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| NPRR Number | [1236](https://www.ercot.com/mktrules/issues/NPRR1236) | NPRR Title | RTC+B Modifications to RUC Capacity Short Calculations |
| Date of Decision | August 8, 2024 |
| Action | Recommended Approval |
| Timeline  | Normal |
| Estimated Impacts | Cost/Budgetary: None Project Duration: Not applicable  |
| Proposed Effective Date | Upon system implementation of PR447, Real-Time Co-Optimization (RTC) |
| Priority and Rank Assigned | Not applicable |
| Nodal Protocol Sections Requiring Revision  | 5.7.4.1.1, Capacity Shortfall Ratio Share |
| Related Documents Requiring Revision/Related Revision Requests | None |
| Revision Description | This Nodal Protocol Revision Request (NPRR) reflects the modifications addressed in the Real-Time Co-optimization Plus Batteries (RTC+B) Task Force whitepaper to the Reliability Unit Commitment (RUC) Capacity Short calculations. These modifications were discussed in RTC+B Task Force meetings on February 21, March 19, and April 10, 2024 as part of RTC+B Task Force Issue No. 17 and were endorsed by TAC on April 15, 2024.This NPRR addresses limitations in the current RUC Capacity Short calculations by considering Ancillary Service sub-types and changes to the calculation process involving Regulation Down Service (Reg-Down). This NPRR also addresses changes required to align Protocol language with the recently-approved NPRR1204, Considerations of State of Charge with Real-Time Co-Optimization Implementation, as it relates to the RUC process.This NPRR implements an approach that continues the current policy (i.e., allocating costs in a manner consistent with cost causation) to first proportionally assign RUC Make Whole costs to Qualified Scheduling Entities (QSEs) that are determined to be short of capacity or Ancillary Service capability when the RUC decision was made and, if necessary, assign the remaining RUC Make Whole costs to QSEs based on Load Ratio Share (LRS). This NPRR continues to follow the TAC-approved RTCTF Key Principle No. 3 (12). |
| Reason for Revision |  [Strategic Plan](https://www.ercot.com/files/docs/2023/08/25/ERCOT-Strategic-Plan-2024-2028.pdf) Objective 1 – Be an industry leader for grid reliability and resilience [Strategic Plan](https://www.ercot.com/files/docs/2023/08/25/ERCOT-Strategic-Plan-2024-2028.pdf) Objective 2 - Enhance the ERCOT region’s economic competitiveness with respect to trends in wholesale power rates and retail electricity prices to consumers [Strategic Plan](https://www.ercot.com/files/docs/2023/08/25/ERCOT-Strategic-Plan-2024-2028.pdf) Objective 3 - Advance ERCOT, Inc. as an independent leading industry expert and an employer of choice by fostering innovation, investing in our people, and emphasizing the importance of our mission General system and/or process improvement(s) Regulatory requirements ERCOT Board/PUCT Directive*(please select ONLY ONE – if more than one apply, please select the ONE that is most relevant)* |
| Justification of Reason for Revision and Market Impacts | After the RTC+B initiative was restarted, the NPRRs approved while the project was on hold (e.g., NPRR1093, Load Resource Participation in Non-Spinning Reserve) were analyzed to determine if there were any gaps or impacts to the RTC+B initiative that needed to be addressed. In this process the following items were identified for the RUC Capacity Short calculation:1. Certain issues in the approved RTC+B Protocols:
	1. Ancillary Service sub-types are not currently considered. For example, a QSE with an RRS-PFR position can cover it with RRS-UFR or RRS-FFR, which should not be allowed.
	2. The logic for Reg-Down has a deficiency in which it is possible for the same Resource capacity to be used for Reg-Down as well as any other Up Ancillary Service types/sub-types (Reg-Up, RRS-FFR, RRS-UFR, RRS-PFR, ECRSS, or Non-Spin), which should not be permissible.
	3. The logic is included to account for an Energy Storage Resource (ESR) providing Ancillary Service when charging.
	4. An ASONPOSSNAP and ASONPOSADJ formula correction is necessary as well as related edits to the billing determinants ASOFFOFRSNAP and ASOFFOFRADJ.
2. The need to incorporate ESR State of Charge (SOC) considerations based on NPRR 1204 and associated discussions with stakeholders in 2023.
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| PRS Decision | On 7/18/24, PRS voted unanimously to recommend approval of NPRR1236 as revised by PRS. All Market Segments participated in the vote.On 8/8/24, PRS voted unanimously to endorse and forward to TAC the 7/18/24 PRS Report and 6/4/24 Impact Analysis for NPRR1236. All Market Segments participated in the vote. |
| Summary of PRS Discussion | On 7/18/24, ERCOT Staff provided an overview of NPRR1236 and proposed desktop edits to clarify the definition of a Settlement variable and correct a typographical error.On 8/8/24, participants reviewed the 6/4/24 Impact Analysis for NPRR1236. |

