Status of the affected Resources in the COP for RUC-Committed Intervals.

5.6 RUC Cost Eligibility

***5.6.1 Verifiable Costs***

(1) The Qualified Scheduling Entity (QSE) is responsible for submitting verifiable costs unless both the QSE and Resource Entity agree that the Resource Entity will have this responsibility, in which case both the QSE and Resource Entity shall submit an affidavit to ERCOT stating this arrangement. Notwithstanding the foregoing, QSEs that submit Power Purchase or Tolling Agreements (PPAs) do not have the option of allowing Resource Entities to file verifiable costs.

(2) Make-Whole Payments for a Resource are based on the Startup Offers and Minimum-Energy Offers for the Resource, limited by caps. Until ERCOT approves verifiable unit-specific costs for that Resource, the caps are the Resource Category Startup Generic Cap and the Resource Category Minimum-Energy Generic Cap. When ERCOT approves verifiable unit-specific costs for that Resource the caps are those verifiable unit-specific costs. A QSE or Resource Entity may file verifiable unit-specific costs for a Resource at any time, but it must file those costs no later than 30 days after five Reliability Unit Commitment (RUC) events for that Resource in a calendar year. A RUC event begins when a Resource receives a RUC instruction to come or stay On-Line and ends the later of when the Resource shuts down or the end of the Operating Day. The most recent ERCOT-approved verifiable costs must be used going forward.

(3) These unit-specific verifiable costs may include and are limited to the following average incremental costs:

(a) Allocation of maintenance requirements based on number of starts between maintenance events using, at the option of the QSE or Resource Entity, either:

(i) Manufacturer-recommended maintenance schedule;

(ii) Historical data for the unit and actual maintenance practices; or

(iii) Another method approved in advance by ERCOT in writing;

(b) Startup fuel calculations based on recorded actual measured flows when the data is available or based on averages of historical flows for similar starts (for example, hot, cold, intermediate) when actual data is not available. Startup fuel will include filing separately the startup fuel required to reach breaker close and fuel after breaker close to Low Sustained Limit (LSL). Any fuel required to shutdown a Resource will be submitted as the fuel from breaker open to shutdown;

(c) Operation costs;

(d) Chemical costs;

(e) Water costs; and

(f) Emission credits.

(4) Standard Operations and Maintenance (O&M) costs pursuant to paragraph (6) below may be used in lieu of the incremental O&M costs set forth in items (3)(a), (c), (d) and (e) above.

(5) These unit-specific verifiable costs may not include:

(a) Fixed costs, which are any cost that is incurred regardless of whether the unit is deployed or not; and

(b) Costs for which the QSE or Resource Entity cannot provide sufficient documentation for ERCOT to verify the costs.

(6) At their election, QSEs or Resource Entities may receive standard O&M costs for both startup and minimum energy. This election may be made by submitting an election form to ERCOT. If a QSE or Resource has received final approval for actual verifiable O&M costs under the verifiable cost process, it may not elect to receive standard O&M costs.

(a) Until December 31, 2011, standard O&M costs are defined as follows:

|  |  |  |  |  |
| --- | --- | --- | --- | --- |
| **Resource Category**  **Start Year = 2009** | **Cold Startup ($/start)** | **Intermediate Startup ($/start)** | **Hot Startup ($/start)** | **Variable O&M ($/MWh)** |
| Aeroderivative simple cycle commissioned after 1996 | 1,000.00 | 1,000.00 | 1,000.00 | 3.94 |
| Reciprocating Engine | $58/MW \* the average of the Seasonal net max sustainable ratings | $58/MW \* the average of the Seasonal net max sustainable ratings | $58/MW \* the average of the Seasonal net max sustainable ratings | 5.09 |
| Simple cycle ≤ 90 MW | 2,300.00 | 2,300.00 | 2,300.00 | 3.94 |
| Simple cycle ≥ 90 MW | 5,000.00 | 5,000.00 | 5,000.00 | 3.94 |
| Combined cycle: for each Combined-Cycle Configuration, the Startup Cost for that configuration is the sum of the Startup Costs for each unit within that configuration as follows: |  |  |  | 3.19 |
| Combustion turbine < 90 MW | 2,300.00 | 2,300.00 | 2,300.00 |  |
| Combustion turbine ≥ 90 MW | 5,000.00 | 5,000.00 | 5,000.00 |  |
| Steam turbine | 3,000.00 | 2,250.00 | 1,250.00 |  |
| Gas-steam non-reheat boiler | 2,310.00 | 1,732.50 | 866.25 | 7.08 |
| Gas-steam reheat boiler | 3,000.00 | 2,250.00 | 1,125.00 | 7.08 |
| Gas-steam supercritical boiler | 4,800.00 | 3,600.00 | 1,800.00 | 7.08 |
| Nuclear, coal, lignite and hydro | 7,200.00 | 5,400.00 | 2,700.00 | 5.02 |
| Renewable | Not Applicable | Not Applicable | Not Applicable | 5.50 |

(b) For the period beginning January 1, 2012 and ending December 31, 2012, standard O&M costs shall be reduced by 10% from the levels specified in the table in paragraph (a) above as follows:

| **Resource Category** | **Cold Startup ($/start)** | **Intermediate Startup ($/start)** | **Hot Startup ($/start)** | **Variable O&M ($/MWh)** |
| --- | --- | --- | --- | --- |
| **Start Year = 2009** |
| Aeroderivative simple cycle commissioned after 1996 | 900.00 | 900.00 | 900.00 | 3.55 |
| Reciprocating Engine | $52.20/MW \* the average of the Seasonal net max sustainable ratings | $52.20/MW \* the average of the Seasonal net max sustainable ratings | $52.20/MW \* the average of the Seasonal net max sustainable ratings | 4.58 |
| Simple cycle ≤ 90 MW | 2,070.00 | 2,070.00 | 2,070.00 | 3.55 |
| Simple cycle ≥ 90 MW | 4,500.00 | 4,500.00 | 4,500.00 | 3.55 |
| Combined cycle: for each Combined-Cycle Configuration, the Startup Cost for that configuration is the sum of the Startup Costs for each unit within that configuration as follows: |  |  |  | 2.87 |
| Combustion turbine < 90 MW | 2,070.00 | 2,070.00 | 2,070.00 |  |
| Combustion turbine ≥ 90 MW | 4,500.00 | 4,500.00 | 4,500.00 |  |
| Steam turbine | 2,700.00 | 2,025.00 | 1,125.00 |  |
| Gas-steam non-reheat boiler | 2,079.00 | 1,559.25 | 779.63 | 6.37 |
| Gas-steam reheat boiler | 2,700.00 | 2,025.00 | 1,012.50 | 6.37 |
| Gas-steam supercritical boiler | 4,320.00 | 3,240.00 | 1,620.00 | 6.37 |
| Nuclear, coal, lignite and hydro | 6,480.00 | 4,860.00 | 2,430.00 | 4.52 |
| Renewable | Not Applicable | Not Applicable | Not Applicable | 4.95 |

(c) Beginning January 1, 2013 and going forward, standard O&M costs shall be reduced by 20% from the levels specified in the table in paragraph (a) above as follows:

| **Resource Category** | **Cold Startup ($/start)** | **Intermediate Startup ($/start)** | **Hot Startup ($/start)** | **Variable O&M ($/MWh)** |
| --- | --- | --- | --- | --- |
| **Start Year = 2009** |
| Aeroderivative simple cycle commissioned after 1996 | 800.00 | 800.00 | 800.00 | 3.15 |
| Reciprocating Engine | $46.40/MW \* the average of the Seasonal net max sustainable ratings | $46.40 /MW \* the average of the Seasonal net max sustainable ratings | $46.40 /MW \* the average of the Seasonal net max sustainable ratings | 4.07 |
| Simple cycle ≤ 90 MW | 1,840.00 | 1,840.00 | 1,840.00 | 3.15 |
| Simple cycle ≥ 90 MW | 4,000.00 | 4,000.00 | 4,000.00 | 3.15 |
| Combined cycle: for each Combined-Cycle Configuration, the Startup Cost for that configuration is the sum of the Startup Costs for each unit within that configuration as follows: |  |  |  | 2.55 |
| Combustion turbine < 90 MW | 1,840.00 | 1,840.00 | 1,840.00 |  |
| Combustion turbine ≥ 90 MW | 4,000.00 | 4,000.00 | 4,000.00 |  |
| Steam turbine | 2,400.00 | 1,800.00 | 1,000.00 |  |
| Gas-steam non-reheat boiler | 1,848.00 | 1,386.00 | 693.00 | 5.66 |
| Gas-steam reheat boiler | 2,400.00 | 1,800.00 | 900.00 | 5.66 |
| Gas-steam supercritical boiler | 3,840.00 | 2,880.00 | 1,440.00 | 5.66 |
| Nuclear, coal, lignite and hydro | 5,760.00 | 4,320.00 | 2,160.00 | 4.02 |
| Renewable | Not Applicable | Not Applicable | Not Applicable | 4.40 |

(d) If the QSE or Resource Entity chooses to utilize the standard O&M costs for O&M, standard O&M costs will be used by ERCOT going forward until either:

(i) Verifiable variable O&M costs are filed; or

(ii) ERCOT notifies the QSE or Resource Entity to update its verifiable costs as set forth in either paragraph (9) or (10) below. If a Resource is receiving standard O&M costs, it may reelect standard O&M costs when resubmitting verifiable costs.

(7) When submitting verifiable costs for combined cycle Resources, the QSE or Resource Entity must elect standard O&M costs for all Combined-Cycle Configurations or verifiable costs for all Combined-Cycle Configurations within the combined cycle train.

(8) QSEs submitting PPAs as Resource-specific verifiable costs documentation are subject to the guidelines detailed below and in the Verifiable Cost Manual.

(a) Only QSEs offering Three-Part Supply Offers for a specific Resource may submit a PPA as verifiable costs documentation.

(b) A QSE submitting a PPA as verifiable costs documentation must represent 100% of the Resource’s capacity.

(c) Only PPAs:

(i) Signed prior to July 16, 2008; and

(ii) Not between Affiliates, subsidiaries or partners will be accepted as verifiable cost documentation.

(d) Verifiable costs for PPAs shall be capped at the level of the highest comparable Resource (referred to as the reference Resource) specific verifiable costs approved by ERCOT without a PPA. The ERCOT approved verifiable costs for a PPA shall be equal to the lesser of:

(i) The cap as described in paragraph (d) above; and

(ii) The costs from the PPA.

(e) ERCOT shall use the Resource actual fuel costs submitted by the QSE for startup and operation at minimum-energy level (LSL), and shall use the Resource Category Startup Offer Generic Costs as the cap for the O&M portion of the Startup Costs until ERCOT receives and approves comparable Resource specific verifiable costs.

(f) PPAs will no longer be accepted as verifiable cost documentation after the primary term of the contract expires.

(g) ERCOT shall produce a report each April that provides the percentage of RUC Make-Whole Payments for Resources with PPAs during the 12 months of the previous calendar year. If there are no Make-Whole Payments for Resources with PPAs, ERCOT shall not produce the annual report. The report shall be based on the final Settlements and include the total number of Resources that used a PPA for their most recent verifiable cost submission that was approved by ERCOT. ERCOT shall present the results of this study to the appropriate Technical Advisory Committee (TAC) subcommittee.

(h) Notwithstanding anything to the contrary in this Section 5.6.1, QSEs representing PPAs may, at any time, submit data from a Resource as verifiable costs documentation and such documentation will be accepted for consideration by ERCOT. A QSE submitting verifiable costs documentation pursuant to this paragraph shall not be required to submit a PPA to ERCOT for consideration for verifiable cost recovery.

(9) ERCOT shall notify a QSE to update verifiable cost data of a Resource when the Resource has received more than 50 RUC instructions meeting the criteria in Section 5.6.2, RUC Startup Cost Eligibility, in a year, but ERCOT may not request an update more frequently than annually.

(10) ERCOT shall notify a QSE to update verifiable cost data of a Resource if at least five years have passed since ERCOT previously approved verifiable cost data for that Resource.

(11) Within 30 days after receiving an update Notice from ERCOT under either paragraph (9) or (10) above, a QSE or Resource Entity must submit verifiable cost data for the Resource. Despite the provisions in paragraph (2) above, if the QSE or Resource Entity does not submit verifiable cost data within 30 days after receiving an update Notice, then ERCOT shall determine payment using the Resource Category Startup Offer Generic Cap, Resource Category Minimum-Energy Offer Generic Cap, and a zeroed value for variable O&M cost as described in Section 4.4.9.4.1, Mitigated Offer Cap, in accordance with the schedule established in this section until updated verifiable costs are approved. If the 30-day deadline has been reached before the start of the tenth day before the end of the month, the Resource’s verifiable costs will revert back to generic costs beginning on the first day of the following month. If the 30-day deadline falls within the last ten days of the month, the Resource’s verifiable costs will revert back to generic costs on the first day of the second month following the deadline month.

(12) Notwithstanding the foregoing, QSEs and Resource Entities shall not submit verifiable costs for Energy Storage Resources (ESRs).

5.6.1.1 Verifiable Startup Costs

(1) The unit-specific verifiable costs for starting a Resource for each cold, intermediate, and hot start condition, as determined using the data submitted under Section 5.6.1, Verifiable Costs, and the Resource Parameters for the Resource are:

(a) Actual fuel consumption rate per start (MMBtu/start) multiplied by a resource fuel price plus consideration of a fuel adder that compensates for the transportation and purchasing of spot fuel as described in the Verifiable Cost Manual; and

(b) Unit-specific verifiable or standard O&M expenses.

5.6.1.2 Verifiable Minimum-Energy Costs

(1) The unit-specific verifiable minimum-energy costs for a Resource are:

(a) Actual fuel cost to operate the unit at its LSL including a fuel adder that compensates for the transportation and purchasing of spot fuel as described in the Verifiable Cost Manual; plus

(b) Verifiable or standard variable O&M expenses.

(2) The QSE must submit the Resource’s cost information by Season if the Resource’s costs vary by Season. For gas-fired units, the actual fuel costs must be calculated using the actual Seasonal heat rate (which must be supplied to ERCOT with Seasonal heat-rate test data) multiplied by the fuel price plus consideration of a fuel adder that compensates for the transportation and purchasing of spot fuel as described in the Verifiable Cost Manual. For coal- and lignite-fired units, the actual fuel costs must be calculated using the actual Seasonal heat rate multiplied by a deemed fuel price of $1.50 per MMBtu. For fuel oil-fired operations, the number of gallons burned must be multiplied by the FOP.

***5.6.2 RUC Startup Cost Eligibility***

(1) For purposes of this Section 5.6.2, all contiguous RUC-Committed Hours are considered as one RUC instruction. For each Resource, only one Startup Cost is eligible per block of contiguous RUC-Committed Hours.

(2) For a Resource’s Startup Costs in the Operating Day, per RUC instruction, to be included in the calculation of the RUC guarantee for that Operating Day, all the criteria below must be met:

(a) According to the RUC Snapshot for the RUC process that committed the Resource, the Resource must not be QSE-committed in the Settlement Interval immediately before the designated start hour or after the last hour of the RUC instruction;

(b) A later RUC instruction or QSE commitment must not connect the designated start hour or last hour of the RUC instruction to a block of QSE-committed Intervals that was QSE-committed before the RUC instruction was given, according to the RUC Snapshot for the RUC process that committed the Resource;

(c) The generation breakers must have been open, as indicated by a telemetered Resource Status of Off-Line, for at least five minutes during the six hours preceding the first RUC-Committed Hour; and

(d) The generation breakers must have been closed, as indicated by a telemetered Resource Status of On-Line, for at least one minute during the RUC commitment period or after the determined five-minute open breaker, as indicated by a telemetered Resource Status of Off-Line, in the six hours preceding the first RUC-Committed Hour.

