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(b) For ~~RRS~~ECRS ~~Service~~, if applicable:

~~**RTAURRAMT** $_{q,r,p,i}$ = (-1) * 1/4 * **RTAURRR** $_{q,r,p}$ * (**RTSPP** $_{p,i}$ - **RTRSVPOR** - **RTRDP**)~~**RTAURECRAMTQSETOT** $_{q}$ = $\sum_{r}$ **RTAURECRAMT** $_{q,r,p,i}$

Where:

RTAU~~R~~ECRAMT $_{q,r,p,i}$ = (-1) * 1/4 * RTAU~~R~~ECRR $_{q,r,p}$ * (RTSPP $_{p,i}$ – RTRSVPOR - RTRDP)

RTRSVPOR = $\sum_{y}$ (RNWF $_{y}$ * RTORPA $_{y}$)

RTRDP = $\sum_{y}$ (RNWF $_{y}$ * RTORDPA $_{y}$)

RNWF $_{y}$ = TLMP $_{y}$ / $\sum_{y}$ TLMP $_{y}$

The above variables are defined as follows:

Variable	Unit	Description
RTAU~~R~~ECRAMTQSETOT $_{q}$	$	*Real-Time Assigned Un-Deployed ~~Response~~ ERCOT Contingency Reserve Service Payment Amount per QSE* - The payment to QSE *q* for a Real-Time un-deployed ~~RRS~~ECRS Ancillary Service Assignment.
RTAU~~R~~ECRAMT $_{q, r, p, i}$	$	*Real-Time Assigned Un-Deployed ERCOT Contingency Reserve Service~~Responsive Reserve~~ Payment Amount per Resource per QSE* - The payment to QSE *q* for a Real-Time un-deployed EC~~R~~RS Ancillary Service Assignment to Resource *r* at the Settlement Point *p* for the 15-minute Settlement Interval *i*.
RTAU~~R~~ECRR $_{q, r, p}$	MW	*Real-Time Assigned Un-Deployed ERCOT Contingency Reserve Service~~Responsive Reserve~~ Quantity per Resource per QSE* - The quantity of un-deployed ~~RRS~~ECRS assigned under a Watch to a QSE *q* for Resource *r* at the Settlement Point *p* for the hour. 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 per Settlement Point*— The Real-Time Settlement Point Price at the Settlement Point *p* for the 15-minute Settlement Interval *i*.
RTRSVPOR	$/MWh	*Real-Time Reserve Price for On-Line Reserves*—The Real-Time Reserve Price for On-Line Reserves for the 15-minute Settlement Interval.

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Variable	Unit	Description
RTRDP	$/MWh	*Real-Time On-Line Reliability Deployment Price*—The Real-Time price for the 15-minute Settlement Interval, reflecting the impact of reliability deployments on energy prices that is calculated from the Real-Time On-Line Reliability Deployment Price Adder.
$TLMP_y$	second	*Duration of SCED interval per interval*—The duration of the SCED interval *y*.
$RNWF_y$	none	*Resource Node Weighting Factor per interval*—The weight used in the Resource Node Settlement Point Price calculation for the portion of the SCED interval *y* within the 15-minute Settlement Interval.
$RTORPA_y$	$/MWh	*Real-Time On-Line Reserve Price Adder per interval*—The Real-Time On-Line Reserve Price Adder for the SCED interval *y*.
$RTORDPA_y$	$/MWh	*Real-Time On-Line Reliability Deployment Price Adder*—The Real-Time Price Adder that captures the impact of reliability deployments on energy prices for the SCED interval *y*.
q	none	A QSE.
r	none	A Generation Resource that was allocated ~~RRS~~ECRS Ancillary Service Assignment by the QSE.
p	none	A Settlement Point for the Resource Node that was allocated ~~RRS~~ECRS Ancillary Service Assignment by the QSE.
i	none	A 15-minute Settlement Interval in the Operating Hour.
y	none	A SCED interval in the 15-minute Settlement Interval.

(c) For ~~PFRS~~RRS, if applicable:

$$\mathbf{RTAU\sout{F}RRAMTQSETOT}_{q} = \sum_{r} \mathbf{RTAU\sout{F}RRAMT}_{q,r,p,i}$$

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$$\mathbf{\sout{RTAUPFRSAMT}_{q,r,p,i} = (-1) * 1/4 * \sout{RTAURPFRS}_{q,r,p} * (\sout{RTSPP}_{p,i} - \sout{RTRSVPOR})}$$

Where:

$$RTAU\sout{F}RRAMT_{q,r,p,i} = (-1) * 1/4 * RTAU\sout{RF}RRR_{q,r,p} * (RTSPP_{p,i} - RTRSVPOR \sout{- RTRDP})$$

$$RTRSVPOR = \sum_{y} (RNWF_y * RTORPA_y)$$

Field Code Changed

$$\sout{RTRDP = \sum_{y} (RNWF_y * RTORDPA_y)}$$

Field Code Changed

$$RNWF_y = TLMP_y / \sum_{y} TLMP_y$$

Field Code Changed

The above variables are defined as follows:

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Variable	Unit	Description
RTAU~~F~~RRAMTQSETOT $_q$	$	*Real-Time Assigned Un-Deployed ~~Frequency Response Service~~Responsive Reserve Payment Amount per QSE* - The payment to QSE *q* for a Real-Time un-deployed ~~FRS~~RRS Ancillary Service Assignment.
RTAU~~PF~~RR~~S~~AMT $_{q,r,p,i}$	$	*Real-Time Assigned Un-Deployed ~~Primary Frequency Response Service~~Responsive Reserve Payment Amount per Resource per QSE* - The payment to QSE *q* for a Real-Time un-deployed ~~PFRS~~RRS Ancillary Service Assignment ~~to~~for Resource *r* at the Settlement Point *p* for the 15-minute Settlement Interval *i*.
RTAU~~R~~~~PF~~RRR~~S~~ $_{q,r,p}$	MW	*Real-Time Assigned Un-Deployed ~~Primary Frequency Response Service~~Responsive Reserve Quantity per Resource per QSE* - The quantity of un-deployed ~~PFRS~~RRS assigned under a Watch to a QSE *q* for Resource *r* at the Settlement Point *p* for the hour. 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 per Settlement Point*— The Real-Time Settlement Point Price at the Settlement Point *p* for the 15-minute Settlement Interval *i*.
RTRSVPOR	$/MWh	*Real-Time Reserve Price for On-Line Reserves*—The Real-Time Reserve Price for On-Line Reserves for the 15-minute Settlement Interval.
~~RTRDP~~	~~$/MWh~~	~~*Real-Time On-Line Reliability Deployment Price*—The Real-Time price for the 15-minute Settlement Interval, reflecting the impact of reliability deployments on energy prices that is calculated from the Real-time On-Line Reliability Deployment Price Adder.~~
TLMP $_y$	Second	*Duration of SCED interval per interval*—The duration of the SCED interval *y*.
RNWF $_y$	None	*Resource Node Weighting Factor per interval*—The weight used in the Resource Node Settlement Point Price calculation for the portion of the SCED interval *y* within the 15-minute Settlement Interval.
RTORPA $_y$	$/MWh	*Real-Time On-Line Reserve Price Adder per interval*—The Real-Time On-Line Reserve Price Adder for the SCED interval *y*.
RTORDPA $_y$	$/MWh	*Real-Time On-Line Reliability Deployment Price Adder*—The Real-Time Price Adder that captures the impact of reliability deployments on energy prices for the SCED interval *y*.
q	none	A QSE.
r	none	A Generation Resource that was allocated ~~PFRS~~RRS Ancillary Service Assignment by the QSE.
p	none	A Settlement Point for the Resource Node that was allocated ~~PFRS~~RRS Ancillary Service Assignment by the QSE.
~~*I*~~*i*	none	A 15-minute Settlement Interval in the Operating Hour.
~~*Y*~~*y*	none	A SCED interval in the 15-minute Settlement Interval.

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6.7.2.1 Charges for Infeasible Ancillary Service Capacity Due to Transmission Constraints

(1) A charge to each QSE with Ancillary Service Supply Responsibility that is deemed infeasible by ERCOT as a result of a transmission constraints, whether or not a SASM is executed, is calculated as follows:

(a) For Reg-Up, if applicable:

$$\mathbf{RUINFQAMT}_{q} = \mathbf{MCPCRU}_{DAM} * \mathbf{RUINFQ}_{q}$$

The above variables are defined as follows:

Variable	Unit	Description
$RUINFQAMT_q$	$	*Reg-Up Infeasible Quantity Amount per QSE*— The charge to QSE *q* for its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for Reg-Up, for the hour.
$MCPCRU_{DAM}$	$/MW per hour	*Market Clearing Price for Capacity for Reg-Up in DAM*—The DAM MCPC for Reg-Up, for the hour.
$RUINFQ_q$	MW	*Reg-Up Infeasible Quantity per QSE* —QSE *q*'s total capacity associated with infeasible Ancillary Service Supply Responsibilities for Reg-Up, for the hour.
q	none	A QSE.

(b) For Reg-Down, if applicable:

$$\mathbf{RDINFQAMT}_{q} = \mathbf{MCPCRD}_{DAM} * \mathbf{RDINFQ}_{q}$$

The above variables are defined as follows:

Variable	Unit	Description
$RDINFQAMT_q$	$	*Reg-Down Infeasible Quantity Amount per QSE*— The charge to QSE *q* for its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for Reg-Down, for the hour.
$MCPCRD_{DAM}$	$/MW per hour	*Market Clearing Price for Capacity for Reg-Down in DAM*—The DAM MCPC for Reg-Down, for the hour.
$RDINFQ_q$	MW	*Reg-Down Infeasibility Quantity per QSE* —QSE *q*'s total capacity associated with infeasible Ancillary Service Supply Responsibilities for Reg-Down, for the hour.
q	none	A QSE.

(c) For ~~RRS~~ECRS, if applicable:

$$\mathbf{~~R~~ECRINFQAMT}_{q} = \mathbf{MCPC~~R~~ECR}_{DAM} * \mathbf{~~R~~ECRINFQ}_{q}$$

The above variables are defined as follows:

Variable	Unit	Description

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~~R~~ECRINFQAMT $_q$	$	*ERCOT Contingency Reserve Service~~Responsive Reserve Service~~ Infeasible Quantity Amount per QSE*—The charge to QSE *q* for its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for ~~RRS~~ECRS, for the hour.
MCPC~~R~~ECR $_{DAM}$	$/MW per hour	*Market Clearing Price for Capacity for ERCOT Contingency Reserve Service~~Responsive Reserve~~ in DAM*—The DAM MCPC for ~~RRS~~ECRS, for the hour.
~~R~~ECRINFQ $_q$	MW	*ERCOT Contingency Reserve Service~~Responsive Reserve~~ Infeasibility Quantity per QSE* —QSE *q*'s total capacity associated with infeasible Ancillary Service Supply Responsibilities for EC~~R~~RS, for the hour.
q	none	A QSE.

(d) For Non-Spin, if applicable:

NSINFQAMT $_q$ = MCPCNS $_{DAM}$ * NSINFQ $_q$

The above variables are defined as follows:

Variable	Unit	Description
NSINFQAMT $_q$	$	*Non-Spin Infeasible Quantity Amount per QSE*—The charge to QSE *q* for its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for Non-Spin, for the hour.
MCPCNS $_{DAM}$	$/MW per hour	*Market Clearing Price for Capacity for Non-Spin in DAM*—The DAM MCPC for Non-Spin, for the hour.
NSINFQ $_q$	MW	*Non-Spin Infeasibility Quantity per QSE*—QSE *q*'s total capacity associated with infeasible Ancillary Service Supply Responsibilities for Non-Spin, for the hour.
q	none	A QSE.

(e) For ~~FRS~~RRS, if applicable:

~~F~~RRINFQAMT $_q$ = MCPC~~F~~RR $_{DAM}$ * ~~F~~RRINFQ $_q$

The above variables are defined as follows:

Variable	Unit	Description
~~F~~RRINFQAMT $_q$	$	*~~Frequency Response Service~~Responsive Reserve Infeasible Quantity Amount per QSE*— The charge to QSE *q* for its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for ~~FRS~~RRS, for the hour.
MCPC~~F~~RR $_{DAM}$	$/MW per hour	*Market Clearing Price for Capacity for ~~Frequency Response Service~~Responsive Reserve in DAM*—The DAM MCPC for ~~FRS~~RRS, for the hour.
~~F~~RRINFQ $_q$	MW	*~~Frequency Response Service~~Responsive Reserve Infeasible Quantity per QSE* —QSE *q*'s total capacity associated with infeasible Ancillary Service Supply Responsibilities for ~~FRS~~RRS, for the hour.
q	none	A QSE.

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[NPRR841: Insert Section 6.7.2.2 below upon system implementation:]

6.7.2.2 Real-Time Adjustments to Day-Ahead Make Whole Payments due to Ancillary Services Infeasibility Charges

(1) ERCOT shall pay the QSE for which ERCOT calculates a charge for infeasible Ancillary Service capacity due to transmission constraints a Real-Time Day-Ahead Make-Whole Payment for an eligible Resource for each Operating Hour in a DAM commitment period.