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| **Opinions** |
| Credit Review | ERCOT Credit Staff and the Credit Finance Sub Group (CFSG) have reviewed NPRR1236 and do not believe that it requires changes to credit monitoring activity or the calculation of liability. |
| Independent Market Monitor Opinion | To be determined |
| ERCOT Opinion | ERCOT supports approval of NPRR1236. |
| ERCOT Market Impact Statement | ERCOT Staff has reviewed NPRR1236 and believes the market impact for NPRR1236 addresses limitations in the current RTC grey-boxed language for RUC Capacity Short calculations by considering Ancillary Service sub-types, changes to the calculation process involving Reg-Down, correction to bill determinant formulas, and SOC of ESRs in alignment with NPRR1204. The changes in this NPRR were anticipated by the RTC+B project and are already being incorporated in the design. |

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| Market Segment | Not applicable |

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| **Comments Received** |
| Comment Author | **Comment Summary** |
| None |  |

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| Market Rules Notes |

None

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| Proposed Protocol Language Revision |

5.7.4.1.1 Capacity Shortfall Ratio Share

(1) In calculating the amount short for each QSE, 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, shall be considered the available capacity of the WGR or PVGR when determining responsibility for the corresponding RUC charges, regardless of the Real-Time output of the WGR or PVGR. Therefore, the HASLSNAP variable used below shall be equal to the WGRPP and PVGRPP described above.

(2) 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 HASLSNAP and HASLADJ variables used below equal to the HASLSNAP value for the Resource immediately before the decommitment instruction was given.

(3) In calculating the short amount for each QSE, if the High Ancillary Service Limit (HASL) for a Resource 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 HASL for that Resource is also credited to the QSE in the HASLADJ.

(4) 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.

(5) 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.

(6) 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*

(7) 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*)

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

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

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

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

(10) The RUC Shortfall in MW for one QSE for one 15-minute Settlement Interval, as measured at Real-Time, but including capacity from IRRs as seen in the RUC snapshot, is:

RUCSFADJ *ruc, q, i* = Max (0, ((RTAML *q, p, i*) \*4) – (HASLSNAP *ruc, q, r, h* + RUCCAPADJ *q, i*))

(11) The amount of capacity that a QSE had in Real-Time for a 15-minute Settlement Interval, excluding capacity from IRRs, is:

RUCCAPADJ *q, i* = HASLADJ *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*