(3) Notwithstanding paragraphs (2)(c) and (2)(d) above, the QSE of a RUC-committed Resource may submit a Settlement dispute for a Resource’s Startup Costs in the Operating Day, per RUC instruction, to be included in the calculation of the RUC guarantee for that Operating Day if the startup time for the RUC-committed Resource is greater than six hours. The dispute is subject to verification and approval by ERCOT based on the criteria below:

(a) The generation breakers must have been open, as indicated by a telemetered Resource Status of Off-Line, for at least five minutes between the time the QSE is notified of the RUC instruction and the first RUC-Committed Hour;

(b) The generation breakers must have been closed, as indicated by a telemetered Resource Status of On-Line, for at least one minute during the RUC commitment period or after the five-minute open breaker determined in item (a) above;

(c) The breaker open-close sequence from items (a) and (b) above does not make the Resource eligible for Startup Cost compensation in the Day-Ahead Market (DAM) or for any other contiguous block of RUC-Committed Hours; and

(d) The startup time used to process the dispute will be the startup time considered by the ERCOT Operator at the time the RUC instruction was issued.

(4) For purposes of this Section 5.6.2, the telemetered Resource Status of OFFQS shall be considered as Off-Line.

(5) A Resource that has a Three-Part Supply Offer cleared in the DAM and subsequently receives a RUC commitment for the Operating Hour for which it was awarded will be settled in accordance with Section 4.6.2.3, Day-Ahead Make-Whole Settlements.

***5.6.3 Forced Outage of a RUC-Committed Resource***

(1) The calculation of a Make-Whole Payment for a RUC-committed Resource that is eligible to receive startup costs under Section 5.6.2, RUC Startup Cost Eligibility, and that experiences a Forced Outage after unit synchronization is governed by Section 5.6.2.

(2) If a RUC-committed Resource, which Resource is eligible to include startup costs in its RUC guarantee under Section 5.6.2 without considering the criteria in item (2)(d) of Section 5.6.2, experiences startup failure that creates a Forced Outage before breaker close, ERCOT shall include the Resource’s submitted and approved verifiable actual costs in the Resource’s RUC guarantee, limited to the lesser of:

(a) Costs that qualify as normal startup expenses, including fuel and operation and maintenance expenses, incurred before the event that caused the Forced Outage; or

(b) Resource’s Startup Offer in the RUC.

(3) The process for determining the verifiable actual costs for a startup attempt under item (2) above is described in the Verifiable Cost Manual.

(4) The verifiable actual costs for a startup attempt under item (2) above shall only be included in the Resource’s RUC guarantee upon QSE notification of the startup attempt under item (2) and approval of the verifiable actual costs under item (3) above.

***5.6.4 Cancellation of a RUC Commitment***

(1) The calculation of payment for a RUC-committed Resource that is issued a RUC Cancellation instruction for the RUC commitment from ERCOT prior to breaker close shall be paid through the RUC Decommitment Payment as described in Section 5.7.3, Payment When ERCOT Decommits a QSE-Committed Resource.

(2) A RUC-committed Resource that receives a RUC Cancellation instruction prior to breaker close may submit through the dispute process all incremental expenses associated with the RUC Cancellation of the RUC-committed Resource. These costs include all costs that qualify as normal Startup Costs, O&M expenses and associated fuel expenses incurred for any attempted start.

(3) The process for determining the verifiable actual costs for a RUC cancellation is described in the Verifiable Cost Manual.

***5.6.5 Settlement for Canceled or Delayed Outages for Outage Schedule Adjustments (OSAs)***

5.6.5.1 Make-Whole Payment for Canceled or Delayed Outages for OSAs

(1) If ERCOT issues an Outage Schedule Adjustment (OSA) pursuant to Section 3.1.4.6, Outage Coordination of Potential Transmission Emergency Conditions, or Section 3.1.6.9, Withdrawal of Approval and Rescheduling of Approved Planned Outages of Resource Facilities, ERCOT shall pay the QSE representing the Resource a Make-Whole Payment as calculated in Section 5.6.5.2, RUC Make-Whole Payment and RUC Clawback Charge for Resources Receiving OSAs, if the QSE has:

(a) Submitted a Settlement and billing dispute consistent with the dispute process described in Section 9.14, Settlement and Billing Dispute Process; and

(b) Submitted the following within 60 days of the issuance of a Real-Time Market (RTM) Initial Statement for an Operating Day on which one or more OSAs was in effect for the Resource:

(i) An attestation signed by an officer or executive with authority to bind the QSE stating that the information contained in the submission is accurate;

(ii) The dollar amount and calculation of the net financial loss, if applicable, by Settlement Interval for:

(A) Actual and indirect costs incurred due to delaying or canceling and rescheduling the Outage. Such costs include, but are not limited to:

(1) Additional staff or contractor time;

(2) Costs associated with re-planning the Outage;

(3) Costs of equipment rental (including but not limited to cranes, manlifts, welding machines, etc.);

(4) Costs of facility rentals and other incidental incremental costs incurred by the Resource, its QSE, or its fuel supplier (e.g. mine-related expenses) created by the cancellation or delay of the Outage; and

(5) Indirect costs necessary for moving any additional Outages due to the OSA.

(B) Costs covered by paragraph (A) above do not include:

(1) The cost of materials due to be installed during the Outage. Such equipment will presumably be installed at a later date in a rescheduled or delayed Outage; and

(2) All loss amounts associated with the Outage Resource as a result of any financial transaction, including selling or repurchasing a hedge (whether the hedge is for energy, Ancillary Services, or fuel); and

(iii) Sufficient documentation to support the QSE’s calculation of all submitted costs.

5.6.5.2 RUC Make-Whole Payment and RUC Clawback Charge for Resources Receiving OSAs

(1) To compensate QSEs representing Resources that submitted a timely Settlement and billing dispute, ERCOT shall calculate a RUC Guarantee for an Operating Day for the OSA Period to be used in the RUC Settlements process and allocated to each instructed Operating Hour as follows:

(a) For a Resource with RUC instructions issued for hours during the OSA Period, the RUC Guarantee calculated for the RUC-Committed Hours shall include the following:

(i) Eligible Startup costs per Section 5.6.2, RUC Startup Cost Eligibility;

(ii) Minimum-energy costs;

(iii) 10% of both Startup costs and minimum-energy costs; and

(iv) Approved net financial loss as defined in Section 5.6.5.1, Make-Whole Payment for Canceled or Delayed Outages for OSAs.

(b) For a Resource without RUC Instructions issued for hours during the OSA Period, ERCOT shall create RUC instructions for all hours of the OSA Period for Settlement purposes only. The created RUC instructions will be assigned to the first RUC process of each Operating Day. The RUC Guarantee shall include only the following:

(i) Approved net financial loss as defined in Section 5.6.5.1.

(c) For a Resource that rescheduled an Outage within 120 days of the end of the OSA Period under paragraph (4) of Section 3.1.6.9, Withdrawal of Approval and Rescheduling of Approved Planned Outages of Resource Facilities, the RUC Guarantee determined in paragraphs (a) and (b) above must include an OSA Make-Whole Cost (OSAMW), calculated for the same corresponding OSA Period hours, when the Outage is rescheduled due to the OSA, starting with the first day of the rescheduled Outage period. The OSAMW calculated for the rescheduled Outage hours shall be allocated to the corresponding RUC instructed hours, in paragraphs (a) or (b) above, on a day-by-day basis. The OSAMW shall be calculated as follows:

OSAMW *q, r, d* = (Max (0, (RTSPP – MOC *q, r, h*)) \* HSL *q, r, h* \* (¼))

The above variables are defined as follows:

| **Variable** | **Unit** | **Definition** | |
| --- | --- | --- | --- |
| OSAMW *q, r, d* | $ | OSA Make-Whole Cost—The OSA Make-Whole cost for Resource *r* represented by QSE *q* during the eligible rescheduled Outage Hours, for the Operating Day *d*. When one or more Combined Cycle Generation Resources receive an OSA, the Make-Whole cost is calculated for the Combined Cycle Train for the OSA Period. | |
| RTSPP | $/MWh | Real-Time Settlement Point Price—The Real-Time Settlement Point Price at the Settlement Point for the 15-minute Settlement Interval of an eligible rescheduled Outage Hour. | |
| MOC *q, r, h* | $/MWh | Mitigated Offer Cap per Resource—The MOC for Resource *r* represented by QSE *q*, for the eligible rescheduled Outage hour *h* at the High Sustained Limit (HSL) as submitted in the COP. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. | |
| HSL *q, r, i* | MW | High Sustained Limit—The HSL of a Generation Resource *r* represented by QSE *q* as submitted in the COP, for the hour that includes the Settlement Interval *i*. Where for a combined cycle Resource, *r* is a Combined Cycle Generation Resource. | |
| *q* | none | A QSE. |
| *r* | none | A Generation Resource. |
| *d* | none | The Operating Day. |
| *h* | none | The Operating Hour. |
| *i* | none | A 15-minute Settlement Interval within the hour. |

(2) Notwithstanding the clawback provisions described in Section 5.7.2, RUC Clawback Charge, the clawback percentage shall be set at 100%.

5.6.5.3 Timeline for Calculating RUC Clawback Charges for Resources Receiving OSAs

(1) Within ten Business Days after the issuance of the RTM True-Up Statement, ERCOT will issue a Miscellaneous Invoice to charge the QSE representing the Resource that has received an OSA the excess revenues not clawed back in RUC Settlements.

(2) All clawed back revenues will be paid to QSEs based on a 15-minute Load-Ratio Share basis.

5.7 Settlement for RUC Process

***5.7.1 RUC Make-Whole Payment***

(1) To make up the difference when the revenues that a Reliability Unit Commitment (RUC)-committed Resource receives are less than its costs as described in paragraph (2) below, ERCOT shall calculate a RUC Make-Whole Payment for that Operating Day for that Resource (whether committed by Day-Ahead RUC (DRUC) or Hourly RUC (HRUC)). ERCOT shall not calculate or pay a RUC Make-Whole Payment for an Energy Storage Resource (ESR).

(2) ERCOT shall pay to the Qualified Scheduling Entity (QSE) for the Resource a Make-Whole Payment if the RUC Guarantee calculated in Section 5.7.1.1, RUC Guarantee, is greater than the sum of:

(a) RUC Minimum-Energy Revenue calculated in Section 5.7.1.2, RUC Minimum-Energy Revenue;

(b) Revenue less cost above Low Sustained Limited (LSL) during RUC-Committed Hours calculated in Section 5.7.1.3, Revenue Less Cost Above LSL During RUC-Committed Hours; and

(c) Revenue less cost during QSE Clawback Intervals calculated in Section 5.7.1.4, Revenue Less Cost During QSE Clawback Intervals.

(3) The RUC Make-Whole Payment to the QSE for each RUC-committed Resource, including Reliability Must-Run (RMR) Units, for each RUC-Committed Hour in an Operating Day is calculated as follows:

RUCMWAMT*q,r,h* = (-1) \* Max (0, RUCG*q,r,d* – RUCMEREV*q,r,d* – RUCEXRR*q,r,d* – RUCEXRQC*q,r,d*) / RUCHR*q,r,d*

The above variables are defined as follows:

| Variable | Unit | Definition |
| --- | --- | --- |
| RUCMWAMT*q,r,h* | $ | *RUC Make-Whole Payment*—The RUC Make-Whole Payment to the QSE for Resource *r*, for each RUC-Committed Hour of the Operating Day. When one or more Combined Cycle Generation Resources are committed by RUC, payment is made to the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| RUCG*q,r,d* | $ | *RUC Guarantee*—The sum of eligible Startup Costs and minimum-energy costs for Resource *r* during all RUC-Committed Hours, for the Operating Day. See Section 5.7.1.1. When one or more Combined Cycle Generation Resources are committed by RUC, guaranteed costs are calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| RUCMEREV*q,r,d* | $ | *RUC Minimum-Energy Revenue*—The sum of the energy revenues for Resource *r*’s generation up to LSL during all RUC-Committed Hours, for the Operating Day. See Section 5.7.1.2. When one or more Combined Cycle Generation Resources are committed by RUC, minimum-energy revenue is calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| RUCEXRR*q,r,d* | $ | *Revenue Less Cost Above LSL During RUC-Committed Hours*—The sum of the total revenue for Resource *r* operating above its LSL less the cost during all RUC-Committed Hours, for the Operating Day. See Section 5.7.1.3. When one or more Combined Cycle Generation Resources are committed by RUC, revenue less cost above LSL is calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| RUCEXRQC*q,r,d* | $ | *Revenue Less Cost During QSE Clawback Intervals*—The sum of the total revenue for Resource *r* less the cost during all QSE Clawback Intervals, for the Operating Day. See Section 5.7.1.4. When one or more Combined Cycle Generation Resources are committed by RUC, revenue less cost during QSE Clawback Intervals is calculated for the Combined Cycle Train for all Combined Cycle Generation Resources earning revenue in QSE Clawback Intervals. |
| RUCHR*q,r,d* | None | RUC Hour—The total number of RUC-Committed Hours, for Resource *r* for the Operating Day. When one or more Combined Cycle Generation Resources are committed by RUC, the total number of RUC-Committed Hours is calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| *q* | None | A QSE. |
| *r* | None | A RUC-committed Generation Resource. |
| *d* | None | An Operating Day containing the RUC-commitment. |
| *h* | None | An hour in the RUC-commitment period. |

5.7.1.1 RUC Guarantee

(1) The allowable Startup Costs and minimum-energy costs of a Resource committed by RUC is the RUC Guarantee. The RUC Guarantee minimum-energy costs are prorated according to the actual generation when the Resource’s average output during a 15-minute Settlement Interval is below the corresponding LSL.

(2) The SUPR, MEPR and LSL used to calculate the RUC Guarantee for a Combined Cycle Train are the SUPR, MEPR and LSL that correspond to the Combined Cycle Generation Resource, within the Combined Cycle Train, that is RUC-committed for the hour. If the RUC-Committed Interval is a RUC for Additional Capacity (RUCAC)-Interval, then the SUPR, MEPR, and LSL that corresponds to the QSE-committed Combined Cycle Generation Resource is also used to calculate RUC Guarantee for a Combined Cycle Train.

(3) For an Aggregate Generation Resource (AGR), the Startup Cost shall be scaled according to the maximum number of its generators online during a contiguous block of RUC-committed intervals, as indicated by telemetry, compared to the total number of generators registered to the AGR and used in the approved verifiable cost for the AGR.