(2) The guaranteed cost, energy revenue, and Ancillary Service revenue calculated for each Combined Cycle Generation Resource are each summed for the Combined Cycle Train, and the Real-Time Day-Ahead Make-Whole Amount is calculated for the Combined Cycle Train.

$$RTDAMWAMT_{q,r,p,h} = (-1)*\text{Max}(0, DAMGCOST_{q,r,p} + \sum_{h} DAEREV_{q,r,p,h} + \sum_{h} INFQAR_{q,r,p,h} + \sum_{h} DAASREV_{q,r,p,h} + \sum_{h} DAMWAMT_{q,r,p,h}) * ASINFQR_{q,r,p,h} / \sum_{h} ASINFQR_{q,r,p,h}$$

Where:

$$INFQAR_{q,r,p,h} = RUINFQAR_{q,r,p,h} + RDINFQAR_{q,r,p,h} + \underline{R}ECRINFQAR_{q,r,p,h} + NSINFQAR_{q,r,p,h} + \underline{F}RRINFQAR_{q,r,p,h}$$

And,

$$RUINFQAR_{q,r,p,h} = MCPCRU_{DAM} * RUINFQR_{q,r,p,h}$$

$$RDINFQAR_{q,r,p,h} = MCPCRD_{DAM} * RDINFQR_{q,r,p,h}$$

$$\underline{R}ECRINFQAR_{q,r,p,h} = MCPC\underline{R}ECR_{DAM} * \underline{R}ECRINFQR_{q,r,p,h}$$

$$NSINFQAR_{q,r,p,h} = MCPCNS_{DAM} * NSINFQR_{q,r,p,h}$$

$$\underline{F}RRINFQAR_{q,r,p,h} = MCPC\underline{F}RR_{DAM} * \underline{F}RRINFQR_{q,r,p,h}$$

$$ASINFQR_{q,r,p,h} = RUINFQR_{q,r,p,h} + RDINFQR_{q,r,p,h} + \underline{R}ECRINFQR_{q,r,p,h} +$$

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NSINFQR $_{q, r, p, h}$ +~~ERR~~INFQR $_{q, r, p, h}$

The above variables are defined as follows:

Variable	Unit	Description
RTDAMWAMT $_{q, r, p, h}$	$	*Real-Time Day-Ahead Make-Whole Payment Amount per QSE per Resource per Settlement Point per hour* —The Real-Time calculated payment to QSE *q* to make-whole the Startup Cost and energy costs of Resource *r* committed in the DAM at Resource Node *p* for the hour *h*. When a Combined Cycle Generation Resource is committed in the DAM, payment is made to the Combined Cycle Train for the DAM-committed Combined Cycle Generation Resource.
DAMGCOST $_{q, r, p}$	$	*Day-Ahead Market Guaranteed Amount per QSE per Resource per Settlement Point* — The sum of the Startup Cost and the operating energy costs of the DAM-committed Resource *r* at Resource Node *p* represented by QSE *q*, for the DAM-commitment period. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
DAEREV $_{q, r, p, h}$	$	*Day-Ahead Energy Revenue per QSE per Resource per Settlement Point per hour* —The revenue received in the DAM for Resource *r* at Resource Node *p* represented by QSE *q*, based on the DAM Settlement Point Price, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
INFQAR $_{q, r, p, h}$	$	*Infeasible Quantity Amount per QSE per Resource per Settlement Point per hour* —The dollar amount to QSE *q* for Resource *r* of its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibility, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
DAMWAMT $_{q, r, p, h}$	$	*Day-Ahead Make-Whole Payment per QSE per Resource per Settlement Point per hour* —The payment to QSE *q* to make-whole the Startup Cost and energy cost of Resource *r* committed in the DAM at Resource Node *p* for the hour *h*. When a Combined Cycle Generation Resource is committed in the DAM, payment is made to the Combined Cycle Train for the DAM-committed Combined Cycle Generation Resource.
DAASREV $_{q, r, h}$	$	*Day-Ahead Ancillary Service Revenue per QSE per Resource by hour*—The revenue received in the DAM for Resource *r* represented by QSE *q*, based on the MCPC for each Ancillary Service in the DAM, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
RUINFQAR $_{q, r, p, h}$	$	*Reg-Up Infeasible Quantity Amount per QSE per Resource per Settlement Point per hour* — The dollar amount to QSE *q*, for Resource *r*, for its capacity associated with infeasible deployment of Ancillary Service Supply Responsibility for Reg-Up, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
MCPCRU $_{DAM}$	$/MW per hour	*Market Clearing Price for Capacity for Reg-Up in DAM*—The DAM MCPC for Reg-Up for the hour.
RDINFQAR $_{q, r, p, h}$	$	*Reg-Down Infeasible Quantity Amount per QSE per Resource per Settlement Point per hour* — The dollar amount to QSE *q*, for Resource *r*, for its total capacity associated with infeasible deployment of Ancillary

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		Service Supply Responsibility for Reg-Down, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
MCPCRD $_{DAM}$	$/MW per hour	*Market Clearing Price for Capacity for Reg-Down in DAM*—The DAM MCPC for Reg-Down for the hour.
~~R~~ECRINFQAR $_{q, r, p, h}$	$	*ERCOT Contingency Reserve Service~~Responsive Reserve Service~~ Infeasible Quantity Amount per QSE per Resource per Settlement Point per hour* — The dollar amount to QSE *q*, for Resource *r*, for its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibility for EC~~R~~RS, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
MCPC~~R~~ECR $_{DAM}$	$/MW per hour	*Market Clearing Price for Capacity for ERCOT Contingency Reserve Service~~Responsive Reserve Service~~ in DAM*—The DAM MCPC for EC~~R~~RS for the hour.
NSINFQAR $_{q, r, p, h}$	$	*Non-Spin Infeasible Quantity Amount per QSE per Resource per Settlement Point per hour* — The dollar amount to QSE *q*, for Resource *r*, for its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibility for Non-Spin, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
MCPCNS $_{DAM}$	$/MW per hour	*Market Clearing Price for Capacity for Non-Spin Service in DAM*—The DAM MCPC for Non-Spin for the hour.
~~F~~RRINFQAR $_{q, r, p, h}$	$	*~~Frequency Response Service~~Responsive Reserve Infeasible Quantity Amount per QSE per Resource per Settlement Point per hour* — The dollar amount to QSE *q*, for Resource *r*, for its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibility for ~~FRS~~RRS, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
MCPC~~F~~RR $_{DAM}$	$/MW per hour	*Market Clearing Price for Capacity for ~~Frequency Response Service~~Responsive Reserve in DAM*—The DAM MCPC for ~~FRS~~RRS for the hour.
ASINFQR $_{q, r, p, h}$	MW	*Ancillary Service Infeasible Quantity per QSE per Resource per Settlement Point per hour* — The Resource *r* total capacity associated with infeasible Ancillary Service Supply Responsibility, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
RUINFQR $_{q, r, p, h}$	MW	*Reg-Up Infeasible Quantity per QSE per Resource per Settlement Point per hour* —The Resource *r* total capacity associated with infeasible Ancillary Service Supply Responsibility for Reg-Up, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
RDINFQR $_{q, r, p, h}$	MW	*Reg-Down Infeasible Quantity per QSE per Resource per Settlement Point per hour* — The Resource *r* total capacity associated with infeasible Ancillary Service Supply Responsibility for Reg-Down, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
~~R~~ECRINFQR $_{q, r, p, h}$	MW	*ERCOT Contingency Reserve Service~~Responsive Reserve~~ Infeasible Quantity per QSE per Resource per Settlement Point per hour* — The

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		Resource *r* total capacity associated with infeasible Ancillary Service Supply Responsibility for ECRRS, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
NSINFQR $_{q, r, p, h}$	MW	*Non-Spin Infeasible Quantity per QSE per Resource per Settlement Point per hour* — The Resource *r* total capacity associated with infeasible Ancillary Service Supply Responsibility for Non-Spin, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
~~FRRINFQR~~ $_{q, r, p, h}$	MW	~~*Frequency Response Service*~~*Responsive Reserve Infeasible Quantity per QSE per Resource per Settlement Point per hour* — The Resource *r* total capacity associated with infeasible Ancillary Service Supply Responsibility for ~~FRS~~RRS, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
h	none	An hour in the DAM-commitment period.
q	none	A QSE.
r	none	A DAM-committed Generation Resource.
p	none	A Resource Node Settlement Point.

(3) The total Real-Time Day-Ahead Make-Whole Payments to each QSE for Generation Resources for a given hour is calculated as follows:

$$RTDAMWAMTQSETOT_{q, h} = \sum_{r} RTDAMWAMT_{q, r, p, h}$$

And,

$$RTDAMWAMTTOT_{h} = \sum_{q} RTDAMWAMTQSETOT_{q, h}$$

The above variables are defined as follows:

Variable	Unit	Definition
RTDAMWAMTQSETOT $_{q, h}$	$	*Real-Time Day-Ahead Make-Whole Payment Amount per QSE per hour*—The Real-Time calculated payment to QSE *q* to make-whole the Startup Cost and energy costs of all Resources *r* committed in the DAM at Resource Node *p* for the hour *h*.
RTDAMWAMT $_{q, r, p, h}$	$	*Real-Time Day-Ahead Make-Whole Payment Amount per QSE per Resource per Settlement Point per hour* —The Real-Time calculated payment to QSE *q* to make-whole the Startup and energy costs of Resource *r* committed in the DAM at Resource Node *p* for the hour *h*. For a Combined Cycle Generation Resource is committed in the DAM, payment is made to the Combined Cycle Train for the DAM-committed Combined Cycle Generation Resource.
RTDAMWAMTTOT $_{h}$	$	*Real-Time Day-Ahead Make-Whole Payment Amount per hour*—The Real-Time calculated payment to all QSEs to make-whole the Startup and energy costs of all Resources *r* committed for the hour *h*.
h	none	An hour in the DAM-commitment period.
q	none	A QSE.
r	none	A DAM-committed Generation Resource.

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p	none	A Resource Node Settlement Point.

(4) For each QSE for which ERCOT calculates a Real-Time DAM Make-Whole payment an adjustment for each Ancillary Service is computed as follows:

$$RUMWINFA_{q,h} = \sum_{r} RTDAMWAMT_{q,r,p,h} * RUINFQR_{q,r,p,h} / ASINFQR_{q,r,p,h}$$

$$RDMWINFA_{q,h} = \sum_{r} RTDAMWAMT_{q,r,p,h} * RDINFQR_{q,r,p,h} / ASINFQR_{q,r,p,h}$$

$$\text{~~R~~ECRMWINFA}_{q,h} = \sum_{r} RTDAMWAMT_{q,r,p,h} * \text{~~R~~ECRINFQR}_{q,r,p,h} / ASINFQR_{q,r,p,h}$$

$$NSMWINFA_{q,h} = \sum_{r} RTDAMWAMT_{q,r,p,h} * NSINFQR_{q,r,p,h} / ASINFQR_{q,r,p,h}$$

$$\text{~~F~~RRMWINFA}_{q,h} = \sum_{r} RTDAMWAMT_{q,r,p,h} * \text{~~F~~RRINFQR}_{q,r,p,h} / ASINFQR_{q,r,p,h}$$

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The above variables are defined as follows:

Variable	Unit	Description
$RUMWINFA_{q,h}$	$	*Regulation Up Make-Whole Infeasible Amount per QSE per hour*— The total Real-Time calculated payment to QSE *q*, for its contribution of Regulation Up Ancillary Service, to make-whole the Startup and energy costs of all Resources committed in the DAM for the hour *h*.
$RDMWINFA_{q,h}$	$	*Regulation Down Make-Whole Amount per QSE per hour* — The total Real-Time calculated payment to QSE *q*, for its contribution of Reg-Down, to make-whole the Startup and energy costs of all Resources committed in the DAM for the hour *h*.
~~R~~ECRMWINFA$_{q,h}$	$	*ERCOT Contingency Reserve Service~~Responsive Reserve~~ Make-Whole Infeasible Amount per QSE per hour* — The total Real-Time calculated payment to QSE *q*, for its contribution of ECR~~R~~RS, to make-whole the Startup and energy costs of all Resources committed in the DAM for the hour *h*.
$NSMWINFA_{q,h}$	$	*Non-Spin Make-Whole Infeasible Amount per QSE per hour* — The total Real-Time calculated payment to QSE *q*, for its contribution of Non-Spin, to make-whole the Startup and energy costs of all Resources committed in the DAM for the hour *h*.
~~F~~RRMWINFA$_{q,h}$	$	*~~Frequency Response Service~~Responsive Reserve Make-Whole Infeasible Amount per QSE per hour* — The total Real-Time calculated payment to QSE *q*, for its contribution of ~~FRS~~RRS, to make-whole the Startup and energy costs of all Resources committed in the DAM for the hour *h*.
$RTDAMWAMT_{q,r,p,h}$	$	*Real-Time Day-Ahead Make-Whole Payment Amount per QSE per Resource per Settlement Point per hour* —The Real-Time calculated payment to QSE *q* to make-whole the Startup Cost and energy costs of Resource *r* committed in the DAM at Resource Node *p* for the hour *h*. When a Combined Cycle Generation Resource is committed in the DAM, payment is made to the Combined Cycle Train for the DAM-committed Combined Cycle Generation Resource.