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 according to the snapshot for the RUC process *ruc* for the 15-minute Settlement Interval *i*. |
| RUCSFADJ *ruc, q, i* | MW | *RUC Shortfall at Adjustment Period*—The QSE *q*’s Adjustment Period capacity shortfall, including capacity from IRRs as seen in the snapshot for the RUC process *ruc*, for the 15-minute Settlement Interval *i*. |
| RUCCAPCREDIT *q, i, z* | MW | *RUC Capacity Credit by QSE*—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*. |
| 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 COP and Trades Snapshot for the RUC process *ruc* for a 15-minute Settlement Interval *i*.  |
| HASLSNAP *q, r, h* | MW | *High Ancillary Services Limit at Snapshot*—The HASL of the Resource *r* represented by the QSE *q*, according to the COP and Trades Snapshot for the RUC process 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. |
| 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*. |
| DCIMPSNAP *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 snapshot for the RUC process for the hour that includes the 15-minute Settlement Interval *i*. |
| RUCCPSNAP *q, h* | MW | *RUC Capacity Purchase at Snapshot*—The QSE *q*’s capacity purchase, according to the COP and Trades Snapshot for the RUC process for the hour *h* that includes the 15-minute Settlement Interval. |
| RUCCSSNAP *q, h* | MW | *RUC Capacity Sale at Snapshot*—The QSE *q*’s capacity sale, according to the COP and Trades Snapshot for the RUC process for the hour *h* that includes the 15-minute Settlement Interval. |
| RUCCAPADJ *q, i* | MW | *RUC Capacity Snapshot during Adjustment Period*—The amount of the QSE *q*’s calculated capacity in the RUC according to the COP and Trades Snapshot, excluding capacity for IRRs, at the end of the Adjustment Period for a 15-minute Settlement Interval *i.* |
| HASLADJ *q, r, h* | MW | *High Ancillary Services Limit at Adjustment Period*—The HASL of a non-IRR *r* represented by the QSE *q*, according to the Adjustment Period snapshot, 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 Adjustment Period*—The QSE *q*’s capacity purchase, according to the Adjustment Period COP and Trades Snapshot for the hour *h* that includes the 15-minute Settlement Interval. |
| RUCCSADJ *q, h* | MW | *RUC Capacity Sale at Adjustment Period*—The QSE *q*’s capacity sale, according to the Adjustment Period COP and Trades Snapshot 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 *q, p, i* | MW | *QSE-to-QSE Energy Purchase by QSE by point*—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 COP and Trades Snapshot. |
| RTQQESSNAP *q, p, i* | MW | *QSE-to-QSE Energy Sale by QSE by point*—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 COP and Trades Snapshot. |
| RTQQEPADJ *q, p, i* | MW | *QSE-to-QSE Energy Purchase by QSE by point*—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 last COP and Trades Snapshot at the end of the Adjustment Period for that Settlement Interval. |
| RTQQESADJ *q, p, i* | MW | *QSE-to-QSE Energy Sale by QSE by point*—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 last COP and Trades Snapshot 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 that is QSE-committed or planning to operate as a Quick Start Generation Resource (QSGR) for the Settlement Interval as shown by the Resource Status of OFFQS in the COP and Trades Snapshot and/or Adjustment Period snapshot; or RUC-decommitted for the Settlement Interval (subject to paragraphs (1) and (2) above); or a Switchable Generation Resource (SWGR) 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 EEA condition. If the Settlement Interval is a RUCAC-Interval, *r* represents the Combined Cycle Generation Resource that was QSE-committed at the time the RUCAC was issued. |
| *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. |

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| ***[NPRR1009, NPRR1014, NPRR1029, NPRR1032, and NPRR1139: Replace applicable portions of Section 5.7.4.1.1 above with the following upon system implementation of the Real-Time Co-Optimization (RTC) project for NPRR1009; or upon system implementation for NPRR1014, NPRR1029, NPRR1032, or NPRR1139:]***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 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 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 Service (FFRS) position can be covered by the QSE’s portfolio of Energy Storage Resources (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, 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 Controllable Load Resources, 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 Controllable Load Resources, 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 Controllable Load Resources, 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 (SOC), 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 Hour Beginning Planned SOC 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 Hour Beginning Planned SOC 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*) +  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 Hour Beginning Planned SOC, MinSOC, MaxSOC and the difference in the Hour Beginning Planned SOC 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. |
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| 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 positive RRS 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.* |
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| 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 Hour Beginning Planned SOC, MinSOC, MaxSOC and the difference in the Hour Beginning Planned SOC 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*. |
| 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. |

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