(4) The RUC Guarantee is calculated for non-Combined Cycle Trains as follows:

RUCG *q, r, d* = (SUPR *q, r, s* \* RUCSUFLAG *q, r, s*) + (MEPR *q, r, i* \* Min ((LSL *q, r, i* \* (¼)), RTMG *q, r, i*))

(5) The RUC Guarantee is calculated for Combined Cycle Trains as follows:

RUCG *q, r, d* = ******(SUPR *q, r,* s \* RUCSUFLAG *q, r,* s) +

******(MAX (0, SUPR - SUPR)) + (RUCGME *q, r, i*)

Where,

If a Combined Cycle Train transitions to a RUC-committed configuration from a QSE-committed or other RUC-committed configuration between two contiguous hours, or to a RUC-committed configuration from a QSE-committed configuration within the same hour due to a RUCAC, the transition is calculated as follows:

MAX (0, SUPR *afterCCGR* – SUPR *beforeCCGR*)

If a Combined Cycle Train transitions to a QSE-committed configuration from a RUC-committed configuration, the transition is calculated as follows:

MAX (0, SUPR *beforeCCGR* – SUPR *afterCCGR*)

If the interval *i* is a RUC-Committed Interval that is not a RUCAC, then:

RUCGME *q, r, i* = MEPR *q, r, i* \* Min ((LSL *q, r, i* \* (¼)), RTMG *q, r, i*)

If the interval *i* is a RUCAC of a previously QSE-Committed Interval, then:

RUCGME *q, r, i* = Max [0, MEPR *q, afterCCGR, i* \* Min ((LSL *q, afterCCGR, i* \*

(¼)), RTMG q, r, i) – MEPR q, beforeCCGR, i \* (LSL q, beforeCCGR, i \* (¼))]

(6) If a validated Three-Part Supply Offer has been submitted for a Resource for the RUC, then the RUC Guarantee for that Resource is based on the minimum of the Startup Offer in that validated Three-Part Supply Offer and Startup Cap and the lesser of the Minimum-Energy Offer in that validated Three-Part Supply Offer and the Minimum-Energy Offer Cap. If a validated Three-Part Supply Offer has not been submitted for a Resource for the RUC and ERCOT has not yet approved verifiable unit-specific costs for the Resource, then the RUC Guarantee for a Resource is based on the Resource Category Startup Generic Cap and the Resource Category Minimum-Energy Generic Cap. If a validated Three-Part Supply Offer has not been submitted for a Resource for the RUC and ERCOT has approved verifiable unit-specific costs for the Resource, then the RUC Guarantee for a Resource is based on the most recent ERCOT-approved verifiable unit-specific costs for that Resource.

**For a Resource which is not an AGR,**

If the QSE submitted a validated Three-Part Supply Offer,

Then, SUPR *q, r,* s = Min (SUO *q, r, s*, SUCAP *q, r, s*)

MEPR *q, r, i* = Min (MEO *q, r, i*, MECAP *q, r, i*)

Otherwise, SUPR *q, r, s* = SUCAP *q, r, s*

MEPR *q, r, i* = MECAP *q, r, i*

If ERCOT has approved verifiable Startup Costs and minimum-energy costs for the Resource,

Then, SUCAP *q, r, s* = verifiable Startup Costs *q, r, s*

MECAP *q, r, i* = verifiable minimum-energy costs *q, r, i*

Otherwise, SUCAP *q, r, s* = RCGSC *s*

MECAP *q, r, i* = RCGMEC *i*

**For AGRs,**

If the QSE submitted a validated Three-Part Supply Offer,

Then, SUPR *q, r,* s = Min (SUO *q, r, s*, SUCAP *q, r, s*)

MEPR *q, r, i* = Min (MEO *q, r, i*, MECAP *q, r, i*)

Otherwise, SUPR *q, r, s* = SUCAP *q, r, s*

MEPR *q, r, i* = MECAP *q, r, i*

If ERCOT has approved verifiable Startup Costs and minimum-energy costs for the Resource,

Then, SUCAP *q, r, s* = Max c (AGRRATIO *q, p, r*) \* verifiable Startup Costs *q, r, s*

MECAP *q, r, i* = verifiable minimum-energy costs *q, r, i*

Where, AGRRATIO *q, p, r* = AGRMAXON *q, p, r* / AGRTOT *q, p, r*

Otherwise, SUCAP *q, r, s* = Max c (AGRRATIO *q, p, r*) \* RCGSC *s*

MECAP *q, r, i* = RCGMEC *i*

The above variables are defined as follows:

| Variable | Unit | Definition |
| --- | --- | --- |
| RUCG *q, r, d* | $ | *RUC Guarantee*—The sum of eligible Startup Costs and minimum-energy costs for Resource *r* represented by QSE *q* during all RUC-Committed Hours, for the Operating Day *d*. When one or more Combined Cycle Generation Resources are committed by RUC, guaranteed costs are calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| RUCGME *q, r, i* | $ | *RUC Minimum-Energy Guarantee by interval*—The guaranteed costs for Resource *r* represented by QSE *q* for minimum energy for the Settlement Interval *i*. When one or more Combined Cycle Generation Resources are committed by RUC, RUC Minimum-Energy Guarantee is calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. During RUCAC-Intervals for a Combined Cycle Train, minimum energy cost is calculated as the difference between the minimum energy cost between the RUC-committed configuration and the QSE-committed configuration. |
| SUPR *q, r, s* | $/Start | *Startup Price per start*—The Settlement price for Resource *r* represented by QSE *q* for the start *s*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| SUO *q, r, s* | $/Start | *Startup Offer per start*—Represents an offer for all costs incurred by Generation Resource *r* represented by QSE *q* in starting up and reaching the Resource’s LSL for the start *s*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| SUCAP *q, r, s* | $/Start | *Startup Cap*—The amount used for AGR *r* or Resource *r* represented by QSE *q* for the start *s* as Startup Costs. The cap is the Resource Category Startup Offer Generic Cap (RCGSC) unless ERCOT has approved verifiable unit-specific Startup Costs for that Resource, in which case the startup cap is the scaled verifiable unit-specific Startup Cost for the AGR or the verifiable unit-specific Startup Cost for non-AGRs. The verifiable unit-specific Startup Cost will be determined as described in Section 5.6.1, Verifiable Costs, minus the average energy produced during the time period between breaker close and LSL multiplied by the heat rate proxy “H” multiplied by the appropriate Fuel Index Price (FIP), Fuel Oil Price (FOP) or solid fuel price, for AGR and non-AGR Resources. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| AGRRATIO *q, p, r* | none | *Aggregate Generation Resource Ratio per QSE per Settlement Point per Aggregate Generation Resource*—A value which represents the ratio of the maximum number of generators online during an hour, as indicated by telemetry, compared to the total number of generators registered to the AGR *r* represented by QSE *q* at the Settlement Point *p* and used in the approved verifiable cost for the AGR. The value is only applicable if the Resource is an AGR. |
| AGRMAXON *q, p, r* | none | *Aggregate Generation Resource Maximum Online per QSE per Settlement Point per Aggregate Generation Resource*—The maximum number of generators registered to the AGR *r* represented by QSE *q* at the Settlement Point *p* online during an hour, as indicated by telemetry. The value is only applicable if the Resource is an AGR. |
| AGRTOT *q, p, r* | none | *Aggregate Generation Resource Total per QSE per Settlement Point per Aggregate Generation Resource*—The total number of generators registered to the AGR *r* represented by QSE *q* at the Settlement Point *p* and used in the approved verifiable cost for the AGR. The value is only applicable if the Resource is an AGR. |
| RCGSC *s* | $/Start | *Resource Category Generic Startup Cost*—The Resource Category Generic Startup Cost cap for the category of the Resource, according to Section 4.4.9.2.3, Startup Offer and Minimum-Energy Offer Generic Caps, for the Operating Day. |
| RUCSUFLAG *q, r, s* | none | *RUC Startup Flag*—The flag that indicates whether or not the start *s* for Resource *r* represented by QSE *q* is eligible for RUC Make-Whole Payment. Its value is one if eligible; otherwise, zero. See Section 5.6.2, RUC Startup Cost Eligibility, and Section 5.6.3, Forced Outage of RUC-Committed Resource, for more information on startup eligibility. For a Combined Cycle Train, the Resource *r* must be one of the registered Combined Cycle Generation Resources within the Combined Cycle Train. When one or more Combined Cycle Generation Resources are committed by RUC, the RUC Startup Flag is calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| MEPR *q, r, i* | $/MWh | *Minimum-Energy Price*—The Settlement price for Resource *r* represented by QSE *q* for minimum energy for the Settlement Interval *i*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| MEO *q, r, i* | $/MWh | *Minimum-Energy Offer*—Represents an offer for the costs incurred by Resource *r* represented by QSE *q* in producing energy at the Resource’s LSL for the Settlement Interval *i*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| MECAP *q, r, i* | $/MWh | *Minimum-Energy Cap*—The amount used for Resource *r* represented by QSE *q* for the Settlement Interval *i* for minimum-energy costs. The minimum cost is the Resource Category Minimum-Energy Generic Cap (RCGMEC) unless ERCOT has approved verifiable unit-specific minimum energy costs for that Resource, in which case the Minimum-Energy Cap is the verifiable unit-specific minimum energy cost. See Section 5.6.1 for more information on verifiable costs. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| RCGMEC *i* | $/MWh | *Resource Category Generic Minimum-Energy Cost*—The Resource Category Generic Minimum Energy Cost cap for the category of the Resource, according to Section 4.4.9.2.3, for the Operating Day. |
| RTMG *q, r, i* | MWh | *Real-Time Metered Generation*—The metered generation of Resource *r* represented by QSE *q* for the Settlement Interval *i*. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| LSL *q, r, i* | MW | *Low Sustained Limit*—The LSL of Generation Resource *r* represented by QSE *q* for the hour that includes the Settlement Interval *i*, as submitted in the Current Operating Plan (COP). Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| *q* | none | A QSE. |
| *p* | none | A Settlement Point. |
| *r* | none | A RUC-committed Generation Resource. |
| *d* | none | An Operating Day containing the RUC-commitment. |
| *i* | none | A 15-minute Settlement Interval within the hour that includes a RUC-commitment. |
| *s* | none | A start that is eligible to have its costs included in the RUC Guarantee. |
| *t* | none | A transition that is eligible to have its costs included in the RUC Guarantee. |
| *c* | none | A contiguous block of RUC–Committed Hours. |
| *afterCCGR* | none | The Combined Cycle Generation Resource to which a Combined Cycle Train transitions. |
| *beforeCCGR* | none | The Combined Cycle Generation Resource from which a Combined Cycle Train transitions. |

5.7.1.2 RUC Minimum-Energy Revenue

(1) The energy revenue for a Resource’s generation up to LSL during all RUC-Committed Hours of the Operating Day is RUC Minimum-Energy Revenue.

(2) The LSL used to calculate RUC Minimum-Energy Revenue for a Combined Cycle Train is the LSL that corresponds to the Combined Cycle Generation Resource, within the Combined Cycle Train, that is RUC-committed for the hour. If the interval is a RUCAC-Interval, then the LSL that corresponds to the QSE-committed Combined Cycle Generation Resource is also used to calculate RUC Minimum-Energy Revenue for a Combined Cycle Train.

(3) For each RUC-committed Resource, RUC Minimum-Energy Revenue is calculated as follows:

RUCMEREV*q,r,d* = (RUCMEREV96 *q, r, i*)

Where,

If the interval *i* is a RUC-Committed Interval that is not a RUCAC-Interval, then:

RUCMEREV96 *q, r, i* = RTSPP *p, i* \* Min (RTMG *q, r, i*, (LSL *q, r, i* \* (¼)))

If the interval *i* is a RUCAC of a previously QSE-Committed Interval, then:

RUCMEREV96 *q, r, i* = RTSPP *p, i* \* Max [0, Min (RTMG *q, r, i*, (LSL *q, afterCCGR, i* \* (¼))) - LSL *q, beforeCCGR, i* \* (¼)]

The above variables are defined as follows:

| Variable | Unit | Definition |
| --- | --- | --- |
| RUCMEREV *q, r, d* | $ | *RUC Minimum-Energy Revenue*—The sum of the energy revenues for generation of Resource *r* represented by QSE *q* up to LSL during all RUC-Committed Hours, for the Operating Day *d*. When one or more Combined Cycle Generation Resources are committed by RUC, RUC Minimum-Energy Revenue is calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| RUCMEREV96 *q, r, i* | $ | *RUC Minimum-Energy Revenue by interval*—The energy revenues for generation of Resource *r* represented by QSE *q* up to LSL during all RUC-Committed Hours, for the Settlement Interval *i*. When one or more Combined Cycle Generation Resources are committed by RUC, RUC Minimum-Energy Revenue is calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. During RUCAC-Intervals for a Combined Cycle Train, the minimum energy revenue is calculated as the difference between the minimum energy revenue of the RUC-committed configuration and the QSE-committed configuration. |
| RTSPP *p, i* | $/MWh | *Real-Time Settlement Point Price*—The Real-Time Settlement Point Price at the Resource Node Settlement Point *p* for the Settlement Interval *i*. |
| RTMG *q, r, i* | MWh | *Real-Time Metered Generation*—The metered generation of Resource *r* represented by QSE *q* for the Settlement Interval *i*. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| LSL *q, r, i* | MW | *Low Sustained Limit*—The LSL of Generation Resource *r* represented by QSE *q* for the hour that includes the Settlement Interval *i*, as submitted in the COP. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| *q* | none | A QSE. |
| *r* | none | A RUC-committed Generation Resource. |
| *d* | none | An Operating Day containing the RUC-commitment. |
| *p* | none | A Resource Node Settlement Point. |
| *i* | none | A 15-minute Settlement Interval within the hour that includes a RUC-commitment. |
| *afterCCGR* | none | The Combined Cycle Generation Resource that is RUC-committed. |
| *beforeCCGR* | none | The Combined Cycle Generation Resource that was QSE-committed. |

5.7.1.3 Revenue Less Cost Above LSL During RUC-Committed Hours

(1) The total revenue for a Resource operating above its LSL less the cost based on the Energy Offer Curve Cost Cap (as described in Section 4.4.9.3.3, Energy Offer Curve Cost Caps) during all RUC-Committed Hours of the Operating Day is Revenue Less Cost Above LSL During RUC-Committed Hours.

(2) The LSL used to calculate Revenue Less Cost Above LSL During RUC-Committed Hours for a Combined Cycle Train is the LSL that corresponds to the Combined Cycle Generation Resource, within the Combined Cycle Train, that is RUC-committed for the hour.