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RUINFQR $_{q, r, p, h}$	MW	*Reg-Up Infeasible Quantity per QSE per Resource per Settlement Point per hour* —The Resource *r total* capacity associated with infeasible Ancillary Service Supply Responsibility for Reg-Up, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
RDINFQR $_{q, r, p, h}$	MW	*Reg-Down Infeasible Quantity per QSE per Resource per Settlement Point per hour* — The Resource *r* total capacity associated with infeasible Ancillary Service Supply Responsibility for Reg-Down, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
~~R~~ECRINFQR $_{q, r, p, h}$	MW	*ERCOT Contingency Reserve Service~~Responsive Reserve~~ Infeasible Quantity per QSE per Resource per Settlement Point per hour* — The Resource *r* total capacity associated with infeasible Ancillary Service Supply Responsibility for ECR~~R~~RS, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
NSINFQR $_{q, r, p, h}$	MW	*Non-Spin Infeasible Quantity per QSE per Resource per Settlement Point per hour* — The Resource *r* total capacity associated with infeasible Ancillary Service Supply Responsibility for Non-Spin, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
~~F~~RRINFQR $_{q, r, p, h}$	MW	*~~Frequency Response Service~~Responsive Reserve Infeasible Quantity per QSE per Resource per Settlement Point per hour* — The Resource *r* total capacity associated with infeasible Ancillary Service Supply Responsibility for ~~FRS~~RRS, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
ASINFQR $_{q, r, p, h}$	MW	*Ancillary Service Infeasible Quantity per QSE per Resource per Settlement Point per hour* — The Resource *r* total capacity associated with infeasible Ancillary Service Supply Responsibility, for the hour *h*. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
h	none	An hour in the DAM-commitment period.
Q	none	A QSE.
r	none	A DAM-committed Generation Resource.
p	none	A Resource Node Settlement Point.

6.7.3 Charges for Ancillary Service Capacity Replaced Due to Failure to Provide

(1) A charge to each QSE that fails on its Ancillary Service Supply Responsibility, whether or not a SASM is executed due to its failure to supply, is calculated based on the greatest of the MCPC in the Day-Ahead Market (DAM) or any SASM for the same Operating Hour. Included in the failed quantity is the charge to each QSE that reduces its Ancillary Service Supply Responsibility by an RSASM, which is calculated based on the cleared MCPC associated with the RSASM. By service, the charge to each QSE for a given Operating Hour is calculated as follows:

(a) The total charge of failure on Ancillary Service Supply Responsibility for Reg-Up by QSE, if applicable:

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RUFQAMTQSETOT $_q$ = **RUFQAMT** $_q$ + **RRUFQAMT** $_q$

Where:

RUFQAMT $_q$ = $(\underset{m}{Max}(\text{MCPCRU}_m) * \text{RUFQ}_q)$

RRUFQAMT $_q$ = MCPCRU $_{rs}$ * RRUFQ $_{q, rs}$

The above variables are defined as follows:

Variable	Unit	Description
RUFQAMTQSETOT $_q$	$	*Reg-Up Failure Quantity Amount per QSE*—The total charge to QSE *q* for its total capacity associated with failures and reconfiguration reductions on its Ancillary Service Supply Responsibility for Reg-Up, for the hour.
RRUFQAMT $_q$	$	*Reconfiguration Reg-Up Failure Quantity Amount per QSE*—The charge to QSE *q* for its total capacity associated with reconfiguration reductions on its Ancillary Service Supply Responsibility for Reg-Up, for the hour.
RUFQAMT $_q$	$	*Reg-Up Failure Quantity Amount per QSE*—The charge to QSE *q* for its total capacity associated with failures on its Ancillary Service Supply Responsibility for Reg-Up, for the hour.
MCPCRU $_m$	$/MW per hour	*Market Clearing Price for Capacity for Reg-Up by market*—The MCPC for Reg-Up in the market *m*, for the hour.
MCPCRU $_{rs}$	$/MW per hour	*Market Clearing Price for Capacity for Reg-Up by RSASM*—The MCPC for Reg-Up in the RSASM *rs*, for the hour.
RUFQ $_q$	MW	*Reg-Up Failure Quantity per QSE*—QSE *q* total capacity associated with failures on its Ancillary Service Supply Responsibility for Reg-Up, for the hour.
RRUFQ $_{q, rs}$	MW	*Reconfiguration Reg-Up Failure Quantity per QSE*—QSE *q* total capacity associated with reconfiguration reductions on its Ancillary Service Supply Responsibility for Reg-Up, for the hour.
rs	none	The RSASM for the given Operating Hour.
m	none	The DAM, SASM, or RSASM for the given Operating Hour.
q	none	A QSE.

(b) The total charge of failure on Ancillary Service Supply Responsibility for Reg-Down by QSE, if applicable:

RDFQAMTQSETOT $_q$ = **RDFQAMT** $_q$ + **RRDFQAMT** $_q$

Where:

RDFQAMT $_q$ = $(\underset{m}{Max}(\text{MCPCRD}_m) * \text{RDFQ}_q)$

RRDFQAMT $_q$ = MCPCRD $_{rs}$ * RRDFQ $_{q, rs}$

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The above variables are defined as follows:

Variable	Unit	Description
RDFQAMTQSETOT $_q$	$	*Reg-Down Failure Quantity Amount per QSE*—The total charge to QSE *q* for its total capacity associated with failures and reconfiguration reductions on its Ancillary Service Supply Responsibility for Reg-Down, for the hour.
RRDFQAMT $_q$	$	*Reconfiguration Reg-Down Failure Quantity Amount per QSE*—The charge to QSE *q* for its total capacity associated with reconfiguration reductions on its Ancillary Service Supply Responsibility for Reg-Down, for the hour.
RDFQAMT $_q$	$	*Reg-Down Failure Quantity Amount per QSE*—The charge to QSE *q* for its total capacity associated with failures on its Ancillary Service Supply Responsibility for Reg-Down, for the hour.
MCPCRD $_m$	$/MW per hour	*Market Clearing Price for Capacity for Reg-Down by market*—The MCPC for Reg-Down in the market *m*, for the hour.
MCPCRD $_{rs}$	$/MW per hour	*Market Clearing Price for Capacity for Reg-Down by RSASM*—The MCPC for Reg-Down in the RSASM *rs*, for the hour.
RDFQ $_q$	MW	*Reg-Down Failure Quantity per QSE*—QSE *q*'s total capacity associated with failures on its Ancillary Service Supply Responsibility for Reg-Down, for the hour.
RRDFQ $_{q, rs}$	MW	*Reconfiguration Reg-Down Failure Quantity per QSE*—QSE *q*'s total capacity associated with reconfiguration reductions on its Ancillary Service Supply Responsibility for Reg-Down, for the hour.
rs	none	The RSASM for the given Operating Hour.
m	none	The DAM, SASM, or RSASM for the given Operating Hour.
q	none	A QSE.

(c) The total charge of failure on Ancillary Service Supply Responsibility for ~~RRS~~ECRS by QSE, if applicable:

~~R~~ECRFQAMTQSETOT $_q$ = ~~R~~ECRFQAMT $_q$ + ~~R~~RECR~~R~~FQAMT $_q$

Where:

~~R~~ECRFQAMT $_q$ = ($\underset{m}{Max}$ (MCPC~~R~~ECR $_m$) * ~~R~~ECRFQ $_q$)

~~R~~RECR~~R~~FQAMT $_q$ = MCPC~~R~~ECR $_{rs}$ * ~~R~~RECR~~R~~FQ $_{q, rs}$

The above variables are defined as follows:

Variable	Unit	Description
~~R~~ECRFQAMTQSETOT $_q$	$	*ERCOT Contingency Reserve Service~~Responsive Reserve~~ Failure Quantity Amount per QSE*—The total charge to QSE *q* for its total capacity associated with failures and reconfiguration reductions on its Ancillary Service Supply Responsibility for ECR~~R~~S, for the hour.

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~~R~~RECR~~R~~FQAMT $_q$	$	*Reconfiguration ERCOT Contingency Reserve Service~~Responsive Reserve~~ Failure Quantity Amount per QSE*—The charge to QSE *q* for its total capacity associated with reconfiguration reductions on its Ancillary Service Supply Responsibility for ECR~~R~~RS, for the hour.
~~R~~ECRFQAMT $_q$	$	*ERCOT Contingency Reserve Service~~Responsive Reserve~~ Failure Quantity Amount per QSE*—The charge to QSE *q* for its total capacity associated with failures on its Ancillary Service Supply Responsibility for ECR~~R~~RS, for the hour.
MCPC~~R~~ECR $_m$	$/MW per hour	*Market Clearing Price for Capacity for ERCOT Contingency Reserve Service~~Responsive Reserve~~ per market*—The MCPC for ECR~~R~~RS in the market *m*, for the hour.
MCPC~~R~~ECR $_{rs}$	$/MW per hour	*Market Clearing Price for Capacity for ERCOT Contingency Reserve Service~~Responsive Reserve~~ per RSASM*—The MCPC for ~~RRS~~ECRS in the RSASM *rs*, for the hour.
~~R~~ECRFQ $_q$	MW	*ERCOT Contingency Reserve Service~~Responsive Reserve~~ Failure Quantity per QSE* - QSE *q*'s total capacity associated with failures on its Ancillary Service Supply Responsibility for ECR~~R~~RS, for the hour.
~~R~~RECR~~R~~FQ $_{q, rs}$	MW	*Reconfiguration ERCOT Contingency Reserve Service~~Responsive Reserve~~ Failure Quantity per QSE*—QSE *q*'s total capacity associated with reconfiguration reductions on its Ancillary Service Supply Responsibility for ECR~~R~~RS, for the hour.
rs	none	The RSASM for the given Operating Hour.
m	none	The DAM, SASM, or RSASM for the given Operating Hour.
q	none	A QSE.

(d) The total charge of failure on Ancillary Service Supply Responsibility for Non-Spin by QSE, if applicable:

NSFQAMTQSETOT $_q$ = **NSFQAMT** $_q$ + **RNSFQAMT** $_q$

Where:

NSFQAMT $_q$ = $(\underset{m}{Max}(\text{MCPCNS}_m) * \text{NSFQ}_q)$

RNSFQAMT $_q$ = MCPCNS $_{rs}$ * RNSFQ $_{q, rs}$

The above variables are defined as follows:

Variable	Unit	Description
NSFQAMTQSETOT $_q$	$	*Non-Spin Failure Quantity Amount per QSE*—The total charge to QSE *q* for its total capacity associated with failures and reconfiguration reductions on its Ancillary Service Supply Responsibility for Non-Spin, for the hour.
RNSFQAMT $_q$	$	*Reconfiguration Non-Spin Failure Quantity Amount per QSE*—The charge to QSE *q* for its total capacity associated with reconfiguration reductions on its Ancillary Service Supply Responsibility for Non-Spin, for the hour.
NSFQAMT $_q$	$	*Non-Spin Failure Quantity Amount per QSE*—The charge to QSE *q* for its total capacity associated with failures on its Ancillary Service Supply Responsibility for

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		Non-Spin, for the hour.
MCPCNS $_m$	$/MW per hour	*Market Clearing Price for Capacity for Non-Spin by market*—The MCPC for Non-Spin in the market *m*, for the hour.
MCPCNS $_{rs}$	$/MW per hour	*Market Clearing Price for Capacity for Non-Spin by RSASM*—The MCPC for Non-Spin in the RSASM *rs*, for the hour.
NSFQ $_q$	MW	*Non-Spin Failure Quantity per QSE*—QSE *q*'s total capacity associated with failures on its Ancillary Service Supply Responsibility for Non-Spin, for the hour.
RNSFQ $_{q, rs}$	MW	*Reconfiguration Non-Spin Failure Quantity per QSE*—QSE *q*'s total capacity associated with reconfiguration reductions on its Ancillary Service Supply Responsibility for Non-Spin, for the hour.
rs	none	The RSASM for the given Operating Hour.
m	none	The DAM, SASM, or RSASM for the given Operating Hour.
q	none	A QSE.

(e) The total charge of failure on Ancillary Service Supply Responsibility for ~~PFRS~~RRS by QSE, if applicable:

~~PFRRS~~FQAMTQSETOT $_q$ = ~~PFRRS~~FQAMT $_q$ + R~~PF~~RR~~S~~FQAMT $_q$

Where:

~~PF~~RR~~S~~FQAMT $_q$ = $\left(\underset{m}{Max}\left(MCPC~~PF~~RR~~S~~_m\right) * ~~PF~~RR~~S~~FQ_q\right)$

R~~PF~~RR~~S~~FQAMT $_q$ = MCPC~~PF~~RR~~S~~ $_{rs}$ * R~~PF~~RR~~S~~FQ $_{q, rs}$

The above variables are defined as follows:

Variable	Unit	Description
~~PF~~RR~~S~~FQAMTQSETOT $_q$	$	*~~Primary Frequency Response Service~~Responsive Reserve Failure Quantity Amount per QSE*—The total charge to QSE *q* for its total capacity associated with failures and reconfiguration reductions on its Ancillary Service Supply Responsibility for ~~PFRS~~RRS, for the hour.
R~~PF~~RR~~S~~FQAMT $_q$	$	*Reconfiguration ~~Primary Frequency Response Service~~Responsive Reserve Failure Quantity Amount per QSE*—The charge to QSE *q* for its total capacity associated with reconfiguration reductions on its Ancillary Service Supply Responsibility for ~~PFRS~~RRS, for the hour.
~~PF~~RR~~S~~FQAMT $_q$	$	*~~Primary Frequency Response Service~~Responsive Reserve Failure Quantity Amount per QSE*—The charge to QSE *q* for its total capacity associated with failures on its Ancillary Service Supply Responsibility for ~~PFRS~~RRS, for the hour.
MCPC~~PF~~RR~~S~~ $_m$	$/MW per hour	*Market Clearing Price for Capacity for ~~Primary Frequency Response Service~~Responsive Reserve per market*—The MCPC for ~~PFRS~~RRS in the market *m*, for the hour.
MCPC~~PF~~RR~~S~~ $_{rs}$	$/MW	*Market Clearing Price for Capacity for ~~Primary Frequency Response~~*

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	per hour	~~*Service*~~*Responsive Reserve per RSASM*—The MCPC for ~~PFRS~~RRS in the RSASM *rs*, for the hour.
~~PF~~RRS~~F~~Q *q*	MW	~~*Primary Frequency Response Service*~~*Responsive Reserve Failure Quantity per QSE* - QSE *q*'s total capacity associated with failures on its Ancillary Service Supply Responsibility for ~~PFRS~~RRS, for the hour.
RP~~F~~RRS~~F~~Q *q, rs*	MW	*Reconfiguration ~~Primary Frequency Response Service~~Responsive Reserve Failure Quantity per QSE*—QSE *q*'s total capacity associated with reconfiguration reductions on its Ancillary Service Supply Responsibility for ~~PFRS~~RRS, for the hour.
~~*Rrs*~~	none	The RSASM for the given Operating Hour.
~~*Mm*~~	none	The DAM, SASM, or RSASM for the given Operating Hour.
~~*Qq*~~	none	A QSE.

6.7.4 Adjustments to Cost Allocations for Ancillary Services Procurement

(1) Each QSE for which ERCOT purchases Ancillary Service capacity in the DAM, a SASM, or an RSASM, is charged for the QSE's share of the net costs incurred for each service. For each QSE, its share of the DAM costs has been calculated in Section 4.6.4, Settlement of Ancillary Services Procured in the DAM; its share of the net total costs incurred in the DAM, a SASM, or an RSASM less its DAM charge is calculated in this section.

(2) For Reg-Up, if applicable:

(a) The net total costs for Reg-Up for a given Operating Hour is calculated as follows:

RUCOSTTOT = (-1) * ($\sum_m$ (RTPCRUAMTTOT $_m$) + PCRUAMTTOT + RUFQAMTTOT + RUINFQAMTTOT)

Where:

Total payment of SASM- and RSASM-procured capacity for Reg-Up by market

RTPCRUAMTTOT $_m$ = $\sum_q$ RTPCRUAMT $_{q, m}$

Total payment of DAM-procured capacity for Reg-Up

PCRUAMTTOT = $\sum_q$ PCRUAMT $_q$

Total charge of failure on Ancillary Service Supply Responsibility for Reg-Up

RUFQAMTTOT = $\sum_q$ RUFQAMTQSETOT $_q$

Total payment of SASM- and RSASM-procured capacity for Reg-Up by QSE

RTPCRUAMTQSETOT $_q$ = $\sum_m$ RTPCRUAMT $_{q, m}$

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Total charge of infeasible Ancillary Service Supply Responsibility for Reg-Up

$$RUINFQAMTTOT = \sum_{q} RUINFQAMT_{q}$$

The above variables are defined as follows:

Variable	Unit	Description
RUCOSTTOT	$	*Reg-Up Cost Total*—The net total costs for Reg-Up for the hour.
$RTPCRUAMTTOT_{m}$	$	*Procured Capacity for Reg-Up Amount Total by market*—The total payments to all QSEs for the Ancillary Service Offers cleared in the market *m* for Reg-Up, for the hour.
$RTPCRUAMT_{q, m}$	$	*Procured Capacity for Reg-Up Amount per QSE by market*—The payment to QSE *q* for its Ancillary Service Offers cleared in the market *m* for Reg-Up, for the hour.
RUFQAMTTOT	$	*Reg-Up Failure Quantity Amount Total*—The total charges to all QSEs for their capacity associated with failures and reconfiguration reductions on their Ancillary Service Supply Responsibilities for Reg-Up, for the hour.
$RUFQAMTQSETOT_{q}$	$	*Reg-Up Failure Quantity Amount Total per QSE*—The charge to QSE *q* for its total capacity associated with failures and reconfiguration reductions on its Ancillary Service Supply Responsibility for Reg-Up, for the hour.
$RTPCRUAMTQSETOT_{q}$	$	*Procured Capacity for Reg-Up Amount Total per QSE*—The total payments to a QSE *q* in all SASMs and RSASMs for the Ancillary Service Offers cleared for Reg-Up, for the hour.
$PCRUAMT_{q}$	$	*Procured Capacity for Reg-Up Amount per QSE in DAM*—The DAM Reg-Up payment for QSE *q*, for the hour.
RUINFQAMTTOT	$	*Reg-Up Infeasible Quantity Amount Total* — The charge to all QSEs for their total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for Reg-Up, for the hour.
$RUINFQAMT_{q}$	$	*Reg-Up Infeasible Quantity Amount per QSE*—The total charge to QSE *q* for its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for Reg-Up, for the hour.
PCRUAMTTOT	$	*Procured Capacity for Reg-Up Amount Total in DAM*—The total of the DAM Reg-Up payments for all QSEs, for the hour.
q	none	A QSE.
m	none	An Ancillary Service market (SASM or RSASM) for the given Operating Hour.

[NPRR841: Replace paragraph (a) above with the following upon system implementation:]

(a) The net total costs for Reg-Up for a given Operating Hour is calculated as follows:

$$\mathbf{RUCOSTTOT = (-1) * (\sum_{m} (RTPCRUAMTTOT_{m}) + PCRUAMTTOT + RUFQAMTTOT + RUINFQAMTTOT + RUMWINFATOT)}$$

Where:

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Total payment of SASM- and RSASM-procured capacity for Reg-Up by market

$$RTPCRUAMTTOT_m = \sum_q RTPCRUAMT_{q,m}$$

Total payment of DAM-procured capacity for Reg-Up

$$PCRUAMTTOT = \sum_q PCRUAMT_q$$

Total charge of failure on Ancillary Service Supply Responsibility for Reg-Up

$$RUFQAMTTOT = \sum_q RUFQAMTQSETOT_q$$

Total payment of SASM- and RSASM-procured capacity for Reg-Up by QSE

$$RTPCRUAMTQSETOT_q = \sum_m RTPCRUAMT_{q,m}$$

Total charge of infeasible Ancillary Service Supply Responsibility for Reg-Up

$$RUINFQAMTTOT = \sum_q RUINFQAMT_q$$

Total Real-Time DAM Make-Whole Payment for Reg-Up

$$RUMWINFATOT = \sum_q RUMWINFA_{q,h}$$

The above variables are defined as follows:

Variable	Unit	Description
RUCOSTTOT	$	*Reg-Up Cost Total*—The net total costs for Reg-Up for the hour.
$RTPCRUAMTTOT_m$	$	*Procured Capacity for Reg-Up Amount Total by market*—The total payments to all QSEs for the Ancillary Service Offers cleared in the market *m* for Reg-Up, for the hour.
RUMWINFATOT	$	*Reg-Up Make-Whole Infeasible Amount total*— The total Real-Time calculated payment to all QSEs, for their contribution of Reg-Up, to make-whole the Startup and energy costs of all Resources committed in the DAM, for the hour.
$RUMWINFA_{q,h}$	$	*Reg-Up Make-Whole Infeasible Amount per QSE per hour*— The total Real-Time calculated payment to QSE *q*, for its contribution of Reg-Up, to make-whole the Startup and energy costs of all Resources committed in the DAM, for the hour *h*.
$RTPCRUAMT_{q,m}$	$	*Procured Capacity for Reg-Up Amount per QSE by market*—The payment to QSE *q* for its Ancillary Service Offers cleared in the market *m* for Reg-Up, for the hour.
RUFQAMTTOT	$	*Reg-Up Failure Quantity Amount Total*—The total charges to all QSEs for their capacity associated with failures and reconfiguration reductions on their Ancillary Service Supply Responsibilities for Reg-Up, for the hour.
$RUFQAMTQSETOT_q$	$	*Reg-Up Failure Quantity Amount Total per QSE*—The charge to QSE *q* for its total capacity associated with failures and reconfiguration reductions on its Ancillary Service Supply Responsibility for Reg-Up, for the hour.
$RTPCRUAMTQSETOT_q$	$	*Procured Capacity for Reg-Up Amount Total per QSE*—The total payments to a QSE *q* in all SASMs and RSASMs for the Ancillary Service Offers

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		cleared for Reg-Up, for the hour.
PCRUAMT $_q$	$	*Procured Capacity for Reg-Up Amount per QSE in DAM*—The DAM Reg-Up payment for QSE *q*, for the hour.
RUINFQAMTTOT	$	*Reg-Up Infeasible Quantity Amount Total* — The charge to all QSEs for their total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for Reg-Up, for the hour.
RUINFQAMT $_q$	$	*Reg-Up Infeasible Quantity Amount per QSE*—The total charge to QSE *q* for its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for Reg-Up, for the hour.
PCRUAMTTOT	$	*Procured Capacity for Reg-Up Amount Total in DAM*—The total of the DAM Reg-Up payments for all QSEs, for the hour.
q	none	A QSE.
m	none	An Ancillary Service market (SASM or RSASM) for the given Operating Hour.

(b) Each QSE's share of the net total costs for Reg-Up for the Operating Hour is calculated as follows:

$$\mathbf{RUCOST}_q = \mathbf{RUPR} * \mathbf{RUQ}_q$$

Where:

$$RUPR = RUCOSTTOT / RUQTOT$$

$$RUQTOT = \sum_q RUQ_q$$

$$RUQ_q = RUO_q - SARUQ_q$$

$$RUO_q = \sum_q (SARUQ_q + \sum_m (RTPCRU_{q,m}) + PCRU_q - RUFQ_q - RRUFQ_q) * HLRS_q$$

$$SARUQ_q = DASARUQ_q + RTSARUQ_q$$

The above variables are defined as follows:

Variable	Unit	Description
RUCOST $_q$	$	*Reg-Up Cost per QSE*—QSE *q*'s share of the net total costs for Reg-Up, for the hour.
RUPR	$/MW per hour	*Reg-Up Price*—The price for Reg-Up calculated based on the net total costs for Reg-Up, for the hour.
RUCOSTTOT	$	*Reg-Up Cost Total*—The net total costs for Reg-Up, for the hour. See item (2)(a) above.
RUQTOT	MW	*Reg-Up Quantity Total*—The sum of every QSE's Ancillary Service Obligation minus its self-arranged Reg-Up quantity in the DAM and any and all SASMs, for the hour.
RUQ $_q$	MW	*Reg-Up Quantity per QSE*—The QSE *q*'s Ancillary Service Obligation minus its self-arranged Reg-Up quantity in the DAM and any and all SASMs, for the hour.
RUO $_q$	MW	*Reg-Up Obligation per QSE*—The Ancillary Service Obligation of QSE *q*, for the

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		hour.
DASARUQ $_q$	MW	*Day-Ahead Self-Arranged Reg-Up Quantity per QSE*—The self-arranged Reg-Up quantity submitted by QSE *q* before 1000 in the Day-Ahead.
RTSARUQ $_q$	MW	*Self-Arranged Reg-Up Quantity per QSE for all SASMs*—The sum of all self-arranged Reg-Up quantities submitted by QSE *q* for all SASMs due to an increase in the Ancillary Service Plan per Section 4.4.7.1, Self-Arranged Ancillary Service Quantities.
RTPCRU $_{q, m}$	MW	*Procured Capacity for Reg-Up per QSE by market*—The MW portion of QSE *q*'s Ancillary Service Offers cleared in the market *m* to provide Reg-Up, for the hour.
RUFQ $_q$	MW	*Reg-Up Failure Quantity per QSE*—QSE *q*'s total capacity associated with failures on its Ancillary Service Supply Responsibility for Reg-Up, for the hour.
RRUFQ $_q$	MW	*Reconfiguration Reg-Up Failure Quantity per QSE*—QSE *q* total capacity associated with reconfiguration reductions on its Ancillary Service Supply Responsibility for Reg-Up, for the hour.
HLRS $_q$	none	*The Hourly Load Ratio Share calculated for QSE q for the hour*. See Section 6.6.2.4, QSE Load Ratio Share for an Operating Hour.
PCRU $_q$	MW	*Procured Capacity for Reg-Up per QSE in DAM*—The total Reg-Up capacity quantity awarded to QSE *q* in the DAM for all the Resources represented by the QSE, for the hour.
SARUQ $_q$	MW	*Total Self-Arranged Reg-Up Quantity per QSE for all markets*—The sum of all self-arranged Reg-Up quantities submitted by QSE *q* for DAM and all SASMs.
q	none	A QSE.
m	none	A SASM for the given Operating Hour.

(c) The adjustment to each QSE's DAM charge for the Reg-Up for the Operating Hour, due to changes during the Adjustment Period or Real-Time operations, is calculated as follows:

RTRUAMT $_q$ = RUCOST $_q$ – DARUAMT $_q$

The above variables are defined as follows:

Variable	Unit	Description
RTRUAMT $_q$	$	*Real-Time Reg-Up Amount per QSE*—The adjustment to QSE *q*'s share of the costs for Reg-Up, for the hour.
RUCOST $_q$	$	*Reg-Up Cost per QSE*—QSE *q*'s share of the net total costs for Reg-Up, for the hour.
DARUAMT $_q$	$	*Day-Ahead Reg-Up Amount per QSE*—QSE *q*'s share of the DAM cost for Reg-Up, for the hour.
q	none	A QSE.