(3) For each RUC-committed Resource, Revenue Less Cost Above LSL During RUC-Committed Hours is calculated as follows:

RUCEXRR *q, r, d* = Max {0, [RUCEXRR96 *q, r, i*]}

Where,

RUCEXRR96 *q, r, i* = RTSPP *p, i* \* Max (0, RTMG *q, r, i* – (LSL *q, r, i* \* (¼)))

+ RTASREV *q, r, i*

+ (-1) \* (VSSVARAMT *q, r, i* + VSSEAMT *q, r, i*)

+ (-1) \* EMREAMT *q, r, i*

– RTEOCOST *q, r, i* \* Max (0, RTMG *q, r, i* – (LSL *q, r, i* \* (¼)))]}

Where,

**RTASREV *q, r, i =* RTRUREV *q, r, i +* RTRDREV *q, r, i +* RTRRREV *q, r, i +* RTECRREV *q, r, i +* RTNSREV *q, r, i***

|  |
| --- |
| ***[NPRR1140: Replace paragraph (3) above with the following upon system implementation:]***  (3) For each RUC-committed Resource, Revenue Less Cost Above LSL During RUC-Committed Hours is calculated as follows:  If RUCFCA exists:  RUCEXRR *q, r, d* = [RUCEXRR96 *q, r, i*]  Otherwise:  RUCEXRR *q, r, d* = Max {0, [RUCEXRR96 *q, r, i*]}  Where,  RUCEXRR96 *q, r, i* = RTSPP *p, i* \* Max (0, RTMG *q, r, i* – (LSL *q, r, i* \* (¼))) + RTASREV *q, r, i*  + (-1) \* (VSSVARAMT *q, r, i* + VSSEAMT *q, r, i*)  + (-1) \* EMREAMT *q, r, i*  – (RTEOCOST *q, r, i* + RUCFCA *q, r, i*) \* Max (0, RTMG *q, r, i* – (LSL *q, r, i* \* (¼)))  Where,  RTASREV *q, r, i =* RTRUREV *q, r, i +* RTRDREV *q, r, i +* RTRRREV *q, r, i +* RTECRREV *q, r, i +* RTNSREV *q, r, i*  And,  RUCFCA *q, r, i* = Max(0, Volume-weighted average actual fuel price *q, r, i* \* Average heat rate – RTEOCOST *q, r, i*) |

The above variables are defined as follows:

| Variable | Unit | Definition |
| --- | --- | --- |
| RUCEXRR *q, r, d* | $ | *Revenue Less Cost Above LSL During RUC-Committed Hours*—The sum of the total revenue for Resource *r* represented by QSE *q* operating above its LSL less the cost during all RUC-Committed Hours, for the Operating Day *d*. When one or more Combined Cycle Generation Resources are committed by RUC, revenue less cost above LSL is calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| RUCEXRR96 *q, r, i* | $ | *Revenue Less Cost Above LSL During RUC-Committed Hours by interval*—The total revenue for Resource *r* represented by QSE *q* operating above its LSL less the cost during all RUC-Committed hours, for the Settlement Interval *i*. When one or more Combined Cycle Generation Resources are committed by RUC, revenue less cost above LSL is calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| RTSPP *p, i* | $/MWh | *Real-Time Settlement Point Price*—The Real-Time Settlement Point Price at the Resource’s Resource Node Settlement Point *p* for the Settlement Interval *i*. |
| RTEOCOST *q, r, i* | $/MWh | *Real-Time Energy Offer Curve Cost Cap*⎯The Energy Offer Curve Cost Cap for Resource *r* represented by QSE *q*, for the Resource’s generation above the LSL for the Settlement Interval *i.*  SeeSection 4.4.9.3.3. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| RTMG *q, r, i* | MWh | *Real-Time Metered Generation*—The metered generation of Resource *r* represented by QSE *q* for the Settlement Interval *i*. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| |  |  |  |  | | --- | --- | --- | --- | | ***[NPRR1140: Insert the variable “RUCFCA q, r, i” below upon system implementation:]***   | RUCFCA *q, r, i* | $/MWh | *Reliability Unit Commitment Fuel Cost Adder*—For a QSE that has been granted a fuel dispute per Section 9.14.7, Disputes for RUC Make-Whole Payment for Fuel Costs, the fuel cost adder is calculated as the volume-weighted average actual fuel price times the output-level average heat rate for Resource *r* represented by QSE *q*, for the Resource’s generation above LSL, for the Settlement Interval *i*, minus the RTEOCOST.When one or more Combined Cycle Generation Resources are committed by RUC, RUCFCA is calculated for the Combined Cycle Train for all RUC-Committed Combined Cycle Generation Resources.  The average heat rate for the Resource is the Average Heat Rate at the output level at Settlement Interval *i*, resulting from the input-output coefficients submitted with verifiable costs, if available, otherwise the heat rate value defined in Section 4.4.9.3.3.  The volume-weighted average actual fuel price must be proven by the QSE by submitting a dispute per Section 9.14.7. | | --- | --- | --- | | | | |
| LSL *q, r, i* | MW | *Low Sustained Limit*—The LSL of Generation Resource *r* represented by QSE *q* for the hour that includes the Settlement Interval *i*, as submitted in the COP. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| RTASREV *q, r, i* | $ | *Real-Time Ancillary Service Revenue*—The total Real-Time Ancillary Service revenue for QSE *q* calculated for Resource *r* for the 15-minute Settlement Interval *i*. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| RTRUREV *q, r, i* | $ | *Real-Time Reg-Up Revenue*—The Real-Time Reg-Up revenue for QSE *q* calculated for Resource *r* for the 15-minute Settlement Interval *i*. See Section 6.7.2, Real-Time Ancillary Service Imbalance Payment or Charge. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| RTRDREV *q, r, i* | $ | *Real-Time Reg-Down Revenue*—The Real-Time Reg-Down revenue for QSE *q* calculated for Resource *r* for the 15-minute Settlement Interval *i*. See Section 6.7.2. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| RTRRREV *q, r, i* | $ | *Real-Time Responsive Reserve Revenue*—The Real-Time RRS revenue for QSE *q* calculated for Resource *r* for the 15-minute Settlement Interval *i*. See Section 6.7.2. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| RTNSREV *q, r, i* | $ | *Real-Time Non-Spin Revenue*—The Real-Time Non-Spin revenue for QSE *q* calculated for Resource *r* for the 15-minute Settlement Interval *i*. See Section 6.7.2. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| RTECRREV *q, r, i* | $ | *Real-Time ERCOT Contingency Reserve Service Revenue*—The Real-Time ECRS revenue for QSE *q* calculated for Resource *r* for the 15-minute Settlement Interval *i*. See Section 6.7.2. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| VSSVARAMT *q, r, i* | $ | *Voltage Support Service VAr Amount—*The payment to the QSE q for the Voltage Support Service (VSS) provided by Generation Resource r for the 15-minute Settlement Interval i. See Section 6.6.7.1, Voltage Support Service Payments. Payment for VSS is made to the Combined Cycle Train. |
| VSSEAMT *q, r, i* | $ | *Voltage Support Service Energy Amount—*The lost opportunity payment to the QSE q for ERCOT-directed VSS from the Generation Resource r for the 15-minute Settlement Interval *i*. See Section 6.6.7.1. Payment for emergency energy is made to the Combined Cycle Train. |
| EMREAMT *q, r, i* | $ | *Emergency Energy Amount—*The payment to the QSE q as additional compensation for the additional energy or Ancillary Services produced or consumed by the Resource r in Real-Time during the Emergency Condition, for the 15-minute Settlement Interval *i*. See Section 6.6.9.1, Payment for Emergency Operations Settlement. Payment for emergency energy is made to the Combined Cycle Train. |
| *q* | none | A QSE. |
| *r* | none | A RUC-committed Generation Resource. |
| *d* | none | An Operating Day containing the RUC-commitment. |
| *p* | none | A Resource Node Settlement Point. |
| *i* | none | A 15-minute Settlement Interval within the hour that includes a RUC instruction. |

5.7.1.4 Revenue Less Cost During QSE Clawback Intervals

(1) The total revenue for a Resource less the cost based on the Energy Offer Curve Cost Cap as described in Section 4.4.9.3.3, Energy Offer Curve Cost Caps, during all QSE Clawback Intervals of the Operating Day is Revenue Less Cost During QSE-Clawback Intervals.

(2) The MEPR and LSL used to calculate Revenue Less Cost During QSE Clawback Intervals for a Combined Cycle Train is the MEPR and LSL that corresponds to the Combined Cycle Generation Resource, within a Combined Cycle Train, that operates in Real-Time for the QSE Clawback Interval.

(3) For each QSE Clawback Interval, Revenue Less Cost During QSE Clawback Intervals is calculated as follows:

RUCEXRQC *q, r, d* = Max {0, [(RTSPP *p, i* \* RTMG *q, r, i*)

+ RTASREV*q, r, i*

+ (-1) \* (VSSVARAMT *q, r, i* + VSSEAMT *q, r, i*)

+ (-1) \* EMREAMT *q, r, i*

– [MEPR *q, r, i* \* Min (RTMG *q, r, i*, (LSL *q, r, i* \* (¼)))]

– [RTEOCOST *q, r, i* \* Max (0, RTMG *q, r, i* – (LSL *q, r, i* \* (¼)))]]}

If the QSE submitted a validated Three-Part Supply Offer for the Resource,

Then, MEPR *q, r, i* = Min (MEO *q, r, i*, MECAP *q, r, i*)

Otherwise, MEPR *q, r, i* = MECAP *q, r, i*

If ERCOT has approved verifiable minimum-energy costs for the Resource,

Then, MECAP *q, r, i* = verifiable minimum-energy costs *q, r, i*

Otherwise, MECAP *q, r, i* = RCGMEC *i*

Where,

RTASREV *q, r, i =* RTRUREV *q, r, i +* RTRDREV *q, r, i +* RTRRREV *q, r, i +* RTECRREV *q, r, i +* RTNSREV *q, r, i*

The above variables are defined as follows:

| Variable | Unit | Definition |
| --- | --- | --- |
| RUCEXRQC *q, r, d* | $ | *Revenue Less Cost During QSE-Clawback Intervals*—The sum of the total revenue for Resource *r* less the cost during all QSE-Clawback Intervals for the Operating Day. When one or more Combined Cycle Generation Resources are committed by RUC, Revenue Less Cost During QSE-Clawback Intervals is calculated for the Combined Cycle Train for all Combined Cycle Generation Resources earning revenue in QSE-Clawback Intervals. |
| RTSPP *p, i* | $/MWh | *Real-Time Settlement Point Price*—The Real-Time Settlement Point Price at the Resource’s Settlement Point for the Settlement Interval *i*. |
| MEPR *q, r, i* | $/MWh | *Minimum-Energy Price*—The Settlement price for Resource *r* for minimum energy for the Settlement Interval *i*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| MEO *q, r, i* | $/MWh | *Minimum-Energy Offer*—Represents an offer for the costs incurred by Resource *r* in producing energy at the Resource’s LSL for the Settlement Interval *i*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| MECAP *q, r, i* | $/MWh | *Minimum-Energy Cap*—The amount used for Resource *r* for minimum-energy costs. The minimum cost is the Resource Category Minimum-Energy Generic Cap (RCGMEC) unless ERCOT has approved verifiable unit-specific minimum energy costs for that Resource, in which case the Minimum-Energy Cap is the verifiable unit-specific minimum energy cost. See Section 5.6.1, Verifiable Costs, for more information on verifiable costs. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| RCGMEC *i* | $/MWh | *Resource Category Generic Minimum-Energy Cost*—The Resource Category Generic Minimum-Energy Cost cap for the category of the Resource, according to Section 4.4.9.2.3, Startup Offer and Minimum-Energy Offer Generic Caps, for the Operating Day. |
| RTEOCOST *q, r, i* | $/MWh | *Real-Time Energy Offer Curve Cost Cap*⎯The Energy Offer Curve Cost Cap for Resource *r* represented by QSE *q*, for the Resource’s generation above the LSL for the Settlement Interval *i.*  SeeSection 4.4.9.3.3. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| RTMG *q, r, i* | MWh | *Real-Time Metered Generation*—The Resource *r*’s metered generation for the Settlement Interval *i*. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| LSL *q, r, i* | MW | *Low Sustained Limit*—The LSL of Generation Resource *r* represented by QSE *q* for the hour that includes the Settlement Interval *i*, as submitted in the COP. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| RTASREV *q, r, i* | $ | *Real-Time Ancillary Service Revenue*—The total Real-Time Ancillary Service revenue for QSE *q* calculated for Resource *r* for the 15-minute Settlement Interval *i*. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| RTRUREV *q, r, i* | $ | *Real-Time Reg-Up Revenue*—The Real-Time Reg-Up revenue for QSE *q* calculated for Resource *r* for the 15-minute Settlement Interval *i*. See Section 6.7.2, Real-Time Ancillary Service Imbalance Payment or Charge. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| RTRDREV *q, r, i* | $ | *Real-Time Reg-Down Revenue*—The Real-Time Reg-Down revenue for QSE *q* calculated for Resource *r* for the 15-minute Settlement Interval *i*. See Section 6.7.2. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| RTRRREV *q, r, i* | $ | *Real-Time Responsive Reserve Revenue*—The Real-Time RRS revenue for QSE *q* calculated for Resource *r* for the 15-minute Settlement Interval *i*. See Section 6.7.2. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| RTNSREV *q, r, i* | $ | *Real-Time Non-Spin Revenue*—The Real-Time Non-Spin revenue for QSE *q* calculated for Resource *r* for the 15-minute Settlement Interval *i*. See Section 6.7.2. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| RTECRREV *q, r, i* | $ | *Real-Time ERCOT Contingency Reserve Service Revenue*—The Real-Time ECRS revenue for QSE *q* calculated for Resource *r* for the 15-minute Settlement Interval *i*. See Section 6.7.2. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train. |
| VSSVARAMT *q, r, i* | $ | *Voltage Support Service VAr Amount—*The payment to the QSE for the VSS provided by Generation Resource r for the 15-minute Settlement Interval *i*. See Section 6.6.7.1, Voltage Support Service Payments. Payment for VSS is made to the Combined Cycle Train. |
| VSSEAMT *q, r, i* | $ | *Voltage Support Service Energy Amount—*The lost opportunity payment to the QSE for ERCOT-directed VSS from the Generation Resource r for the 15-minute Settlement Interval *i*. See Section 6.6.7.1. Payment for VSS is made to the Combined Cycle Train. |
| EMREAMT *q, r, i* | $ | *Emergency Energy Amount—*The payment to the QSE as additional compensation for the additional energy or Ancillary Services produced or consumed by the Resource *r* in Real-Time during the Emergency Condition, for the 15-minute Settlement Interval *i*. See Section 6.6.9.1, Payment for Emergency Operations Settlement. Payment for emergency energy is made to the Combined Cycle Train. |
| *q* | none | A QSE. |
| *r* | none | A RUC-committed Generation Resource. |
| *d* | none | An Operating Day containing the RUC-commitment. |
| *p* | none | A Resource Node Settlement Point. |
| *i* | none | A 15-minute Settlement Interval within the hour that is identified as a QSE-Clawback Interval. |

***5.7.2 RUC Clawback Charge***

(1) A QSE for a Resource shall pay a RUC Clawback Charge for the Operating Day if the RUC Guarantee is less than the sum of:

(a) RUC Minimum-Energy Revenue calculated in Section 5.7.1.2, RUC Minimum-Energy Revenue;

(b) Revenue Less Cost Above LSL During RUC-Committed Hours calculated in Section 5.7.1.3, Revenue Less Cost Above LSL During RUC-Committed Hours; and

(c) Revenue Less Cost During QSE-Clawback Intervals calculated in Section 5.7.1.4, Revenue Less Cost During QSE Clawback Intervals.

(2) The RUC Clawback Charge for a Resource, including RMR Units, for each Operating Day is allocated evenly over the RUC-Committed Hours for that Resource.

(3) ESRs are not subject to RUC Clawback Charges.

(4) For each RUC-committed Resource, the RUC Clawback Charge for each RUC-Committed Hour of the Operating Day is calculated as follows:

RUCCBAMT *q, r, h* = Max (0, RUCMEREV *q, r, d* + RUCEXRR *q, r, d* + RUCEXRQC *q, r, d* – RUCACREV *q, r, d* – RUCG *q, r, d*) / RUCHR *q, r, d*

Where,

The RUCAC revenue is calculated for a Combined Cycle Train as follows:

RUCACREV *q, r, d* = Max{0,  RUCMEREV96 *q, r, i* + Max(0, RUCEXRR96 *q, r, i*)}

The above variables are defined as follows:

| Variable | Unit | Definition |
| --- | --- | --- |
| RUCCBAMT *q, r, h* | $ | *RUC Clawback Charge*––The RUC Clawback Charge to a QSE for Resource *r* represented by QSE *q* as described in this Section, for each RUC-Committed Hour *h* of the Operating Day for that Resource. When one or more Combined Cycle Generation Resources are committed by RUC, a charge is made to the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| RUCG *q, r, d* | $ | *RUC Guarantee*—The sum of eligible Startup Costs and Minimum-Energy Costs for Resource *r* represented by QSE *q* during all RUC-Committed Hours, for the Operating Day *d*. See Section 5.7.1.1, RUC Guarantee. When one or more Combined Cycle Generation Resources are committed by RUC, guaranteed costs are calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| RUCMEREV *q, r, d* | $ | *RUC Minimum-Energy Revenue*—The sum of the energy revenues for generation of Resource *r* represented by QSE *q* up to LSL during all RUC-Committed Hours, for the Operating Day *d*. See Section 5.7.1.2. When one or more Combined Cycle Generation Resources are committed by RUC, RUC Minimum-Energy Revenue is calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| RUCEXRR *q, r, d* | $ | *Revenue Less Cost Above LSL During RUC-Committed Hours*—The sum of the total revenue for Resource *r* represented by QSE *q* above the LSL less the cost during all RUC-Committed Hours, for the Operating Day *d*. See Section 5.7.1.3. When one or more Combined Cycle Generation Resources are committed by RUC, Revenue Less Cost Above LSL During RUC-Committed Hours is calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| RUCEXRQC *q, r, d* | $ | *Revenue Less Cost from QSE-Clawback Intervals*—The sum of the total revenue for Resource *r* represented by QSE *q* less the cost during all QSE-Clawback Intervals for the Operating Day *d*. See Section 5.7.1.4. When one or more Combined Cycle Generation Resources are committed by RUC, Revenue Less Cost from QSE-Clawback Intervals is calculated for the Combined Cycle Train for all Combined Cycle Generation Resources earning revenue in QSE Clawback Intervals. |
| RUCACREV *q, r, d* | $ | *Revenue from RUCAC Hours*—The net positive sum for the energy revenues for generation of Resource *r* represented by QSE *q* up to LSL and the total revenue for Resource *r* operating above its LSL less the cost during all RUCAC-Hours, for the Operating Day *d*. When one or more Combined Cycle Generation Resources are RUCAC, revenue from RUCAC Hours is calculated for the Combined Cycle Train for all Combined Cycle Generation Resources that were RUC-committed during the RUCAC-Hours. |
| RUCMEREV96 *q, r, i* | $ | *RUC Minimum-Energy Revenue by Interval*—The energy revenues for generation of Resource *r* represented by QSE *q* up to LSL during all RUC-Committed Hours, for the Settlement Interval *i*. When one or more Combined Cycle Generation Resources are committed by RUC, RUC Minimum-Energy Revenue is calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. During RUCAC-Intervals for a Combined Cycle Train, the minimum energy revenue is calculated as the difference between the minimum energy revenue of the RUC-committed configuration and the QSE-committed configuration. |
| RUCEXRR96 *q, r, i* | $ | *Revenue Less Cost Above LSL During RUC-Committed Hours by Interval*—The total revenue for Resource *r* represented by QSE *q* operating above its LSL less the cost during all RUC-Committed hours, for the Settlement Interval *i*. When one or more Combined Cycle Generation Resources are committed by RUC, revenue less cost above LSL is calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| RUCHR *q, r, d* | none | *RUC Hour*—The total number of RUC-Committed Hours, for Resource *r* represented by QSE *q* for the Operating Day *d*. When one or more Combined Cycle Generation Resources are committed by RUC, the total number of RUC-Committed Hours is calculated for the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| *q* | none | A QSE. |
| *r* | none | A RUC-committed Generation Resource. |
| *d* | none | An Operating Day containing the RUC-commitment. |
| *h* | none | An hour in the RUC-commitment period. |
| *i* | none | A 15-minute Settlement Interval within the hour that includes a RUCAC instruction. |

***5.7.3 Payment When ERCOT Decommits a QSE-Committed Resource***

(1) If ERCOT decommits a QSE-committed Resource during the RUC process earlier than its scheduled shutdown within the Operating Day, then no compensation is due to the affected QSE from ERCOT.

(2) If ERCOT decommits a QSE committed Resource that is not scheduled to shutdown within the Operating Day, then ERCOT shall pay the affected QSE an amount as calculated below for the hours of decommitment. The number of continuous decommitted hours used in the calculation are the hours beginning with the first decommitted hour until the earlier of:

(a) The hour ERCOT determines that the Resource may again be at LSL; and

(b) The end of the last hour of the Operating Day.

(3) If ERCOT decommits a QSE-committed Resource not scheduled to shutdown within the Operating Day, and the decommitment period spans more than one Operating Day, the RUC Decommitment Payment Amount shall be calculated and paid in the Operating Day in which the RUC decommitment originated. The number of continuous decommitted hours used in the calculation are the hours beginning with the first decommitted hour until the end of the last hour of the Operating Day in which the RUC decommitment originated.

(4) The payment for a RUC Cancellation instruction for a Resource is settled for each hour through an adjustment in the RUC Decommitment Payment Amount as shown in paragraph (8) below.

(5) ERCOT shall produce a report each April that provides the percentage of the RUC Decommitment Payment Amounts that are a result of RUC cancellations during the 12 months of the previous calendar year. The report shall be based on the Final Settlements. ERCOT shall present the results of this study to the appropriate Technical Advisory Committee (TAC) subcommittee. If there are no RUC Decommitment Payment Amounts for a given calendar year, then ERCOT will not be required to produce the annual report.

(6) The SUPR, MEPR and LSL used to calculate payment when ERCOT decommits a QSE-committed Combined Cycle Train is the SUPR, MEPR and LSL that corresponds to the Combined Cycle Generation Resource, within the Combined Cycle Train, that is RUC-decommitted in the first hour of a contiguous decommitted period.

(7) If the SUPR used to calculate payment when ERCOT decommits a QSE-committed AGR is based upon approved verifiable cost for all of the generators associated with the AGR, ERCOT shall scale the startup payment according to the number of generators of the AGR that started following the decommitment. ERCOT shall make the adjustment no later than on Final Settlement.

(8) The payment for a RUC decommitment instruction for a Resource, including RMR Units and excluding ESRs, is calculated for each hour as follows:

RUCDCAMT*q,r,h* = (-1) \* Max (0, (SUPR*q,r,s* - (Max (0, MEPR*q,r,i* - RTSPP*p,i*) \* (LSL*q,r,i* \* (¼))))) / NCDCHR*q,r,h*

Where:

If the QSE submitted a validated Three-Part Supply Offer for the Resource*,*

Then, SUPR*q,r,s* = Min (SUO*q,r,s*, SUCAP *q,r,s*)

MEPR*q,r,i* = Min (MEO*q,r,i*, MECAP *q,r,i*)

Otherwise, SUPR*q,r,s* = SUCAP*q,r,s*

MEPR*q,r,i* = MECAP*q,r,i*

If ERCOT has approved verifiable Startup Costs and minimum-energy costs for the Resource,

Then, SUCAP*q,r,s* = verifiable Startup Costs*q,r,s*

MECAP*q,r,i* = verifiable minimum-energy costs*q,r,i*

Otherwise, SUCAP*q,r,s* = RCGSC*s*

MECAP*q,r,i* = RCGMEC*i*

The above variables are defined as follows:

| Variable | Unit | Definition |
| --- | --- | --- |
| RUCDCAMT*q,r,h* | $ | *RUC Decommitment Payment Amount*—The payment to the QSE for the Resource that was decommitted by ERCOT but that was not scheduled to shut down in the Operating Day, for each decommitted hour of the Operating Day. When one or more Combined Cycle Generation Resources are decommitted by RUC, payment is made to the Combined Cycle Train for all RUC-decommitted Combined Cycle Generation Resources. |
| SUPR*q,r,s* | $/Start | *Startup Price per start*—The Settlement price for Resource *r* for the start *s*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| SUO*q,r,s* | $/Start | *Startup Offer per start*—Represents an offer for all costs incurred by Generation Resource *r* in starting up and reaching the Resource’s LSL. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| SUCAP*q,r,s* | $/Start | *Startup Cap*—The amount used for Resource *r* as Startup Costs. The cap is the Resource Category Startup Offer Generic Cap (RCGSC) unless ERCOT has approved verifiable unit-specific Startup Costs for that Resource, in which case the Startup Cap is the verifiable unit-specific Startup Cost. The verifiable unit-specific Startup Cost will be determined as described in Section 5.6.1, Verifiable Costs, minus the average energy produced during the time period between breaker close and LSL multiplied by the heat rate proxy “H” multiplied by the appropriate FIP, FOP, or solid fuel price. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| RCGSC*s* | $/Start | *Resource Category Generic Startup Cost*—The Resource Category Startup Offer Generic Cap cost for the category of the Resource, according to Section 4.4.9.2.3, Startup Offer and Minimum-Energy Offer Generic Caps, for the Operating Day. |
| MEPR*q,r,i* | $/MWh | *Minimum-Energy Price*—The Settlement price for Resource *r* for minimum energy for the Settlement Interval *i*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| MEO*q,r,i* | $/MWh | *Minimum-Energy Offer*—Represents an offer for the costs incurred by Resource *r* in producing energy at the Resource’s LSL for the Settlement Interval *i*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| MECAP*q,r,i* | $/MWh | *Minimum-Energy Cap*—The amount used for Resource *r* for minimum-energy costs. The minimum cost is the Resource Category Minimum-Energy Generic Cap (RCGMEC) unless ERCOT has approved verifiable unit-specific minimum energy costs for that Resource, in which case the Minimum-Energy Cap is the verifiable unit-specific minimum energy cost. See Section 5.6.1 for more information on verifiable costs. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| RCGMEC*i* | $/MWh | *Resource Category Generic Minimum-Energy Cost*—The Resource Category Minimum-Energy Generic Cap cost for the category of the Resource, according to Section 4.4.9.2.3. |
| LSL*q,r,i* | MW | *Low Sustained Limit*—The LSL of Generation Resource *r* represented by QSE *q* for the hour that includes the Settlement Interval *i*, as submitted in the COP. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| RTSPP*p,i* | $/MWh | *Real-Time Settlement Point Price*—The Real-Time Settlement Point Price at the Resource’s Settlement Point for the Settlement Interval *i*. |
| NCDCHR*q,r,h* | none | *Number of Continuous Decommitted Hours*—The number of continuous decommitment hours for Resource *r* within an Operating Day. When one or more Combined Cycle Generation Resources are decommitted by RUC, the Number of Continuous Decommitted Hours is calculated for the Combined Cycle Train for all RUC-decommitted Combined Cycle Generation Resources. |
| *q* | none | A QSE. |
| *r* | none | A RUC-decommitted Generation Resource. |
| *h* | none | An hour in the RUC decommitment period. |
| *p* | none | A Resource Node Settlement Point. |
| *s* | none | A start. |
| *i* | none | A 15-minute Settlement Interval within the contiguous decommitted period. |

***5.7.4 RUC Make-Whole Charges***

(1) All QSEs that were capacity-short in each RUC will be charged for that shortage, as described in Section 5.7.4.1, RUC Capacity-Short Charge. If the revenues from the charges under Section 5.7.4.1 are not enough to cover all RUC Make-Whole Payments for a Settlement Interval, then the difference will be uplifted to all QSEs on a Load Ratio Share (LRS) basis, as described in Section 5.7.4.2, RUC Make-Whole Uplift Charge.

(2) On a monthly basis, within ten days after the Initial Settlement of the last day of the month has been completed, ERCOT shall post on the Market Information System (MIS) Secure Area the total RUC Make-Whole Charges and RUC Clawback Payment Amounts, by Settlement Interval, by QSE capacity-shortfall and by amount uplifted.

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| ***[NPRR1239: Replace paragraph (2) above with the following upon system implementation:]***  (2) On a monthly basis, within ten days after the Initial Settlement of the last day of the month has been completed, ERCOT shall post on the ERCOT website the total RUC Make-Whole Charges and RUC Clawback Payment Amounts, by Settlement Interval, by QSE capacity-shortfall and by amount uplifted. |

5.7.4.1 RUC Capacity-Short Charge

(1) The dollar amount charged to each QSE, due to capacity shortfalls for a particular RUC, for a 15-minute Settlement Interval, is the QSE’s shortfall ratio share multiplied by the total RUC Make-Whole Payments, including amounts for RMR Units, to all QSEs for that RUC, subject to a cap. The cap on the charge to each QSE is two multiplied by the total RUC Make-Whole Payments, including amounts for RMR Units, for all QSEs multiplied by that QSE’s capacity shortfall for that RUC process divided by the total capacity of all RUC-committed Resources during that Settlement Interval for the RUC process. That dollar amount charged to each QSE is calculated as follows:

RUCCSAMT *ruc, i, q* = (-1) \* Max [(RUCSFRS *ruc, i, q* \* RUCMWAMTRUCTOT *ruc, h*),   
(2 \* RUCSF *ruc, i, q* \* RUCMWAMTRUCTOT *ruc, h* / RUCCAPTOT *ruc, h*)] / 4

Where:

RUCMWAMTRUCTOT *ruc, h*  = RUCMWAMT *ruc, q, r, h*

RUCCAPTOT *ruc, h* = (RUCHSL *ruc, h, r* – RUCHSL *ruc, h, beforeCCGR*)

The above variables are defined as follows:

| Variable | Unit | Definition |
| --- | --- | --- |
| RUCCSAMT *ruc, i, q* | $ | *RUC Capacity-Short Amount*—The charge to a QSE *q*, due to capacity shortfall for a particular RUC process *ruc*, for the 15-minute Settlement Interval *i*. |
| RUCMWAMTRUCTOT *ruc, h* | $ | *RUC Make-Whole Amount Total per RUC*—The sum of RUC Make-Whole Payments for a particular RUC process *ruc*, including amounts for RMR Units, for the hour *h* that includes the 15-minute Settlement Interval. |
| RUCMWAMT *ruc, q, r, h* | $ | *RUC Make-Whole Payment*—The RUC Make-Whole Payment to the QSE *q* for Resource *r*, for a particular RUC process *ruc*, for the hour *h* that includes the 15-minute Settlement Interval. See Section 5.7.1, RUC Make-Whole Payment. When one or more Combined Cycle Generation Resources are committed by RUC, payment is made to the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| RUCSFRS *ruc, i, q* | none | *RUC Shortfall Ratio Share*—The ratio of the QSE *q*’s capacity shortfall to the sum of all QSEs’ capacity shortfalls for a particular RUC process *ruc*, for the 15-minute Settlement Interval *i*. See Section 5.7.4.1.1, Capacity Shortfall Ratio Share. |
| RUCSF *ruc, i, q* | MW | *RUC Shortfall*—The QSE *q*’s capacity shortfall for a particular RUC process *ruc* for the 15-minute Settlement Interval *i*. See formula in Section 5.7.4.1.1. |
| RUCCAPTOT *ruc, h* | MW | *RUC Capacity Total*—The sum of the High Sustained Limits (HSLs) of all RUC-committed Resources for a particular RUC process *ruc*, for the hour *h* that includes the 15-minute Settlement Interval. See formula in Section 5.7.4.1.1. |
| RUCHSL *ruc, q, r, h* | MW | *High Sustained Limit at RUC Snapshot*—The HSL of Generation Resource *r* represented by QSE *q* for the hour *h*, according to the COP and Trades Snapshot for the RUC process *ruc*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| *ruc* | none | The RUC process for which the RUC Capacity-Short Charge is calculated. |
| *i* | none | A 15-minute Settlement Interval. |
| *q* | none | A QSE. |
| *h* | none | The hour that includes the Settlement Interval *i*. |
| *r* | none | A Generation Resource that is RUC-committed for the hour that includes the Settlement Interval *i*, as a result of a particular RUC process. |
| *beforeCCGR* | none | The Combined Cycle Generation Resource that was QSE-committed in a RUCAC-Interval. |

5.7.4.1.1 Capacity Shortfall Ratio Share

(1) In calculating the shortfall amount for each QSE, the Resource capacity (RCAPSNAP and RCAPADJ) shall be calculated for a Generation Resource that meets any of the following conditions:

(a) QSE-committed;

(b) Planning to operate as a Quick Start Generation Resource (QSGR) for the Settlement Interval as shown by the COP Status of OFFQS in the RUC Snapshot for the RUC Process and/or Adjustment Period; or

(c) A Switchable Generation Resource (SWGR) that is released by a non-ERCOT Control Area Operator (CAO) to operate in the ERCOT Control Area due to an ERCOT RUC instruction for an actual or anticipated Energy Emergency Alert (EEA) condition and that is shown as On-Line in its COP; or

(d) If the Settlement Interval is a RUCAC-Interval, the Combined Cycle Generation Resource that was QSE-committed at the time the RUCAC was issued, excluding the condition for SWGRs as describe in paragraph (c) above.