(3) For Reg-Down, if applicable:

(a) The net total costs for Reg-Down for a given Operating Hour is calculated as follows:

RDCOSTTOT = (-1) * ($\sum_m$ (RTPCRDAMTTOT $_m$) + PCRDAMTTOT + RDFQAMTTOT + RDINFQAMTTOT)

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Where:

Total payment of SASM- and RSASM-procured capacity for Reg-Down by market

$$RTPCRDAMTTOT_{m} = \sum_{q} RTPCRDAMT_{q,m}$$

Total payment of DAM-procured capacity for Reg-Down

$$PCRDAMTTOT = \sum_{q} PCRDAMT_{q}$$

Total charge of failure on Ancillary Service Supply Responsibility for Reg-Down

$$RDFQAMTTOT = \sum_{q} RDFQAMTQSETOT_{q}$$

Total payment of SASM- and RSASM-procured capacity for Reg-Down by QSE

$$RTPCRDAMTQSETOT_{q} = \sum_{m} RTPCRDAMT_{q,m}$$

Total charge of infeasible Ancillary Service Supply Responsibility for Reg-Down

$$RDINFQAMTTOT = \sum_{q} RDINFQAMT_{q}$$

The above variables are defined as follows:

Variable	Unit	Description
RDCOSTTOT	$	*Reg-Down Cost Total*—The net total costs for Reg-Down, for the hour.
$RTPCRDAMTTOT_{m}$	$	*Procured Capacity for Reg-Down Amount Total by market*—The total payments to all QSEs for the Ancillary Service Offers cleared in the market *m* for Reg-Down, for the hour.
$RTPCRDAMT_{q, m}$	$	*Procured Capacity for Reg-Down Amount per QSE by market*—The payment to QSE *q* for its Ancillary Service Offers cleared in the market *m* for Reg-Down, for the hour.
RDFQAMTTOT	$	*Reg-Down Failure Quantity Amount Total*—The total charges to all QSEs for their capacity associated with failures on their Ancillary Service Supply Responsibilities for Reg-Down, for the hour.
$RDFQAMTQSETOT_{q}$	$	*Reg-Down Failure Quantity Amount Total per QSE*—The charge to QSE *q* for its total capacity associated with failures and reconfiguration reductions on its Ancillary Service Supply Responsibility for Reg-Down, for the hour.
$RTPCRDAMTQSETOT_{q}$	$	*Procured Capacity for Reg-Down Amount Total per QSE*—The total payments to a QSE *q* in all SASMs and RSASMs for the Ancillary Service Offers cleared for Reg-Down, for the hour.
$PCRDAMT_{q}$	$	*Procured Capacity for Reg-Down Amount per QSE for DAM*—The DAM Reg-Down payment for QSE *q*, for the hour.
PCRDAMTTOT	$	*Procured Capacity for Reg-Down Amount Total in DAM*—The total of the DAM Reg-Down payments for all QSEs for the hour.
RDINFQAMTTOT	$	*Reg-Down Infeasible Quantity Amount Total* — The charge to all QSEs for their total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for Reg-Down, for the hour.
$RDINFQAMT_{q}$	$	*Reg-Down Infeasible Quantity Amount per QSE*—The total charge to QSE *q* for its total capacity associated with infeasible deployment of its Ancillary Service Supply Responsibilities for Reg-Down, for the hour.
q	none	A QSE.

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Variable	Unit	Description
m	none	An Ancillary Service market (SASM or RSASM) for the given Operating Hour.

[NPRR841: Replace paragraph (a) above with the following upon system implementation:]

(a) The net total costs for Reg-Down for a given Operating Hour is calculated as follows:

$$\mathbf{RDCOSTTOT} = \mathbf{(-1) * (\sum_{m} (RTPCRDAMTTOT_{m}) + PCRDAMTTOT + RDFQAMTTOT + RDINFQAMTTOT + RDMWINFATOT)}$$

Where:

Total payment of SASM- and RSASM-procured capacity for Reg-Down by market

$$RTPCRDAMTTOT_{m} = \sum_{q} RTPCRDAMT_{q,m}$$

Total payment of DAM-procured capacity for Reg-Down

$$PCRDAMTTOT = \sum_{q} PCRDAMT_{q}$$

Total charge of failure on Ancillary Service Supply Responsibility for Reg-Down

$$RDFQAMTTOT = \sum_{q} RDFQAMTQSETOT_{q}$$

Total payment of SASM- and RSASM-procured capacity for Reg-Down by QSE

$$RTPCRDAMTQSETOT_{q} = \sum_{m} RTPCRDAMT_{q,m}$$

Total charge of infeasible Ancillary Service Supply Responsibility for Reg-Down

$$RDINFQAMTTOT = \sum_{q} RDINFQAMT_{q}$$

Total Real-Time Day-Ahead Make-Whole Payment for Reg-Down

$$RDMWINFATOT = \sum_{q} RDMWINFA_{q,h}$$

The above variables are defined as follows:

Variable	Unit	Description
RDCOSTTOT	$	*Reg-Down Cost Total*—The net total costs for Reg-Down, for the hour.
$RTPCRDAMTTOT_{m}$	$	*Procured Capacity for Reg-Down Amount Total by market*—The total payments to all QSEs for the Ancillary Service Offers cleared in the market *m* for Reg-Down, for the hour.
$RTPCRDAMT_{q,m}$	$	*Procured Capacity for Reg-Down Amount per QSE by market*—The payment to QSE *q* for its Ancillary Service Offers cleared in the market *m*

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		for Reg-Down, for the hour.
RDFQAMTTOT	$	*Reg-Down Failure Quantity Amount Total*—The total charges to all QSEs for their capacity associated with failures on their Ancillary Service Supply Responsibilities for Reg-Down, for the hour.
RDMWINFATOT	$	*Reg-Down Make-Whole Infeasible Amount total*— The total Real-Time calculated payment to all QSEs, for their contribution of Reg-Down, to make-whole the Startup and energy costs of all Resources committed in the DAM, for the hour.
$RDMWINFA_{q,h}$	$	*Reg-Down Make-Whole Infeasible Amount per QSE per hour*— The total Real-Time calculated payment to QSE *q*, for its contribution of Reg-Down, to make-whole the Startup and energy costs of all Resources committed in the DAM, for the hour *h*.
$RDFQAMTQSETOT_{q}$	$	*Reg-Down Failure Quantity Amount Total per QSE*—The charge to QSE *q* for its total capacity associated with failures and reconfiguration reductions on its Ancillary Service Supply Responsibility for Reg-Down, for the hour.
$RTPCRDAMTQSETOT_{q}$	$	*Procured Capacity for Reg-Down Amount Total per QSE*—The total payments to a QSE *q* in all SASMs and RSASMs for the Ancillary Service Offers cleared for Reg-Down, for the hour.
$PCRDAMT_{q}$	$	*Procured Capacity for Reg-Down Amount per QSE for DAM*—The DAM Reg-Down payment for QSE *q*, for the hour.
PCRDAMTTOT	$	*Procured Capacity for Reg-Down Amount Total in DAM*—The total of the DAM Reg-Down payments for all QSEs for the hour.
RDINFQAMTTOT	$	*Reg-Down Infeasible Quantity Amount Total* — The charge to all QSEs for their total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for Reg-Down, for the hour.
$RDINFQAMT_{q}$	$	*Reg-Down Infeasible Quantity Amount per QSE*—The total charge to QSE *q* for its total capacity associated with infeasible deployment of its Ancillary Service Supply Responsibilities for Reg-Down, for the hour.
q	none	A QSE.
m	none	An Ancillary Service market (SASM or RSASM) for the given Operating Hour.

(b) Each QSE's share of the net total costs for Reg-Down for the Operating Hour is calculated as follows:

$$\mathbf{RDCOST}_{q} = \mathbf{RDPR} * \mathbf{RDQ}_{q}$$

Where:

$$RDPR = RDCOSTTOT / RDQTOT$$

$$RDQTOT = \sum_{q} RDQ_{q}$$

$$RDQ_{q} = RDO_{q} - SARDQ_{q}$$

$$RDO_{q} = \sum_{q}(SARDQ_{q} + \sum_{m}(RTPCRD_{q,m}) + PCRD_{q} - RDFQ_{q} - RRDFQ_{q}) * HLRS_{q}$$

$$SARDQ_{q} = DASARDQ_{q} + RTSARDQ_{q}$$

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The above variables are defined as follows:

Variable	Unit	Description
RDCOST $_q$	$	*Reg-Down Cost per QSE*—QSE *q*'s share of the net total costs for Reg-Down, for the hour.
RDPR	$/MW per hour	*Reg-Down Price*—The price for Reg-Down calculated based on the net total costs for Reg-Down, for the hour.
RDCOSTTOT	$	*Reg-Down Cost Total*—The net total costs for Reg-Down, for the hour. See item (3)(a) above.
RDQTOT	MW	*Reg-Down Quantity Total*—The sum of every QSE's Ancillary Service Obligation minus its self-arranged Reg-Down quantity in the DAM and any and all SASMs for the hour.
RDQ $_q$	MW	*Reg-Down Quantity per QSE*—The QSE *q*'s Ancillary Service Obligation minus its self-arranged Reg-Down quantity in the DAM and any and all SASMs, for the hour.
RDO $_q$	MW	*Reg-Down Obligation per QSE*—The Ancillary Service Obligation of QSE *q*, for the hour.
DASARDQ $_q$	MW	*Self-Arranged Reg-Down Quantity per QSE for DAM*—The self-arranged Reg-Down quantity submitted by QSE *q* before 1000 in the Day-Ahead.
RTSARDQ $_q$	MW	*Self-Arranged Reg-Down Quantity per QSE for all SASMs*—The sum of all self-arranged Reg-Down quantities submitted by QSE *q* for all SASMs due to an increase in the Ancillary Service Plan per Section 4.4.7.1.
RTPCRD $_{q, m}$	MW	*Procured Capacity for Reg-Down per QSE by market*—The MW portion of QSE *q*'s Ancillary Service Offers cleared in the market *m* to provide Reg-Down, for the hour.
RDFQ $_q$	MW	*Reg-Down Failure Quantity per QSE*—QSE *q*'s total capacity associated with failures on its Ancillary Service Supply Responsibility for Reg-Down, for the hour.
RRDFQ $_q$	MW	*Reconfiguration Reg-Down Failure Quantity per QSE*—QSE *q*'s total capacity associated with reconfiguration reductions on its Ancillary Service Supply Responsibility for Reg-Down, for the hour.
HLRS $_q$		*The Hourly Load Ratio Share calculated for QSE q for the hour*. See Section 6.6.2.4.
PCRD $_q$	MW	*Procured Capacity for Reg-Down per QSE in DAM*—The total Reg-Down capacity quantity awarded to QSE *q* in the DAM for all the Resources represented by the QSE, for the hour.
SARDQ $_q$	MW	*Total Self-Arranged Reg-Down Quantity per QSE for all markets*—The sum of all self-arranged Reg-Down quantities submitted by QSE *q* for DAM and all SASMs.
q	none	A QSE.
m	none	An Ancillary Service market (SASM or RSASM) for the given Operating Hour.

(c) The adjustment to each QSE's DAM charge for the Reg-Down for the Operating Hour, due to changes during the Adjustment Period or Real-Time operations, is calculated as follows:

RTRDAMT $_q$ = RDCOST $_q$ – DARDAMT $_q$

The above variables are defined as follows:

Variable	Unit	Description
RTRDAMT $_q$	$	*Real-Time Reg-Down Amount per QSE*—The adjustment to QSE *q*'s share of the costs for Reg-Down, for the hour.

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RDCOST $_q$	$	*Reg-Down Cost per QSE*—QSE *q*'s share of the net total costs for Reg-Down, for the hour.
DARDAMT $_q$	$	*Day-Ahead Reg-Down Amount per QSE*—QSE *q*'s share of the DAM cost for Reg-Down, for the hour.
q	none	A QSE.