(2) In calculating the amount short for each QSE, the available capacity of an IRR when determining responsibility for the corresponding RUC charges shall be the lesser of the HSL value, as reflected in the COP, and the Wind-powered Generation Resource Production Potential (WGRPP), as described in Section 4.2.2, Wind-Powered Generation Resource Production Potential, for a Wind-powered Generation Resource (WGR), or the PhotoVoltaic Generation Resource Production Potential (PVGRPP), as described in Section 4.2.3, PhotoVoltaic Generation Resource Production Potential, for a PhotoVoltaic Generation Resource (PVGR), at the time of RUC execution. For an IRR, the RCAPSNAP variable used below shall be equal to the minimum of the WGRPP or PVGRPP described above and the HSL value as reflected in the QSE’s COP, at the time of the RUC execution.

(3) In calculating the amount short for each QSE, the QSE must be given a capacity credit for non-Intermittent Renewable Resources (IRRs) that were given notice of decommitment within the two hours before the Operating Hour as a result of the RUC process by setting the RCAPSNAP and RCAPADJ variables used below set equal to the RCAPSNAP value for the Resource immediately before the decommitment instruction was given.

(4) In calculating the short amount for each QSE, if the RCAPSNAP for a non-IRR was credited to the QSE during the RUC Snapshot but the Resource experiences a Forced Outage within two hours before the start of the Settlement Interval, then the RCAPSNAP for that Resource is also credited to the QSE in the RCAPADJ.

(5) In calculating the short amount for each QSE, if the DCIMPSNAP was credited to the QSE during the RUC Snapshot but the entire Direct Current Tie (DC Tie) experiences a Forced Outage within two hours before the start of the Settlement Interval, then the DCIMPSNAP is also credited to the QSE in the DCIMPADJ.

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| ***[NPRR1032: Replace paragraph (5) above with the following upon system implementation:]***  (5) In calculating the short amount for each QSE, if the DCIMPSNAP was credited to the QSE during the RUC Snapshot but the entire Direct Current Tie (DC Tie) experiences a Forced Outage within two hours before the start of the Settlement Interval, then the DCIMPSNAP is also credited to the QSE in the RTDCIMP. |

(6) For Combined Cycle Generation Resources, if more than one Combined Cycle Generation Resource is shown On-Line in its COP for the same Settlement hour, then the provisions of paragraph (6)(a) of Section 3.9.1, Current Operating Plan (COP) Criteria, apply in the determination of the On-Line Combined Cycle Generation Resource for that Settlement hour.

(7) The QSE Ancillary Service shortfall calculation in MW for each hour in the RUC Snapshot or for the end of the Adjustment Period involves solving an optimization that minimizes any potential Ancillary Service shortfall for a QSE. This is done by determining the optimal utilization of Ancillary Service capabilities within each QSE’s portfolio of Resources to meet its net Ancillary Service position for each Ancillary Service sub-type. A QSE’s Ancillary Service shortfall for an hour is the difference between the QSE’s net Ancillary Service position and its coverage of Ancillary Services using the outputs of this optimization based on the QSE’s Resource Ancillary Service capabilities for that hour as reflected in the COPs submitted by the QSE.

(a) For each Ancillary Service sub-type, the Ancillary Service MW capability for each Resource in the QSE’s portfolio for a given hour in the RUC Snapshot or at the end of the Adjustment Period (ASMWCAPSNAP and ASMWCAPADJ) is calculated as the minimum of:

(i) HSL minus LSL in the COP if the Resource is On-Line (ON, ONOS, ONSC, and ONL). If a Generation Resource COP Resource Status is OFF or OFFQS, only the COP HSL is used. For a Combined Cycle Train, the Resource refers to a particular Combined Cycle Generation Resource belonging to that Combined Cycle Train. For a Combined Cycle Train, select the Combined Cycle Generation Resource that is On-Line (ON or ONOS) with the highest HSL. If none of the Combined Cycle Generation Resources of a Combined Cycle Train are On-Line, then select the Combined Cycle Generation Resource that has the highest HSL and a COP Resource Status of OFF and that can be started up within 30 minutes;

(ii) Submitted Ancillary Service Offer MW quantity for the Ancillary Service type/sub-type;

(iii) Submitted COP Ancillary Service MW capability; and

(iv) Qualified Ancillary Service MW amount for the Ancillary Service sub-type. For Resources with COP Resource Status of OFFQS, the qualified MW amounts for Reg-Up, Reg-Down, and RRS will be set to zero. For Resources with a COP Resource Status of OFF, the qualified MW amounts for Reg-Up, Reg-Down, RRS, and ECRS will be set to zero.

(b) The QSE Ancillary Service shortfall calculation enforces the following constraints for each hour using data from the RUC Snapshot or the end of the Adjustment Period:

(i) Ensure that a QSE’s portfolio of Resource capacities are only used to cover that QSE’s net Ancillary Service position by each Ancillary Service sub-type.

(ii) A QSE’s Fast Frequency Response (FFR) Service (FFRS) position can be covered by the QSE’s portfolio of ESRs qualified to provide FFRS, Load Resources having a high-set under-frequency Relay that are qualified for Responsive Reserve (RRS) or Controllable Load Resources (CLRs), Generation Resources, and ESRs that are qualified to provide RRS as Primary Frequency Response.

(iii) A QSE’s RRS position of the type provided by Load Resources having a high-set under-frequency Relay that are qualified for RRS can be covered by the QSE’s portfolio of Load Resources qualified to provide this type of RRS or CLRs, Generation Resources, and ESRs that are qualified to provide RRS as Primary Frequency Response.

(iv) A QSE’s ERCOT Contingency Reserve Service (ECRS) position of the type that is not SCED-dispatchable can be covered by the QSE’s portfolio of Load Resources that are qualified to provide non-SCED dispatchable ECRS, or by CLRs, Generation Resources, and ESRs that are qualified to provide ECRS of the type that is SCED-dispatchable.

(v) A QSE’s Non-Spinning Reserve (Non-Spin) position of the type that is not SCED-dispatchable can be covered by the QSE’s portfolios of Load Resources that are qualified to provide non-SCED dispatchable Non-Spin, or by CLRs, Generation Resources, and ESRs that are qualified to provide Non-Spin of the type that is SCED-dispatchable.

(vi) For each Resource and Ancillary Service sub-type:

(A) Ancillary Service capacity used for each Ancillary Service sub-type cannot exceed that Resource’s Ancillary Service capability for that Ancillary Service sub-type.

(B) The sum of all the Ancillary Service capacities used for each Ancillary Service sub-type cannot exceed the COP HSL minus LSL limits. For Generation Resources that have a Resource Status of OFF and the Ancillary Service type is Non-Spin, consider LSL to be zero. Likewise, for Generation Resources that have a Resource Status of OFFQS and the Ancillary Service type is Non-Spin or ECRS, consider LSL to be zero.

(C) For ESRs, consider:

(1) Duration requirements for each Ancillary Service type and the submitted COP values for Hour Beginning Planned State of Charge (HBSOC), Minimum SOC (MinSOC) and Maximum SOC (MaxSOC);

(2) Ancillary Service deployment factors, duration requirements for different Ancillary Service types or sub-types, and the difference between the submitted COP HBSOC for the hour under consideration and the next hour; and

(3) The charge or discharge MW required to satisfy the above constraints.

(c) The outputs of the optimization for each Resource are:

(i) The Resource’s MW capacity used to cover its QSE’s net Ancillary Service position by Ancillary Service sub-type for a given hour. These values are ASMWCAPUSNAP for a given hour in the RUC Snapshot and ASMWCAPUADJ for the end of the Adjustment Period.

(ii) For an ESR, the MW discharge (positive) or charge (negative) required to support the ESR’s calculated Ancillary Service coverage of its QSE’s net Ancillary Service position, considering the submitted COP values for MinSOC, MaxSOC, and the difference in the HBSOC for the hour under consideration and the next hour. This value will also account for Ancillary Service deployment factors and the duration requirements for energy and different Ancillary Service types. These values are MWSNAP for a given hour in the RUC Snapshot and MWADJ for the end of the Adjustment Period.

(8) The capacity shortfall ratio share of a specific QSE for a particular RUC process is calculated, for a 15-minute Settlement Interval, as follows:

**RUCSFRS *ruc, i, q* = RUCSF *ruc, i, q* / RUCSFTOT *ruc, i***

Where:

RUCSFTOT *ruc, i* = RUCSF *ruc, i, q*

(9) The RUC Shortfall in MW for one QSE for one 15-minute Settlement Interval is:

**RUCSF *ruc, i, q* = Max (0, Max (RUCSFSNAP *ruc, q, i*, RUCSFADJ *ruc, q, i*) – RUCCAPCREDIT *q, i, z*)**

(10) The RUC Shortfall in MW for one QSE for one 15-minute Settlement Interval, as measured at the RUC Snapshot, is:

**RUCSFSNAP *ruc, q, i* = Max (RUCOSFSNAP *ruc, q, i* , RUCASFSNAP *ruc, q, i*)**

(11) The overall shortfall in MW that a QSE had according to the RUC Snapshot for a 15-minute Settlement Interval is:

**RUCOSFSNAP *ruc, q, i* = Max (0, ((RTAML *q, p, i* \* 4) + ASONPOSSNAP *ruc, q, i* – RUCCAPSNAP *ruc, q, i*))**

The QSE’s On-Line Ancillary Service Position according to the RUC Snapshot for a 15-minute Settlement Interval is:

**ASONPOSSNAP *ruc, q, i* = RUPOSSNAP *ruc, q, h* + RRPOSSNAP *ruc, q, h* + ECRPOSSNAP *ruc, q, h* + Max (0, (NSPOSSNAP *ruc, q, h* – ASOFFOFRSNAP *ruc, q, r, h*))**

The amount of capacity that a QSE had according to the RUC Snapshot for a 15-minute Settlement Interval is:

**RUCCAPSNAP *ruc, q, i* = RCAPSNAP *ruc, q, r, h* + (RUCCPSNAP *ruc, q, h* – RUCCSSNAP *ruc, q, h*) + (DAEP *q, p, h* –DAES *q, p, h*) + (RTQQEPSNAP *ruc, q, p, i* – RTQQESSNAP *ruc, q, p, i*) +  DCIMPSNAP *ruc, q, p, i* + ASOFRLRSNAP *ruc, q, r, h* + ESRMWSNAP *ruc, q, h* + ESRASSNAP *ruc, q, h***

Where:

The QSE’s net up Ancillary Service position (Reg-Up + RRS + ECRS + Non-Spin) covered by the QSE’s portfolio of ESRs is:

ESRASSNAP *ruc, q, h* = ASMWCAPUSNAP *ruc, q, h, ASSubType, r*

The sum of the QSE’s ESR discharging (positive) or charging (negative) output is:

ESRMWSNAP *ruc, q, h* = MWSNAP *ruc, q, h, r*

(12) The Ancillary Service shortfall in MW that a QSE had according to the RUC Snapshot for a 15-minute Settlement Interval is:

**RUCASFSNAP *ruc, q, i* = RUPOSSNAP *ruc, q, h*** + **RDPOSSNAP *ruc, q, h***

+ **RRPOSSNAP *ruc, q, h*** + **ECRPOSSNAP *ruc, q, h***

+ **NSPOSSNAP *ruc, q, h*** **– ASMWCAPUQSNAP *ruc, q, h***

Where:

ASMWCAPUQSNAP *ruc, q, h*  = ****ASMWCAPUSNAP *ruc, q, h, ASSubType, r*

RRPOSSNAP *ruc, q, h* = Max(0, PFPOSSNAP *ruc, q, h* + Max(0, UFPOSSNAP *ruc, q, h* + FFPOSSNAP *ruc, q, h*))

ECRPOSSNAP *ruc, q, h* = Max(0, ECSPOSSNAP *ruc, q, h* + ECMPOSSNAP *ruc, q, h*)

NSPOSSNAP *ruc, q, h* = Max(0, NSSPOSSNAP *ruc, q, h* + NSMPOSSNAP *ruc, q, h*)

(13) The RUC Shortfall in MW for one QSE for one 15-minute Settlement Interval, as measured at the end of the Adjustment Period, is:

**RUCSFADJ *ruc, q, i* = Max (RUCOSFADJ *ruc, q, i*, RUCASFADJ *q, i* )**

(14) The overall shortfall in MW that a QSE had at the end of the Adjustment Period for a 15-minute Settlement Interval, but including capacity from IRRs as seen in the RUC Snapshot, is:

**RUCOSFADJ *ruc, q, i*  = Max (0, ((RTAML *q, p, i* \*4) + ASONPOSADJ *q, i* – (RCAPSNAP *ruc, q, r, h* + RUCCAPADJ *q, i*)))**

Where:

The On-Line Ancillary Service Position the QSE had at the end of the Adjustment Period for a 15-minute Settlement Interval is:

ASONPOSADJ *q ,i* = RUPOSADJ *q, h* + RRPOSADJ *q, h* + ECRPOSADJ *q, h* + Max (0, (NSPOSADJ *q, h* – ASOFFOFRADJ *q, r, h*))

The amount of capacity that a QSE had at the end of the Adjustment Period for a 15-minute Settlement Interval, excluding capacity from IRRs, is:

RUCCAPADJ *q, i* = RCAPADJ *q, r, h* + (RUCCPADJ *q, h* – RUCCSADJ *q, h*) + (DAEP *q, p, h* – DAES *q, p, h*) + (RTQQEPADJ *q, p, i* – RTQQESADJ *q, p, i*) +  DCIMPADJ *q, p, i* + ASOFRLRADJ *q, r, h* + ESRMWADJ *q, h* + ESRASADJ *q, h*

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| ***[NPRR1032: Replace the formula “RUCCAPADJ q, i” above with the following upon system implementation:]***  RUCCAPADJ *q, i* = RCAPADJ *q, r, h* + (RUCCPADJ *q, h* – RUCCSADJ *q, h*) + (DAEP *q, p, h* – DAES *q, p, h*) + (RTQQEPADJ *q, p, i* – RTQQESADJ *q, p, i*) +  RTDCIMP *q, p* + ASOFRLRADJ *q, r, h* + ESRMWADJ *q, h* + ESRASADJ *q, h* |

Where:

The QSE’s net up Ancillary Service position (Reg-Up + RRS + ECRS + Non-Spin) covered by the QSE’s portfolio of ESRs is:

ESRASADJ *q, h* = ASMWCAPUADJ *q, h, ASSubType, r*

The sum of the QSE’s ESR discharging (positive) or charging (negative) output is:

ESRMWADJ *q, h* = MWADJ *q, h, r*

(15) The Ancillary Service shortfall in MW that a QSE had at the end of the Adjustment Period for a 15-minute Settlement Interval is:

**RUCASFADJ *q, i* = RUPOSADJ *q, h*** + **RDPOSADJ *q, h***

+ **RRPOSADJ *q, h*** + **ECRPOSADJ *q, h*** + **NSPOSADJ *q, h***

– **ASMWCAPUQADJ *q, h***

Where:

ASMWCAPUQADJ *q, h* = ****ASMWCAPUADJ  *q, h, ASSubType, r*

RRPOSADJ *q, h* = Max(0, PFPOSADJ *q, h* + Max(0,UFPOSADJ *q, h* + FFPOSADJ *q, h*))

ECRPOSADJ *q, h* = Max(0, ECSPOSADJ *q, h* + ECMPOSADJ *q, h*)

NSPOSADJ *q, h* = Max(0,NSSPOSADJ *q, h* + NSMPOSADJ *q, h*)

The above variables are defined as follows:

| Variable | Unit | Definition |
| --- | --- | --- |
| RUCSFRS *ruc, i, q* | none | *RUC Shortfall Ratio Share*—The ratio of the QSE *q*’s capacity shortfall to the sum of all QSEs’ capacity shortfalls, for the RUC process *ruc*, for the 15-minute Settlement Interval *i*. |
| RUCSF *ruc, i, q* | MW | *RUC Shortfall*—The QSE *q*’s capacity shortfall for the RUC process *ruc* for the 15-minute Settlement Interval *i*. |
| RUCSFTOT *ruc, i* | MW | *RUC Shortfall Total*—The sum of all QSEs’ capacity shortfalls, for a RUC process *ruc*, for a 15-minute Settlement Interval *i*. |
| RUCSFSNAP *ruc, q, i* | MW | *RUC Shortfall at Snapshot*—The QSE *q*’s capacity shortfall will be the maximum of the QSE’s overall shortfall or Ancillary Service shortfall, as calculated for the RUC process *ruc* for the 15-minute Settlement Interval *i*. |
| RUCSFADJ *ruc, q, i* | MW | *RUC Shortfall at End of Adjustment Period*—The QSE *q*’s end of Adjustment Period capacity shortfall will be the maximum of the QSE’s overall shortfall or Ancillary Service shortfall, as calculated for the RUC process *ruc*, for the 15-minute Settlement Interval *i*. |
| RUCCAPCREDIT *q, i, z* | MW | *RUC Capacity Credit*—The QSE *q*’s capacity credit resulting from capacity paid through the RUC Capacity-Short Amount for RUC process *z* for the 15-minute Settlement Interval *i*. |
| RUCOSFSNAP *ruc, q, i* | MW | *RUC Overall Shortfall at Snapshot*—The QSE *q*’s overall capacity shortfall according to the RUC Snapshot for the RUC process *ruc* for the 15-minute Settlement Interval *i*. |
| RUCASFSNAP *ruc, q, i* | MW | *RUC Ancillary Service Shortfall at Snapshot*—The QSE *q*’s Ancillary Service capacity shortfall according to the RUC Snapshot for the RUC process *ruc* for the 15-minute Settlement Interval *i*. |
| ASONPOSSNAP *ruc, q, i* | MW | *Ancillary Service On-Line Position at Snapshot*⎯The QSE *q’s* total On-Line Ancillary Service position according to the RUC Snapshot for the RUC process *ruc* for the 15-minute Settlement Interval *i.* |
| RUPOSSNAP *ruc, q, h* | MW | *Regulation Up Position at Snapshot*⎯The QSE *q’s* net positive Real-Time Reg-Up Ancillary Service Position according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. |
| RRPOSSNAP *ruc, q, h* | MW | *Responsive Reserve Service Position at Snapshot*⎯The QSE *q’s* net positive Real-Time RRS Ancillary Service Position according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. |
| ECRPOSSNAP *ruc, q, h* | MW | *ERCOT Contingency Reserve Service Position at Snapshot*⎯The QSE *q’s* net positive Real-Time ECRS Ancillary Service Position according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. |
| NSPOSSNAP *ruc, q, h* | MW | *Non-Spin Reserve Service Position at Snapshot*⎯The QSE *q’s* net positive Real-Time Non-Spin Ancillary Service Position according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. |
| RDPOSSNAP *ruc, q, h* | MW | *Regulation Down Position at Snapshot*⎯The QSE *q’s* net positive Real-Time Regulation Down Service (Reg-Down) Ancillary Service Position according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. |
| ASOFFOFRSNAP *ruc, q, r, h* | MW | *Ancillary Service Offline Offers at Snapshot*⎯The capacity represented by validated Ancillary Service Offers for Non-Spin for Resource *r* with COP status of “OFF”, represented by QSE *q* according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. A Resource’s offered capacity is only included in the sum to the extent that the Resource’s COP Status and Ancillary Service Capability indicate it would be capable of providing the Ancillary Service during the hour *h*. |
| ASOFRLRSNAP *ruc, q, r, h* | MW | *Ancillary Service Offer per Load Resource at Snapshot*⎯The capacity represented by validated Ancillary Service Offers for Reg-Up, Non-Spin, RRS, and ECRS for the Load Resource *r* represented by QSE *q* according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. A Resource’s offered capacity is only included in the sum to the extent that the Resource’s COP Status and Ancillary Service Capability indicate it would be capable of providing the Ancillary Service during the hour *h*. |
| PFPOSSNAP *ruc, q, h* | MW | *Responsive Reserve (Governor Response or Governor-Like Response) Position at Snapshot*⎯The QSE *q’s* net Real-Time RRS-PFR Ancillary Service Position according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. This value can be positive or negative. |
| UFPOSSNAP *ruc, q, h* | MW | *Responsive Reserve (Under Frequency trigger at 59.7 Hz.) Position at Snapshot*⎯The QSE *q’s* net Real-Time RRS-UFR Ancillary Service Position according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. This value can be positive or negative. |
| FFPOSSNAP *ruc, q, h* | MW | *Responsive Reserve (Fast Frequency Response) Position at Snapshot*⎯The QSE *q’s* net positive Real-Time RRS-FFR Ancillary Service Position according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. |
| ECSPOSSNAP *ruc, q, h* | MW | *ERCOT Contingency Reserve Service (SCED Dispatchable) Position at Snapshot*⎯The QSE *q’s* net ECRS Ancillary Service Position that is SCED-dispatchable according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. This value can be positive or negative. |
| ECMPOSSNAP *ruc, q, h* | MW | *ERCOT Contingency Reserve Service (Non-SCED Dispatchable) Position at Snapshot*⎯The QSE *q’s* net positive ECRS Ancillary Service Position that is non-SCED-dispatchable according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. |
| NSSPOSSNAP *ruc, q, h* | MW | *Non-Spin Reserve Service (SCED Dispatchable) Position at Snapshot*⎯The QSE *q’s* net Non-Spin Ancillary Service Position that is SCED-dispatchable according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. This value can be positive or negative. |
| NSMPOSSNAP *ruc, q, h* | MW | *Non-Spin Reserve Service (Non-SCED Dispatchable) Position at Snapshot*⎯The QSE *q’s* net positive Non-Spin Ancillary Service Position that is non-SCED-dispatchable according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. |
| ASMWCAPUQSNAP *ruc, q, h* | MW | *Calculated Total MW Capacity used to cover the QSE’s Ancillary Service Position at Snapshot*—The calculated total MW capacity for a QSE *q* that represents the amount of the QSE’s Ancillary Service Position covered by its Resourcesfor the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. |
| ASMWCAPUSNAP *ruc, q, h, ASSubType, r* | MW | *Calculated MW Capacity used to cover the QSE’s ‘AStype’ Ancillary Service Position at Snapshot*—The calculated MW Capacity of a Resource *r* represented by QSE *q* that is used to cover its QSE’s “ASSubType” Ancillary Service Positionfor the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. |
| MWSNAP *ruc, q, h, r* | MW | *Calculated MW required to support ESR’s calculated Ancillary Service coverage at Snapshot*—The MW discharge (positive) or charge (negative) required to support the ESR’s calculated Ancillary Service coverage considering the submitted COP values for HBSOC, MinSOC, MaxSOC and the difference in the HBSOC for the hour under consideration and the next hour while accounting for Ancillary Service deployment factors and the duration requirements for energy and different Ancillary Service types Positionfor the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. |
| ESRASSNAP ***ruc, q, h*** | MW | *Calculated Ancillary Service MW Capacity Provided By QSE’s ESR Portfolio at Snapshot*—The total ESR MW capacity used to cover the QSE *q’s* Upward Ancillary Service position for Reg-Up, RRS, ECRS, and Non-Spin in the RUC Snapshot for the RUC process *ruc*, for the hour *h* that includes the 15-minute Settlement Interval. |
| ESRMWSNAP ***ruc, q, h*** | MW | *Calculated QSE Total ESR MW Discharging or Charging Required To Support Ancillary Service at Snapshot*—The total net ESR MW discharging or charging required to cover the QSE *q’s* Ancillary Service position provided by the QSE ESR portfolio in the RUC Snapshot for the RUC process *ruc*, for the hour *h* that includes the 15-minute Settlement Interval, taking into account the COP SOC values from COP. |
| RUCOSFADJ *ruc, q, i* | MW | *RUC Overall Shortfall at End of Adjustment Period*—The QSE *q’s* overall capacity shortfall at the end of the Adjustment Period, including capacity from IRRs as seen in the RUC Snapshot for the RUC process *ruc*, for the 15-minute Settlement Interval *i*. |
| RUCASFADJ *q, i* | MW | *RUC Ancillary Service Shortfall at End of Adjustment Period*—The QSE *q’s* Ancillary Service capacity shortfall at the end of the Adjustment Period for the 15-minute Settlement Interval *i*. |
| ASONPOSADJ *q ,i* | MW | *Ancillary Service On-Line Position at End of Adjustment Period*⎯The QSE *q’s* total On-Line Ancillary Service position at the end of the Adjustment Periodfor the 15-minute Settlement Interval *i.* |
| RUPOSADJ *q, h* | MW | *Regulation Up Position at End of Adjustment Period*⎯The QSE *q’s* net positive Reg-Up Ancillary Service Position at the end of the Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. |
| RRPOSADJ *q, h* | MW | *Responsive Reserve Service Position at End of Adjustment Period*⎯The QSE *q’s* net positiveRRS Ancillary Service Position at the end of the Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. |
| ECRPOSADJ *q, h* | MW | *ERCOT Contingency Reserve Service Position at End of Adjustment Period*⎯The QSE *q’s* net positive ECRS Ancillary Service Position at the end of the Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. |
| NSPOSADJ *q, h* | MW | *Non-Spin Reserve Service Position at End of Adjustment Period*⎯The QSE *q’s* net positive Non-Spin Ancillary Service Position at the end of the Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. |
| RDPOSADJ *q, h* | MW | *Regulation Down Position at End of Adjustment Period*⎯The QSE *q’s* net positive Reg-Down Ancillary Service Position at the end of the Adjustment period for the hour *h* that includes the 15-minute Settlement Interval. |
| ASOFFOFRADJ *q, r, h* | MW | *Ancillary Service Offline Offers at End of Adjustment Period*⎯The capacity represented by validated Ancillary Service Offers for Non-Spin for Resource *r* with COP status of “OFF”,represented by QSE *q* at the end of the Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. A Resource’s offered capacity is only included in the sum to the extent that the Resource’s COP Status and Ancillary Service Capability indicate it would be capable of providing the Ancillary Service during the hour *h*. |
| ASOFRLRADJ *q, r, h* | MW | *Ancillary Service Offer per Load Resource at End of Adjustment Period*⎯The capacity represented by validated Ancillary Service Offers for Reg-Up, Non-Spin, RRS, and ECRS for the Load Resource *r* represented by QSE *q* at the end of the Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. A Resource’s offered capacity is only included in the sum to the extent that the Resource’s COP Status and Ancillary Service Capability indicate it would be capable of providing the Ancillary Service during the hour *h.* |
| PFPOSADJ *q, h* | MW | *Responsive Reserve (Governor Response or Governor-Like Response) Position at End of Adjustment Period*—The QSE *q’s* net RRS-PFR Ancillary Service Position at the end of the Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. This value can be positive or negative. |
| UFPOSADJ *q, h* | MW | *Responsive Reserve (Under Frequency trigger at 59.7 Hz.) Position at End of Adjustment Period*—The QSE *q’s* net RRS-UFR Ancillary Service Position at the end of the Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. This value can be positive or negative. |
| FFPOSADJ *q, h* | MW | *Responsive Reserve (Fast Frequency Response) Position at End of Adjustment Period*—The QSE *q’s* net positive RRS-FFR Ancillary Service Position at the end of the Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. |
| ECSPOSADJ *q, h* | MW | *ERCOT Contingency Reserve Service (SCED Dispatchable) Position at End of Adjustment Period*—The QSE *q’s* net ECRS SCED Dispatchable Ancillary Service Position at the end of the Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. This value can be positive or negative. |
| ECMPOSADJ *q, h* | MW | *ERCOT Contingency Reserve Service (Non-SCED Dispatchable) Position at End of Adjustment Period*—The QSE *q’s* net positive ECRS non-SCED-dispatchable Ancillary Service Position at the end of the Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. |
| NSSPOSADJ *q, h* | MW | *Non-Spin Reserve Service (SCED Dispatchable) Position at End of Adjustment Period*⎯The QSE *q’s* net Non-Spin SCED-dispatchable Ancillary Service Position at the end of the Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. This value can be positive or negative. |
| NSMPOSADJ *q, h* | MW | *Non-Spin Reserve Service (Non-SCED Dispatchable) Position at End of Adjustment Period*—The QSE *q’s* net positive Non-Spin non-SCED-dispatchable Ancillary Service Position at the end of the Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. |
| ASMWCAPUQADJ *q, h* | MW | *Calculated Total MW Capacity used to cover the QSE’s Ancillary Service Position at End of Adjustment Period*—The calculated total MW capacity for a QSE *q* that represents the amount of the QSE’s Ancillary Service Position covered by its Resourcesat the end of Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. |
| ASMWCAPUADJ *q, h, ASSubType, r* | MW | *Calculated MW Capacity used to cover the QSE’s ‘AStype’ Ancillary Service Position at End of Adjustment Period*—The calculated MW Capacity of a Resource *r* represented by QSE *q* that is used to cover its QSE’s “ASSubType” Ancillary Service Positionat the end of Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. |
| MWADJ *q, h, r* | MW | *Calculated MW discharge (positive) or charge (negative) required to support ESR’s calculated Ancillary Service coverage at End of Adjustment Period*—The MW discharge (positive) or charge (negative) required to support the ESR’s calculated Ancillary Service coverage considering the submitted COP values for HBSOC, MinSOC, MaxSOC and the difference in the HBSOC for the hour under consideration and the next hour while accounting for Ancillary Service deployment factors and the duration requirements for energy and different Ancillary Service types Positionat the end of Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. |
| ESRASADJ *q, h* | MW | *Calculated Ancillary Service MW Capacity Provided By QSE’s ESR Portfolio at the End of Adjustment Period*—The total ESR MW capacity used to cover the QSE *q’s* Upward Ancillary Service position for Reg-Up, RRS, ECRS, and Non-Spin at the end of Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. |
| ESRMWADJ *q, h* | MW | *Calculated QSE Total ESR MW Discharging or Charging Required To Support Ancillary Service at End of Adjustment Period*—The total net ESR MW discharging or charging required to cover the QSE *q’s* Ancillary Service position provided by the QSE ESR portfolio at the end of Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval, taking into account the COP SOC values from COP. |
| RTAML *q, p, i* | MWh | *Real-Time Adjusted Metered Load*—The QSE *q*’s Adjusted Metered Load (AML) at the Settlement Point *p* for the 15-minute Settlement Interval *i*. |
| RUCCAPSNAP *ruc, q, i* | MW | *RUC Capacity Snapshot at time of RUC*—The amount of the QSE *q*’s calculated capacity in the RUC Snapshot for the RUC process *ruc* for a 15-minute Settlement Interval *i*. |
| RCAPSNAP *ruc, q, r, h* | MW | *Resource Capacity at Snapshot*—The available capacity of Generation Resource *r* represented by the QSE *q*, according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. For Generation Resources that are not IRRs, the available capacity shall be equal to HSL. For WGRs and PVGRs, the available capacity shall be equal to the lesser of the HSL or the WGRPP and the PVGRPP, respectively. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| DCIMPSNAP *ruc, q, p, i* | MW | *DC Import at Snapshot*—The approved aggregated DC Tie Schedule submitted by QSE *q* as an importer into the ERCOT System through DC Tie *p*, according to the RUC Snapshot for the RUC process *ruc* for the 15-minute Settlement Interval *i*. |
| DCIMPADJ *q, p, i* | MW | *DC Import per QSE per Settlement Point*—The approved aggregated DC Tie Schedule submitted by QSE *q* as an importer into the ERCOT System through DC Tie *p* according to the Adjustment Period snapshot, for the 15-minute Settlement Interval *i*. |
| |  |  |  |  | | --- | --- | --- | --- | | ***[NPRR1032: Replace the variable “DCIMPADJ q, p, i” above with the following upon system implementation:]***   |  |  |  | | --- | --- | --- | | RTDCIMP *q, p* | MW | *Real-Time DC Import per QSE per Settlement Point*—The aggregated final, approved DC Tie Schedule submitted by QSE *q* as an importer into the ERCOT System through DC Tie *p*, for the 15-minute Settlement Interval. | | | | |
| RUCCPSNAP *ruc, q, h* | MW | *RUC Capacity Purchase at Snapshot*—The QSE *q*’s capacity purchase, according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. |
| RUCCSSNAP *ruc, q, h* | MW | *RUC Capacity Sale at Snapshot*—The QSE *q*’s capacity sale, according to the RUC Snapshot for the RUC process *ruc* for the hour *h* that includes the 15-minute Settlement Interval. |
| RUCCAPADJ *q, i* | MW | *RUC Capacity at End of Adjustment Period*—The amount of the QSE *q*’s calculated capacity, excluding capacity for IRRs, at the end of the Adjustment Period for a 15-minute Settlement Interval *i.* |
| RCAPADJ *q, r, h* | MW | *Resource Capacity at End of Adjustment Period*—The HSL of a non-IRR Generation Resource *r* represented by the QSE *q* at the end of the Adjustment Period, for the hour *h* that includes the 15-minute Settlement Interval. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train. |
| RUCCPADJ *q, h* | MW | *RUC Capacity Purchase at End of Adjustment Period*—The QSE *q*’s capacity purchase, at the end of Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. |
| RUCCSADJ *q, h* | MW | *RUC Capacity Sale at End of Adjustment Period*—The QSE *q*’s capacity sale, at the end of Adjustment Period for the hour *h* that includes the 15-minute Settlement Interval. |
| DAEP *q, p, h* | MW | *Day-Ahead Energy Purchase*—The QSE *q*’s energy purchased in the DAM at the Settlement Point *p* for the hour *h* that includes the 15-minute Settlement Interval. |
| DAES *q, p, h* | MW | *Day-Ahead Energy Sale*—The QSE *q*’s energy sold in the DAM at the Settlement Point *p* for the hour *h* that includes the 15-minute Settlement Interval. |
| RTQQEPSNAP *ruc, q, p, i* | MW | *Real-Time QSE-to-QSE Energy Purchase at Snapshot*—The QSE *q*’s Energy Trades in which the QSE is the buyer at the delivery Settlement Point *p* for the 15-minute Settlement Interval *i*, in the RUC Snapshot for the RUC process *ruc*. |
| RTQQESSNAP *ruc, q, p, i* | MW | *Real-Time QSE-to-QSE Energy Sale at Snapshot*—The QSE *q*’s Energy Trades in which the QSE is the seller at the delivery Settlement Point *p* for the 15-minute Settlement Interval *i*, in the RUC Snapshot for the RUC process *ruc*. |
| RTQQEPADJ *q, p, i* | MW | *Real-Time QSE-to-QSE Energy Purchase at End of Adjustment Period*—The QSE *q*’s Energy Trades in which the QSE is the buyer at the delivery Settlement Point *p* for the 15-minute Settlement Interval *i*, at the end of the Adjustment Period for that Settlement Interval. |
| RTQQESADJ *q, p, i* | MW | *Real-Time QSE-to-QSE Energy Sale at End of Adjustment Period*—The QSE *q*’s Energy Trades in which the QSE is the seller at the delivery Settlement Point *p* for the 15-minute Settlement Interval *i*, at the end of the Adjustment Period for that Settlement Interval. |
| *q* | none | A QSE. |
| *p* | none | A Settlement Point. |
| *r* | none | A Generation Resource, an ESR, or a Load Resource. |
| *ASSubType* | none | Ancillary Service Sub-Type: Reg-Up, Reg-Down, RRS provided as Primary Frequency Response, RRS provided via a high-set under-frequency relay, Fast Frequency Response (FFR), ECRS that is SCED-dispatchable, ECRS that is non-SCED dispatchable, Non-Spin that is SCED-dispatchable, and Non-Spin that is non-SCED-dispatchable. |
| *z* | none | A previous RUC process for the Operating Day. |
| *i* | none | A 15-minute Settlement Interval. |
| *h* | none | The hour that includes the Settlement Interval *i*. |
| *ruc* | none | The RUC process for which this RUC Shortfall Ratio Share is calculated. |