(4) For ~~RRS~~ECRS, if applicable:

(a) The net total costs for ~~RRS~~ECRS for a given Operating Hour is calculated as follows:

~~R~~ECRCOSTTOT = (-1) * ($\sum_m$ (RTPC~~R~~ECRAMTTOT $_m$) + PC~~R~~ECRAMTTOT + ~~R~~ECRFQAMTTOT + ~~R~~ECRINFQAMTTOT)

Where:

Total payment of SASM- and RSASM-procured capacity for ~~RRS~~ECRS by market

RTPC~~R~~ECRAMTTOT $_m$ = $\sum_q$ RTPC~~R~~ECRAMT $_{q, m}$

Total payment of DAM-procured capacity for ~~RRS~~ECRS

PC~~R~~ECRAMTTOT = $\sum_q$ PC~~R~~ECRAMT $_q$

Total charge of failure on Ancillary Service Supply Responsibility for ~~RRS~~ECRS

~~R~~ECRFQAMTTOT = $\sum_q$ ~~R~~ECRFQAMTQSETOT $_q$

Total payment of SASM- and RSASM-procured capacity ~~RRS~~ECRS Service by QSE

RTPC~~R~~ECRAMTQSETOT $_q$ = $\sum_m$ RTPC~~R~~ECRAMT $_{q, m}$

Total charge of infeasible Ancillary Service Supply Responsibility for ~~RRS~~ECRS

~~R~~ECRINFQAMTTOT = $\sum_q$ ~~R~~ECRINFQAMT $_q$

The above variables are defined as follows:

Variable	Unit	Description
~~R~~ECRCOSTTOT	$	*ERCOT Contingency Reserve Service~~Responsive Reserve~~ Cost Total*—The net total costs for ~~RRS~~ECRS, for the hour.
RTPC~~R~~ECRAMTTOT $_m$	$	*Procured Capacity for ERCOT Contingency Reserve Service~~Responsive Reserve~~ Amount Total by market*—The total payments to all QSEs for the Ancillary Service Offers cleared in the market *m* for ~~RRS~~ECRS, for the hour.
RTPC~~R~~ECRAMT $_{q, m}$	$	*Procured Capacity for ERCOT Contingency Reserve Service~~Responsive Reserve~~ Amount per QSE by market*—The payment to QSE *q* for its Ancillary Service Offers cleared in the market *m* for ~~RRS~~ECRS, for the hour.
~~R~~ECRFQAMTTOT	$	*ERCOT Contingency Reserve Service~~Responsive Reserve~~ Failure Quantity Amount Total*—The total charges to all QSEs for their capacity associated

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Variable	Unit	Description
		with failures and reconfiguration reductions on their Ancillary Service Supply Responsibilities for ~~RRS~~ECRS, for the hour.
~~R~~ECRFQAMTQSETOT $_q$	$	*ERCOT Contingency Reserve Service~~Responsive Reserve~~ Failure Quantity Amount Total per QSE*—The charge to QSE *q* for its total capacity associated with failures and reconfiguration reductions on its Ancillary Service Supply Responsibility for ~~RRS~~ECRS, for the hour.
RTPC~~R~~ECRAMTQSETOT $_q$	$	*Procured Capacity for ERCOT Contingency Reserve Service~~Responsive Reserve~~ Amount Total per QSE*—The total payments to a QSE *q* in all SASMs and RSASMs for the Ancillary Service Offers cleared for ~~RRS~~ECRS, for the hour.
PC~~R~~ECRAMT $_q$	$	*Procured Capacity for ERCOT Contingency Reserve Service~~Responsive Reserve~~ Amount per QSE for DAM*—The DAM EC~~R~~RS payment for QSE *q*, for the hour.
PC~~R~~ECRAMTTOT	$	*Procured Capacity for ~~Responsive Reserve~~ERCOT Contingency Reserve Service Amount Total in DAM*—The total of the DAM EC~~R~~RS payments for all QSEs, for the hour.
~~R~~ECRINFQAMTTOT	$	*ERCOT Contingency Reserve Service~~Responsive Reserve~~ Infeasible Quantity Amount Total* — The charge to all QSEs for their total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for EC~~R~~RS, for the hour.
~~R~~ECRINFQAMT $_q$	$	*ERCOT Contingency Reserve Service~~Responsive Reserve~~ Infeasible Quantity Amount per QSE*—The total charge to QSE *q* for its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for EC~~R~~RS, for the hour.
q	none	A QSE.
m	none	An Ancillary Service market (SASM or RSASM) for the given Operating Hour.

[NPRR841: Replace paragraph (a) above with the following upon system implementation:]

(a) The net total costs for EC~~R~~RS for a given Operating Hour is calculated as follows:

~~R~~ECRCOSTTOT = (-1) * ($\sum_m$ (RTPC~~R~~ECRAMTTOT $_m$) + PC~~R~~ECRAMTTOT + ~~R~~ECRFQAMTTOT + ~~R~~ECRINFQAMTTOT + ~~R~~ECRMWINFATOT)

Where:

Total payment of SASM- and RSASM-procured capacity for ~~RRS~~ECRS by market

RTPC~~R~~ECRAMTTOT $_m$ = $\sum_q$ RTPC~~R~~ECRAMT $_{q,m}$

Total payment of DAM-procured capacity for ~~RRS~~ECRS

PC~~R~~ECRAMTTOT = $\sum_q$ PC~~R~~ECRAMT $_q$

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Total charge of failure on Ancillary Service Supply Responsibility for ~~RRS~~ECRS

$$~~R~~ECRFQAMTTOT = \sum_{q} ~~R~~ECRFQAMTQSETOT_{q}$$

Total payment of SASM- and RSASM-procured capacity ~~RRS~~ECRS Service by QSE

$$RTPC~~R~~ECRAMTQSETOT_{q} = \sum_{m} RTPC~~R~~ECRAMT_{q,m}$$

Total charge of infeasible Ancillary Service Supply Responsibility for ~~RRS~~ECRS

$$~~R~~ECRINFQAMTTOT = \sum_{q} ~~R~~ECRINFQAMT_{q}$$

Total Real-Time Day-Ahead Make-Whole Payment for ~~RRS~~ECRS

$$~~R~~ECRMWINFATOT = \sum_{q} ~~R~~ECRMWINFA_{q,h}$$

The above variables are defined as follows:

Variable	Unit	Description
~~R~~ECRCOSTTOT	$	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Cost Total*—The net total costs for ~~RRS~~ECRS, for the hour.
RTPC~~R~~ECRAMTTOT $_{m}$	$	*Procured Capacity for ~~Responsive Reserve~~ERCOT Contingency Reserve Service Amount Total by market*—The total payments to all QSEs for the Ancillary Service Offers cleared in the market *m* for ~~RRS~~ECRS, for the hour.
RTPC~~R~~ECRAMT $_{q,m}$	$	*Procured Capacity for ~~Responsive Reserve~~ERCOT Contingency Reserve Service Amount per QSE by market*—The payment to QSE *q* for its Ancillary Service Offers cleared in the market *m* for ~~RRS~~ECRS, for the hour.
~~R~~ECRFQAMTTOT	$	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Failure Quantity Amount Total*—The total charges to all QSEs for their capacity associated with failures and reconfiguration reductions on their Ancillary Service Supply Responsibilities for ~~RRS~~ECRS, for the hour.
~~R~~ECRMWINFATOT	$	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Make-Whole Infeasible Amount total*— The total Real-Time calculated payment to all QSEs, for their contribution of ~~RRS~~ECRS, to make-whole the Startup and energy costs of all Resources committed in the DAM, for the hour.
~~R~~ECRMWINFA $_{q,h}$	$	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Make-Whole Infeasible Amount per QSE per hour*— The total Real-Time calculated payment to QSE *q*, for its contribution of ~~RRS~~ECRS, to make-whole the Startup and energy costs of all Resources committed in the DAM, for the hour *h*.
~~R~~ECRFQAMTQSETOT $_{q}$	$	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Failure Quantity Amount Total per QSE*—The charge to QSE *q* for its total capacity associated with failures and reconfiguration reductions on its Ancillary Service Supply Responsibility for ~~RRS~~ECRS, for the hour.
RTPC~~R~~ECRAMTQSETOT $_{q}$	$	*Procured Capacity for ~~Responsive Reserve~~ERCOT Contingency Reserve Service Amount Total per QSE*—The total payments to a QSE *q* in all SASMs and RSASMs for the Ancillary Service Offers cleared for ~~RRS~~ECRS, for the hour.
PC~~R~~ECRAMT $_{q}$	$	*Procured Capacity for ~~Responsive Reserve~~ERCOT Contingency Reserve*

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		Service Amount per QSE for DAM—The DAM ~~RRS~~ECRS payment for QSE *q*, for the hour.
PC~~R~~ECRAMTTOT	$	*Procured Capacity for ~~Responsive Reserve~~ERCOT Contingency Reserve Service Amount Total in DAM*—The total of the DAM ~~RRS~~ECRS payments for all QSEs, for the hour.
~~R~~ECRINFQAMTTOT	$	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Infeasible Quantity Amount Total* — The charge to all QSEs for their total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for ~~RRS~~ECRS, for the hour.
~~R~~ECRINFQAMT $_q$	$	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Infeasible Quantity Amount per QSE*—The total charge to QSE *q* for its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for ~~RRS~~ECRS, for the hour.
q	none	A QSE.
m	none	An Ancillary Service market (SASM or RSASM) for the given Operating Hour.

(b) Each QSE's share of the net total costs for ~~RRS~~ECRS for the Operating Hour is calculated as follows:

~~R~~ECRCOST $_q$ = ~~R~~ECRPR * ~~R~~ECRQ $_q$

Where:

~~R~~ECRPR = ~~R~~ECRCOSTTOT / ~~R~~ECRQTOT

~~R~~ECRQTOT = $\sum_q$ ~~R~~ECRQ $_q$

~~R~~ECRQ $_q$ = ~~R~~ECRO $_q$ – SA~~R~~ECRQ $_q$

~~R~~ECRO $_q$ = $\sum_q$ (SA~~R~~ECRQ$_q$ + $\sum_m$ (RTPC~~R~~ECR $_{q,m}$) + PC~~R~~ECR $_q$ – ~~R~~ECRFQ $_q$ – ~~R~~RECR~~R~~FQ $_q$) * HLRS $_q$

SA~~R~~ECRQ $_q$ = DASA~~R~~ECRQ $_q$ + RTSA~~R~~ECRQ $_q$

The above variables are defined as follows:

Variable	Unit	Description
~~R~~ECRCOST $_q$	$	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Cost per QSE*—QSE *q*'s share of the net total costs for ~~RRS~~ECRS, for the hour.
~~R~~ECRPR	$/MW per hour	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Price*—The price for ~~RRS~~ECRS calculated based on the net total costs for ~~RRS~~ECRS, for the hour.
~~R~~ECRCOSTTOT	$	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Cost Total*—The net total costs for ~~RRS~~ECRS, for the hour. See item (4)(a) above.
~~R~~ECRQTOT	MW	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Quantity Total*—The sum of every QSE's Ancillary Service Obligation minus its self-arranged ~~RRS~~ECRS quantity in the DAM and any and all SASMs for the hour.
~~R~~ECRQ $_q$	MW	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Quantity per QSE*—The QSE *q*'s Ancillary Service Obligation minus its self-arranged ~~RRS~~ECRS quantity in

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Variable	Unit	Description
		the DAM and any and all SASMs, for the hour.
~~R~~ECRO $_q$	MW	~~*Responsive Reserve*~~*ERCOT Contingency Reserve Service Obligation per QSE*—The Ancillary Service Obligation of QSE *q*, for the hour.
DASAECR~~R~~RQ $_q$	MW	*Day-Ahead Self-Arranged ~~Responsive Reserve~~ERCOT Contingency Reserve Service Quantity per QSE*—The self-arranged ~~RRS~~ECRS quantity submitted by QSE *q* before 1000 in the Day-Ahead.
RTSA~~R~~ECRQ $_q$	MW	*Self-Arranged ~~Responsive Reserve~~ERCOT Contingency Reserve Service Quantity per QSE for all SASMs*—The sum of all self-arranged ~~RRS~~ECRS quantities submitted by QSE *q* for all SASMs due to an increase in the Ancillary Service Plan per Section 4.4.7.1.
RTPC~~R~~ECR $_{q, m}$	MW	*Procured Capacity for ~~Responsive Reserve~~ERCOT Contingency Reserve Service per QSE by market*—The MW portion of QSE *q*'s Ancillary Service Offers cleared in the market *m* to provide ~~RRS~~ECRS, for the hour.
~~R~~ECRFQ $_q$	MW	~~*Responsive Reserve*~~*ERCOT Contingency Reserve Service Failure Quantity per QSE*—QSE *q*'s total capacity associated with failures on its Ancillary Service Supply Responsibility for ~~RRS~~ECRS, for the hour.
~~R~~RECR~~R~~FQ $_q$	MW	*Reconfiguration ~~Responsive Reserve~~ERCOT Contingency Reserve Service Failure Quantity per QSE*—QSE *q*'s total capacity associated with reconfiguration reductions on its Ancillary Service Supply Responsibility for ~~RRS~~ECRS, for the hour.
HLRS $_q$	none	*The Hourly Load Ratio Share calculated for QSE q for the hour*. See Section 6.6.2.4.
PC~~R~~ECR $_q$	MW	*Procured Capacity for ~~Responsive Reserve~~ERCOT Contingency Reserve Service per QSE in DAM*—The total ~~RRS~~ECRS capacity quantity awarded to QSE *q* in the DAM for all the Resources represented by the QSE, for the hour.
SA~~R~~ECRQ $_q$	MW	*Total Self-Arranged ~~Responsive Reserve~~ERCOT Contingency Reserve Service Quantity per QSE for all markets*—The sum of all self-arranged ~~RRS~~ECRS quantities submitted by QSE *q* for DAM and all SASMs.
q	none	A QSE.
m	none	An Ancillary Service market (SASM or RSASM) for the given Operating Hour.

(c) The adjustment to each QSE's DAM charge for the ~~RRS~~ECRS for the Operating Hour, due to changes during the Adjustment Period or Real-Time operations, is calculated as follows:

RT~~R~~ECRAMT $_q$ = ~~R~~ECRCOST $_q$ – DA~~R~~ECRAMT $_q$

The above variables are defined as follows:

Variable	Unit	Description
RT~~R~~ECRAMT $_q$	$	*Real-Time ~~Responsive Reserve~~ERCOT Contingency Reserve Service Amount per QSE*—The adjustment to QSE *q*'s share of the costs for ~~RRS~~ECRS, for the hour.
~~R~~ECRCOST $_q$	$	~~*Responsive Reserve*~~*ERCOT Contingency Reserve Service Cost per QSE*—QSE *q*'s share of the net total costs for ~~RRS~~ECRS, for the hour.
DA~~R~~ECRAMT $_q$	$	*Day-Ahead ~~Responsive Reserve~~ERCOT Contingency Reserve Service Amount per QSE*—QSE *q*'s share of the DAM cost for ~~RRS~~ECRS, for the hour.
q	none	A QSE.