5.7.4.1.2 RUC Capacity Credit

(1) A QSE that is charged for a capacity shortfall in one RUC process gets a capacity credit equal to the minimum of the QSE’s RUC shortfall (MW) or the total RUC capacity purchased multiplied by the QSE’s shortfall ratio share. The capacity credit to be used in future RUC processes for the same 15-minute Settlement Interval is calculated as follows:

RUCCAPCREDIT*ruc,i,q* = Min [RUCSF*ruc,i,q*, (RUCCAPTOT*ruc,h*\* RUCSFRS*ruc,i,q*)]

The above variables are defined as follows:

| Variable | Unit | Definition |
| --- | --- | --- |
| RUCCAPCREDIT*ruc,i,q* | MW | *RUC Capacity Credit by QSE*—The capacity credit resulting from capacity paid through the RUC Capacity-Short Charge for the 15-minute Settlement Interval. |
| RUCSF*ruc,i,q* | MW | *RUC Shortfall*—The QSE’s capacity shortfall for the RUC process for the 15-minute Settlement Interval. |
| RUCSFRS*ruc,i,q* | none | *RUC Shortfall Ratio Share*—The ratio of the QSE’s capacity shortfall to the sum of all QSEs’ capacity shortfalls, for the RUC process, for the 15-minute Settlement Interval. |
| RUCCAPTOT*ruc,h* | MW | *RUC Capacity Total*—The total capacity of all RUC-committed Resources during the RUC process, for the hour that includes the 15-minute Settlement Interval. |
| *q* | none | A QSE. |
| *i* | none | A 15-minute Settlement Interval. |
| *h* | none | The hour that includes the Settlement Interval *i*. |
| *ruc* | none | The RUC process for which this RUC Capacity Credit is calculated. |

5.7.4.2 RUC Make-Whole Uplift Charge

(1) If the revenues from the charges under Section 5.7.4.1, RUC Capacity-Short Charge, are not enough to cover all RUC Make-Whole Payments, including amounts for RMR Units, for a 15-minute Settlement Interval, then the difference will be uplifted to all QSEs on a Load Ratio Share basis, as a RUC Make-Whole Uplift Charge, calculated as follows:

LARUCAMT*q,i* = (-1) \* ( RUCMWAMTTOT*h* / 4 + RUCCSAMTTOT*i*) \* LRS*q,i*

Where:

RUCMWAMTTOT*h*  = RUCMWAMTRUCTOT*ruc,h*

RUCCSAMTTOT*i* = RUCCSAMT*ruc,i,q*

The above variables are defined as follows:

|  |  |  |
| --- | --- | --- |
| Variable | Unit | Definition |
| LARUCAMT*q,i* | $ | *RUC Make-Whole Uplift Charge*—The amount owed from the QSE based on Load Ratio Share, for the 15-minute Settlement Interval. |
| RUCMWAMTTOT*h* | $ | *RUC Make-Whole Amount Total*—The sum of RUC Make-Whole Payments for all RUC processes, including amounts for RMR Units, for the hour that includes the 15-minute Settlement Interval. |
| RUCMWAMTRUCTOT*ruc,h* | $ | *RUC Make-Whole Amount Total per RUC*—The sum of RUC Make-Whole Payments for a particular RUC process, including payments for RMR Units, for the hour that includes the 15-minute Settlement Interval. |
| RUCCSAMTTOT*i* | $ | *RUC Capacity Amount Total*—The sum of RUC Capacity-Short Charges for all QSEs and RUC processes, including payments for RMR Units, for the 15-minute Settlement Interval. |
| RUCCSAMT*ruc,i,q* | $ | *RUC Capacity-Short Amount*—The charge to a QSE, due to capacity shortfall for a particular RUC process, for the 15-minute Settlement Interval. |
| LRS*q,i* | none | *Load Ratio Share*—The ratio of Adjusted Metered Load to the total ERCOT Adjusted Metered Load for the 15-minute Settlement Interval. See Section 6.6.2, Load Ratio Share, item (2). |
| *i* | none | A 15-minute Settlement Interval. |
| *h* | none | The hour that includes the Settlement Interval *i*. |
| *ruc* | none | A RUC Process. |
| *q* | none | A QSE. |

***5.7.5 RUC Clawback Payment***

(1) ERCOT shall pay the revenues from all RUC Clawback Charges, including amounts for RMR Units, in a 15-minute Settlement Interval to all QSEs, on an LRS basis, as the RUC Clawback Payment. The RUC Clawback Payment is calculated as follows for each QSE for each 15-minute Settlement Interval:

LARUCCBAMT*q,i* = (-1) \* (RUCCBAMTTOT*h* / 4 \* LRS*q,i*)

Where:

RUCCBAMTTOT*h* = RUCCBAMT*q,r,h*

The above variables are defined as follows:

| Variable | Unit | Definition |
| --- | --- | --- |
| LARUCCBAMT*q,i* | $ | *RUC Clawback Payment*—The RUC make-whole clawback payment to a QSE to uplift RUC Make-Whole Clawback Charges received, for a 15-minute Settlement Interval. |
| RUCCBAMTTOT*h* | $ | *RUC Clawback Charge Total* —The sum of RUC Clawback Charges to all QSEs, including amounts for RMR Units, for the hour that includes the 15-minute Settlement Interval. |
| LRS*q,i* | none | *Load Ratio Share*—The LRS for the 15-minute Settlement Interval. See Section 6.6.2, Load Ratio Share. |
| RUCCBAMT*q,r,h* | $ | *RUC Clawback Charge*—The RUC Clawback Charge to the QSE *q* for the Resource *r*, for the hour that includes the 15-minute Settlement Interval. When one or more Combined Cycle Generation Resources are committed by RUC, a charge is made to the Combined Cycle Train for all RUC-committed Combined Cycle Generation Resources. |
| *q* | None | A QSE. |
| *i* | none | A 15-minute Settlement Interval. |
| *h* | none | The hour that includes the Settlement Interval *i*. |
| *r* | none | A RUC-committed Generation Resource. |

***5.7.6 RUC Decommitment Charge***

(1) ERCOT shall charge each QSE a RUC Decommitment Charge, on an LRS basis, all revenues paid as a result of RUC Decommitment Payments, including amounts for RMR Units. The RUC Decommitment Charge for a 15-minute Settlement Interval is calculated as follows:

LARUCDCAMT*q,i* = (-1) \* [(RUCDCAMTTOT*h* / 4) \* LRS*q,i*]

Where:

RUCDCAMTTOT*h* = RUCDCAMT*q,r,h*

The above variables are defined as follows:

| Variable | Unit | Definition |
| --- | --- | --- |
| LARUCDCAMT*q,i* | $ | *RUC Decommitment Charge*—The RUC Decommitment Charge to a QSE, for a 15-minute Settlement Interval. |
| RUCDCAMTTOT*h* | $ | *RUC Decommitment Charge Total*—The sum of RUC Decommitment Payments to all QSEs, including amounts for RMR Units, for the hour that includes the 15-minute Settlement Interval. |
| LRS*q,i* | none | *Load Ratio Share*—The LRS for the 15-minute Settlement Interval. See Section 6.6.2, Load Ratio Share. |
| RUCDCAMT*q,r,h* | $ | *RUC Decommitment Charge*—The RUC Decommitment Charge to the QSE *q* for the Resource *r*, for the hour that includes the 15-minute Settlement Interval. When one or more Combined Cycle Generation Resources are decommitted by RUC, payment is made to the Combined Cycle Train for all RUC-decommitted Combined Cycle Generation Resources. |
| *q* | None | A QSE. |
| *i* | none | A 15-minute Settlement Interval. |
| *h* | none | The hour that includes the Settlement Interval *i*. |
| *r* | None | A RUC-decommitted Generation Resource. |

***5.7.7 Settlement of Switchable Generation Resources (SWGRs) Operating in a Non-ERCOT Control Area***

(1) A QSE representing an SWGR operating in ERCOT due to a RUC instruction for an actual or anticipated Energy Emergency Alert (EEA) condition with a status of ONRUC is not eligible for RUC Settlement as described in Section 5.7.1, RUC Make-Whole Payment, and Section 5.7.2, RUC Clawback Charge, but may obtain compensation by submitting a Settlement and billing dispute pursuant to Section 6.6.12, Make-Whole Payment for Switchable Generation Resources Committed for Energy Emergency Alert (EEA).

5.8 Annual RUC Reporting Requirement

(1) ERCOT shall report to the Technical Advisory Committee (TAC), each January, an assessment of market impacts and Settlements for the aggregate Reliability Unit Commitment (RUC) activity, delineated by type of RUC instruction as follows:

(a) RUC instructions issued for irresolvable transmission system constraints;

(b) RUC instructions issued in anticipation of extreme cold weather/startup failures;

(c) RUC instructions issued for capacity;

(d) RUC instructions issued for expected Energy Storage Resource (ESR) energy consumption;

(e) RUC instructions issued for system inertia;

(f) RUC instructions issued to Resources receiving an Outage Schedule Adjustment (OSA); and

(g) A summary of RUC Settlements;

(i) RUC charges associated with RUC Make-Whole Amount Total per RUC, as defined in Section 5.7.4.1, RUC Capacity-Short Charge; and

(ii) RUC Shortfall Total, as defined in Section 5.7.4.1.1, Capacity Shortfall Ratio Share.