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(5) For Non-Spin, if applicable:

(a) The net total costs for Non-Spin for a given Operating Hour is calculated as follows:

NSCOSTTOT = (-1) * (Σ_m (RTPCNSAMTTOT $_m$) + PCNSAMTTOT + NSFQAMTTOT + NSINFQAMTTOT)

Where:

Total payment of SASM- and RSASM-procured capacity for Non-Spin by market

$$RTPCNSAMTTOT_m = \Sigma_q RTPCNSAMT_{q,m}$$

Total payment of DAM-procured capacity for Non-Spin

$$PCNSAMTTOT = \Sigma_q PCNSAMT_q$$

Total charge of failure on Ancillary Service Supply Responsibility for Non-Spin

$$NSFQAMTTOT = \Sigma_q NSFQAMTQSETOT_q$$

Total payment of SASM- and RSASM-procured capacity for Non-Spin by QSE

$$RTPCNSAMTQSETOT_q = \Sigma_m RTPCNSAMT_{q,m}$$

Total charge of infeasible Ancillary Service Supply Responsibility for Non-Spin

$$NSINFQAMTTOT = \Sigma_q NSINFQAMT_q$$

The above variables are defined as follows:

Variable	Unit	Description
NSCOSTTOT	$	*Non-Spin Cost Total*—The net total costs for Non-Spin, for the hour.
RTPCNSAMTTOT $_m$	$	*Procured Capacity for Non-Spin Amount Total by market*—The total payments to all QSEs for the Ancillary Service Offers cleared in the market *m* for Non-Spin, for the hour.
RTPCNSAMT $_{q,m}$	$	*Procured Capacity for Non-Spin Amount per QSE by market*—The payment to QSE *q* for its Ancillary Service Offers cleared in the market *m* for Non-Spin, for the hour.
NSFQAMTTOT	$	*Non-Spin Failure Quantity Amount Total*—The total charges to all QSEs for their capacity associated with failures and reconfiguration reductions on their Ancillary Service Supply Responsibilities for Non-Spin, for the hour.
NSFQAMTQSETOT $_q$	$	*Non-Spin Failure Quantity Amount Total per QSE*—The charge to QSE *q* for its total capacity associated with failures and reconfiguration reductions on its Ancillary Service Supply Responsibility for Non-Spin, for the hour.
RTPCNSAMTQSETOT $_q$	$	*Procured Capacity for Non-Spin Amount Total per QSE*—The total payments to a QSE *q* in all SASMs and RSASMs for the Ancillary Service Offers cleared for Non-Spin, for the hour.

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Variable	Unit	Description
PCNSAMT $_q$	$	*Procured Capacity for Non-Spin Amount per QSE in DAM*—The DAM Non-Spin payment for QSE *q*, for the hour.
PCNSAMTTOT	$	*Procured Capacity for Non-Spin Amount Total in DAM*—The total of the DAM Non-Spin payments for all QSEs, for the hour.
NSINFQAMTTOT	$	*Non-Spin Infeasible Quantity Amount Total* — The charge to all QSEs for their total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for Non-Spin, for the hour.
NSINFQAMT $_q$	$	*Non-Spin Infeasible Quantity Amount per QSE*—The total charge to QSE *q* for its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for Non-Spin, for the hour.
q	none	A QSE.
m	none	An Ancillary Service market (SASM or RSASM) for the given Operating Hour.

[NPRR841: Replace paragraph (a) above with the following upon system implementation:]

(a) The net total costs for Non-Spin for a given Operating Hour is calculated as follows:

NSCOSTTOT = (-1) * ($\sum_m$ (RTPCNSAMTTOT $_m$) + PCNSAMTTOT + NSFQAMTTOT + NSINFQAMTTOT + NSMWINFATOT)

Where:

Total payment of SASM- and RSASM-procured capacity for Non-Spin by market

RTPCNSAMTTOT $_m$ = $\sum_q$ RTPCNSAMT $_{q,m}$

Total payment of DAM-procured capacity for Non-Spin

PCNSAMTTOT = $\sum_q$ PCNSAMT $_q$

Total charge of failure on Ancillary Service Supply Responsibility for Non-Spin

NSFQAMTTOT = $\sum_q$ NSFQAMTQSETOT $_q$

Total payment of SASM- and RSASM-procured capacity for Non-Spin by QSE

RTPCNSAMTQSETOT $_q$ = $\sum_m$ RTPCNSAMT $_{q,m}$

Total charge of infeasible Ancillary Service Supply Responsibility for Non-Spin

NSINFQAMTTOT = $\sum_q$ NSINFQAMT $_q$

Total Real-Time Day-Ahead Make-Whole Payment for Non-Spin

NPRR Comments

$$NSMWINFATOT = \sum_{q} NSMWINFA_{q,h}$$

The above variables are defined as follows:

Variable	Unit	Description
NSCOSTTOT	$	*Non-Spin Cost Total*—The net total costs for Non-Spin, for the hour.
RTPCNSAMTTOT $_m$	$	*Procured Capacity for Non-Spin Amount Total by market*—The total payments to all QSEs for the Ancillary Service Offers cleared in the market *m* for Non-Spin, for the hour.
RTPCNSAMT $_{q,m}$	$	*Procured Capacity for Non-Spin Amount per QSE by market*—The payment to QSE *q* for its Ancillary Service Offers cleared in the market *m* for Non-Spin, for the hour.
NSFQAMTTOT	$	*Non-Spin Failure Quantity Amount Total*—The total charges to all QSEs for their capacity associated with failures and reconfiguration reductions on their Ancillary Service Supply Responsibilities for Non-Spin, for the hour.
NSMWINFATOT	$	*Non Spin Make-Whole Infeasible Amount total*— The total Real-Time calculated payment to all QSEs, for their contribution of Non-Spin, to make-whole the Startup and energy costs of all Resources committed in the DAM, for the hour.
NSMWINFA $_{q,h}$	$	*Non Spin Make-Whole Infeasible Amount per QSE per hour*— The total Real-Time calculated payment to QSE *q*, for its contribution of Non-Spin, to make-whole the Startup and energy costs of all Resources committed in the DAM, for the hour *h*.
NSFQAMTQSETOT $_q$	$	*Non-Spin Failure Quantity Amount Total per QSE*—The charge to QSE *q* for its total capacity associated with failures and reconfiguration reductions on its Ancillary Service Supply Responsibility for Non-Spin, for the hour.
RTPCNSAMTQSETOT $_q$	$	*Procured Capacity for Non-Spin Amount Total per QSE*—The total payments to a QSE *q* in all SASMs and RSASMs for the Ancillary Service Offers cleared for Non-Spin, for the hour.
PCNSAMT $_q$	$	*Procured Capacity for Non-Spin Amount per QSE in DAM*—The DAM Non-Spin payment for QSE *q*, for the hour.
PCNSAMTTOT	$	*Procured Capacity for Non-Spin Amount Total in DAM*—The total of the DAM Non-Spin payments for all QSEs, for the hour.
NSINFQAMTTOT	$	*Non-Spin Infeasible Quantity Amount Total* — The charge to all QSEs for their total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for Non-Spin, for the hour.
NSINFQAMT $_q$	$	*Non-Spin Infeasible Quantity Amount per QSE*—The total charge to QSE *q* for its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for Non-Spin, for the hour.
q	none	A QSE.
m	none	An Ancillary Service market (SASM or RSASM) for the given Operating Hour.

(b) Each QSE's share of the net total costs for Non-Spin for the Operating Hour is calculated as follows:

$$\mathbf{NSCOST}_q = \mathbf{NSPR} * \mathbf{NSQ}_q$$

Where:

NPRR Comments

$$NSPR = NSCOSTTOT / NSQTOT$$

$$NSQTOT = \sum_{q} NSQ_{q}$$

$$NSQ_{q} = NSO_{q} - SANSQ_{q}$$

$$NSO_{q} = \sum_{q}(SANSQ_{q} + \sum_{m}(RTPCNS_{q,m}) + PCNS_{q} - NSFQ_{q} - RNSFQ_{q}) * HLRS_{q}$$

$$SANSQ_{q} = DASANSQ_{q} + RTSANSQ_{q}$$

The above variables are defined as follows:

Variable	Unit	Description
$NSCOST_{q}$	$	*Non-Spin Cost per QSE*—QSE *q*'s share of the net total costs for Non-Spin, for the hour.
NSPR	$/MW per hour	*Non-Spin Price*—The price for Non-Spin calculated based on the net total costs for Non-Spin, for the hour.
NSCOSTTOT	$	*Non-Spin Cost Total*—The net total costs for Non-Spin for the hour. See item (5)(a) above.
NSQTOT	MW	*Non-Spin Quantity Total*—The sum of every QSE's Ancillary Service Obligation minus its self-arranged Non-Spin quantity in the DAM and any and all SASMs, for the hour.
NSQ_{q}	MW	*Non-Spin Quantity per QSE*—The difference in QSE *q*'s Ancillary Service Obligation minus its self-arranged Non-Spin quantity in the DAM and any and all SASMs, for the hour.
NSO_{q}	MW	*Non-Spin Obligation per QSE*—The Ancillary Service Obligation of QSE *q*, for the hour.
$DASANSQ_{q}$	MW	*Day-Ahead Self-Arranged Non-Spin Quantity per QSE for DAM*—The self-arranged Non-Spin quantity submitted by QSE *q* before 1000 in the Day-Ahead.
$RTSANSQ_{q}$	MW	*Self-Arranged Non-Spin Quantity per QSE for all SASMs*—The sum of all self-arranged Non-Spin quantities submitted by QSE *q* for all SASMs due to an increase in the Ancillary Service Plan per Section 4.4.7.1.
$RTPCNS_{q,m}$	MW	*Procured Capacity for Non-Spin per QSE by market*—The MW portion of QSE *q*'s Ancillary Service Offers cleared in the market *m* to provide Non-Spin, for the hour.
$NSFQ_{q}$	MW	*Non-Spin Failure Quantity per QSE*—QSE *q*'s total capacity associated with failures on its Ancillary Service Supply Responsibility for Non-Spin, for the hour.
$RNSFQ_{q}$	MW	*Reconfiguration Non-Spin Failure Quantity per QSE*—QSE *q*'s total capacity associated with reconfiguration reductions on its Ancillary Service Supply Responsibility for Non-Spin, for the hour.
$HLRS_{q}$	none	*The Hourly Load Ratio Share calculated for QSE q for the hour*. See Section 6.6.2.4.
$PCNS_{q}$	MW	*Procured Capacity for Non-Spin Service per QSE in DAM*—The total Non-Spin capacity quantity awarded to QSE *q* in the DAM for all the Resources represented by the QSE, for the hour.
$SANSQ_{q}$	MW	*Total Self-Arranged Non-Spin Supplied Quantity per QSE for all markets*—The sum of all self-arranged Non-Spin quantities submitted by QSE *q* for DAM and all SASMs.
q	none	A QSE.

NPRR Comments

Variable	Unit	Description
m	none	An Ancillary Service market (SASM or RSASM) for the given Operating Hour.

(c) The adjustment to each QSE's DAM charge for the Non-Spin for the Operating Hour, due to changes during the Adjustment Period or Real-Time operations, is calculated as follows:

RTNSAMT $_q$ = NSCOST $_q$ – DANSAMT $_q$

The above variables are defined as follows:

Variable	Unit	Description
RTNSAMT $_q$	$	*Real-Time Non-Spin Amount per QSE*—The adjustment to QSE *q*'s share of the costs for Non-Spin, for the hour.
NSCOST $_q$	$	*Non-Spin Cost per QSE*—QSE *q*'s share of the net total costs for Non-Spin, for the hour.
DANSAMT $_q$	$	*Day-Ahead Non-Spin Amount per QSE*—QSE *q*'s share of the DAM cost for Non-Spin, for the hour.
q	none	A QSE.

(6) For ~~PFRS~~RRS, if applicable:

(a) The net total costs for ~~PFRS~~RRS for a given Operating Hour is calculated as follows:

~~PF~~RR~~S~~COSTTOT = (-1) * ($\sum_m$ (RTPC~~PF~~RR~~S~~AMTTOT $_m$) + PC~~PF~~RR~~S~~AMTTOT + ~~PF~~RR~~S~~FQAMTTOT + ~~PF~~RR~~S~~INFQAMTTOT)

Where:

Total payment of SASM- and RSASM-procured capacity for ~~PFRS~~RRS by market

RTPC~~PF~~RR~~S~~AMTTOT $_m$ = $\sum_q$ RTPC~~PF~~RR~~S~~AMT $_{q,m}$

Total payment of DAM-procured capacity for ~~PFRS~~RRS

PC~~PF~~RR~~S~~AMTTOT = $\sum_q$ PC~~PF~~RR~~S~~AMT $_q$

Total charge of failure on Ancillary Service Supply Responsibility for ~~PFRS~~RRS

~~PF~~RR~~S~~FQAMTTOT = $\sum_q$ ~~PF~~RR~~S~~FQAMTQSETOT $_q$

Total payment of SASM- and RSASM-procured capacity ~~PFRS~~RRS by QSE

RTPC~~PF~~RR~~S~~AMTQSETOT $_q$ = $\sum_m$ RTPC~~PF~~RR~~S~~AMT $_{q,m}$

Total charge of infeasible Ancillary Service Supply Responsibility for ~~PFRS~~RRS

NPRR Comments

$$PFRRSINFQAMTTOT = \sum_{q} PFRRSINFQAMT_{q}$$

Field Code Changed

The above variables are defined as follows:

Variable	Unit	Description
PFRRSCOSTTOT	$	*Primary Frequency Response Service*Responsive Reserve Cost Total—The net total costs for PFRSRRS, for the hour.
RTPCPFRRSAMTTOT $_m$	$	*Procured Capacity for Primary Frequency Response Service*Responsive Reserve Amount Total by market—The total payments to all QSEs for the Ancillary Service Offers cleared in the market *m* for PFRSRRS, for the hour.
RTPCPFRRSAMT $_{q, m}$	$	*Procured Capacity for Primary Frequency Response Service*Responsive Reserve Amount per QSE by market—The payment to QSE *q* for its Ancillary Service Offers cleared in the market *m* for PFRSRRS, for the hour.
PFRRSFQAMTTOT	$	*Primary Frequency Response Service*Responsive Reserve Failure Quantity Amount Total—The total charges to all QSEs for their capacity associated with failures and reconfiguration reductions on their Ancillary Service Supply Responsibilities for PFRSRRS, for the hour.
PFRRSFQAMTQSETOT $_q$	$	*Primary Frequency Response Service*Responsive Reserve Failure Quantity Amount Total per QSE—The charge to QSE *q* for its total capacity associated with failures and reconfiguration reductions on its Ancillary Service Supply Responsibility for PFRSRRS, for the hour.
RTPCPFRRSAMTQSETOT $_q$	$	*Procured Capacity for Primary Frequency Response Service*Responsive Reserve Amount Total per QSE—The total payments to a QSE *q* in all SASMs and RSASMs for the Ancillary Service Offers cleared for PFRSRRS, for the hour.
PCPFRRSAMT $_q$	$	*Procured Capacity for Primary Frequency Response Service*Responsive Reserve Amount per QSE for DAM—The DAM PFRSRRS payment for QSE *q*, for the hour.
PCPFRRSAMTTOT	$	*Procured Capacity for Primary Frequency Response Service*Responsive Reserve Amount Total in DAM—The total of the DAM PFRSRRS payments for all QSEs, for the hour.
PFRRSINFQAMTTOT	$	*Primary Frequency Response Service*Responsive Reserve Infeasible Quantity Amount Total — The charge to all QSEs for their total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for PFRSRRS, for the hour.
PFRRSUINFQAMT $_q$	$	*Primary Frequency Response Service*Responsive Reserve Infeasible Quantity Amount per QSE—The total charge to QSE *q* for its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for PFRSRRS, for the hour.
q	none	A QSE.
m	none	An Ancillary Service market (SASM or RSASM) for the given Operating Hour.

[NPRR841: Replace paragraph (a) above with the following upon system implementation:]

(a) The net total costs for ~~FRS~~RRS for a given Operating Hour is calculated as follows:

NPRR Comments

$$\text{FRRCOSTTOT} = (-1) * (\sum_{m} (\text{RTPCFRRAMTTOT}_{m}) + \text{PCFRRAMTTOT} + \text{FRRFQAMTTOT} + \text{FRRINFQAMTTOT} + \text{FRRMWINFATOT})$$

Where:

Total payment of SASM- and RSASM-procured capacity for FRSRRS by market

$$\text{RTPCFRRAMTTOT}_{m} = \sum_{q} \text{RTPCFRRAMT}_{q,m}$$

Total payment of DAM-procured capacity for FRSRRS

$$\text{PCFRRAMTTOT} = \sum_{q} \text{PCFRRAMT}_{q}$$

Total charge of failure on Ancillary Service Supply Responsibility for FRSRRS

$$\text{FRRFQAMTTOT} = \sum_{q} \text{FRRFQAMTQSETOT}_{q}$$

Total payment of SASM- and RSASM-procured capacity for FRSRRS by QSE

$$\text{RTPCFRRAMTQSETOT}_{q} = \sum_{m} \text{RTPCFRRAMT}_{q,m}$$

Total charge of infeasible Ancillary Service Supply Responsibility for FRSRRS

$$\text{FRRINFQAMTTOT} = \sum_{q} \text{FRRINFQAMT}_{q}$$

Total Real-Time Day-Ahead Make-Whole Payment for FRSRRS

$$\text{FRRMWINFATOT} = \sum_{q} \text{FRRMWINFA}_{q,h}$$

The above variables are defined as follows:

Variable	Unit	Description
FRRCOSTTOT	$	~~Frequency Response Service~~*Responsive Reserve Cost Total*—The net total costs for FRSRRS, for the hour.
RTPCFRRAMTTOT $_{m}$	$	*Procured Capacity for ~~Frequency Response Service~~Responsive Reserve Amount Total by market*—The total payments to all QSEs for the Ancillary Service Offers cleared in the market *m* for FRSRRS, for the hour.
RTPCFRRAMT $_{q,m}$	$	*Procured Capacity for ~~Frequency Response Service~~Responsive Reserve Amount per QSE by market*—The payment to QSE *q* for its Ancillary Service Offers cleared in the market *m* for FRSRRS, for the hour.
FRRFQAMTTOT	$	~~Frequency Response Service~~*Responsive Reserve Failure Quantity Amount Total*—The total charges to all QSEs for their capacity associated with failures and reconfiguration reductions on their Ancillary Service Supply Responsibilities for FRSRRS, for the hour.
FRRMWINFATOT	$	~~Frequency Response Service~~*Responsive Reserve Make-Whole Infeasible Amount total*— The total Real-Time calculated payment to all QSEs, for their contribution of FRSRRS, to make-whole the Startup and energy costs of all Resources committed in the DAM, for the hour.
FRRMWINFA $_{q,h}$	$	~~Frequency Response Service~~*Responsive Reserve Make-Whole Infeasible*

NPRR Comments

		Amount per QSE per hour—The total Real-Time calculated payment to QSE *q*, for its contribution of ~~FRS~~RRS, to make-whole the Startup and energy costs of all Resources committed in the DAM, for the hour *h*.
~~F~~RRFQAMTQSETOT $_q$	$	~~*Frequency Response Service*~~*Responsive Reserve Failure Quantity Amount Total per QSE*—The charge to QSE *q* for its total capacity associated with failures and reconfiguration reductions on its Ancillary Service Supply Responsibility for ~~FRS~~RRS, for the hour.
RTPC~~F~~RRAMTQSETOT $_q$	$	*Procured Capacity for* ~~*Frequency Response Service*~~*Responsive Reserve Amount Total per QSE*—The total payments to a QSE *q* in all SASMs and RSASMs for the Ancillary Service Offers cleared for ~~FRS~~RRS, for the hour.
PC~~F~~RRAMT $_q$	$	*Procured Capacity for* ~~*Frequency Response Service*~~*Responsive Reserve Amount per QSE in DAM*—The DAM ~~FRS~~RRS payment for QSE *q*, for the hour.
PC~~F~~RRAMTTOT	$	*Procured Capacity for* ~~*Frequency Response Service*~~*Responsive Reserve Amount Total in DAM*—The total of the DAM ~~FRS~~RRS payments for all QSEs, for the hour.
~~F~~RRINFQAMTTOT	$	~~*Frequency Response Service*~~*Responsive Reserve Infeasible Quantity Amount Total* — The charge to all QSEs for their total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for ~~FRS~~RRS, for the hour.
~~F~~RRINFQAMT $_q$	$	~~*Frequency Response Service*~~*Responsive Reserve Infeasible Quantity Amount per QSE*—The total charge to QSE *q* for its total capacity associated with infeasible deployment of Ancillary Service Supply Responsibilities for ~~FRS~~RRS, for the hour.
q	none	A QSE.
m	none	An Ancillary Service market (SASM or RSASM) for the given Operating Hour.

(b) Each QSE's share of the net total costs for ~~PFRS~~RRS for the Operating Hour is calculated as follows:

~~PF~~RR~~S~~COST $_q$ = ~~PF~~RR~~S~~PR * ~~PF~~RR~~S~~Q $_q$

Where:

~~PF~~RR~~S~~PR = ~~PF~~RR~~S~~COSTTOT / ~~PF~~RR~~S~~QTOT

~~PF~~RR~~S~~QTOT = $\sum_q$ ~~PF~~RR~~S~~Q $_q$

~~PF~~RR~~S~~Q $_q$ = ~~PF~~RR~~S~~O $_q$ – SA~~PF~~RR~~S~~Q $_q$

~~PF~~RR~~S~~O $_q$ = $\sum_q$ (SA~~PF~~RR~~S~~Q $_q$ + $\sum_m$ (RTPC~~PF~~RR~~S~~ $_{q,m}$) + PC~~PF~~RR~~S~~ $_q$ – ~~PF~~RR~~S~~FQ $_q$ – R~~PF~~RR~~S~~FQ $_q$) * HLRS $_q$

SA~~PF~~RR~~S~~Q $_q$ = DASA~~PF~~RR~~S~~Q $_q$ + RTSA~~PF~~RR~~S~~Q $_q$

NPRR Comments

The above variables are defined as follows:

Variable	Unit	Description
~~PFRRS~~COST $_q$	$	~~*Primary Frequency Response Service*~~*Responsive Reserve Cost per QSE*—QSE *q*'s share of the net total costs for ~~PFRS~~RRS, for the hour.
~~PFRRS~~PR	$/MW per hour	~~*Primary Frequency Response Service*~~*Responsive Reserve Price*—The price for ~~PFRS~~RRS calculated based on the net total costs for ~~PFRS~~RRS, for the hour.
~~PFRRS~~COSTTOT	$	~~*Primary Frequency Response Service*~~*Responsive Reserve Cost Total*—The net total costs for ~~PFRS~~RRS, for the hour. See item (~~4~~6)(a) above.
~~PFRRS~~QTOT	MW	~~*Primary Frequency Response Service*~~*Responsive Reserve Quantity Total*—The sum of every QSE's Ancillary Service Obligation minus its self-arranged ~~PFRS~~RRS quantity in the DAM and any and all SASMs for the hour.
~~PFRRS~~Q $_q$	MW	~~*Primary Frequency Response Service*~~*Responsive Reserve Quantity per QSE*—The QSE *q*'s Ancillary Service Obligation minus its self-arranged ~~PFRS~~RRS quantity in the DAM and any and all SASMs, for the hour.
~~PFRRS~~O $_q$	MW	~~*Primary Frequency Response Service*~~*Responsive Reserve Obligation per QSE*—The Ancillary Service Obligation of QSE *q*, for the hour.
DASA~~PFRRS~~Q $_q$	MW	*Day-Ahead Self-Arranged ~~Primary Frequency Response Service~~Responsive Reserve Quantity per QSE*—The self-arranged ~~PFRS~~RRS quantity submitted by QSE *q* before 1000 in the Day-Ahead.
RTSA~~PFRRS~~Q $_q$	MW	*Self-Arranged ~~Primary Frequency Response Service~~Responsive Reserve Quantity per QSE for all SASMs*—The sum of all self-arranged ~~PFRS~~RRS quantities submitted by QSE *q* for all SASMs due to an increase in the Ancillary Service Plan per Section 4.4.7.1.
RTPC~~PFRRS~~ $_{q,m}$	MW	*Procured Capacity for ~~Primary Frequency Response Service~~Responsive Reserve per QSE by market*—The MW portion of QSE *q*'s Ancillary Service Offers cleared in the market *m* to provide ~~PFRS~~RRS, for the hour.
~~PFRRS~~FQ $_q$	MW	~~*Primary Frequency Response Service*~~*Responsive Reserve Failure Quantity per QSE*—QSE *q*'s total capacity associated with failures on its Ancillary Service Supply Responsibility for ~~PFRS~~RRS, for the hour.
R~~PFRRS~~FQ $_q$	MW	*Reconfiguration ~~Primary Frequency Response Service~~Responsive Reserve Failure Quantity per QSE*—QSE *q*'s total capacity associated with reconfiguration reductions on its Ancillary Service Supply Responsibility for ~~PFRS~~RRS, for the hour.
HLRS $_q$	none	*The Hourly Load Ratio Share calculated for QSE q for the hour*. See Section 6.6.2.4.
PC~~PFRRS~~ $_q$	MW	*Procured Capacity for ~~Primary Frequency Response Service~~Responsive Reserve per QSE in DAM*—The total ~~PFRS~~RRS capacity quantity awarded to QSE *q* in the DAM for all the Resources represented by the QSE, for the hour.
SA~~PFRRS~~Q $_q$	MW	*Total Self-Arranged ~~Primary Frequency Response Service~~Responsive Reserve Quantity per QSE for all markets*—The sum of all self-arranged ~~PFRS~~RRS quantities submitted by QSE *q* for DAM and all SASMs.
q	none	A QSE.
m	none	An Ancillary Service market (SASM or RSASM) for the given Operating Hour.

(c) The adjustment to each QSE's DAM charge for the ~~PFRS~~RRS for the Operating Hour, due to changes during the Adjustment Period or Real-Time operations, is calculated as follows:

NPRR Comments

RTPFRRSAMT $_q$ = PFRRSCOST $_q$ – DAPFRRSAMT $_q$

The above variables are defined as follows:

Variable	Unit	Description
RTPFRRSAMT $_q$	$	*Real-Time ~~Primary Frequency Response Service~~Responsive Reserve Amount per QSE*—The adjustment to QSE *q*'s share of the costs for ~~PFRS~~RRS, for the hour.
PFRRSCOST $_q$	$	*~~Primary Frequency Response Service~~Responsive Reserve Cost per QSE*—QSE *q*'s share of the net total costs for ~~PFRS~~RRS, for the hour.
DAPFRRSAMT $_q$	$	*Day-Ahead ~~Primary Frequency Response Service~~Responsive Reserve Amount per QSE*—QSE *q*'s share of the DAM cost for ~~PFRS~~RRS, for the hour.
q	None	A QSE.

6.7.5 Real-Time Ancillary Service Imbalance Payment or Charge

Commented [CP5]: Please note NPRRs 885, 910, and 912 also propose revisions to this section.

(1) Based on the Real-Time On-Line Reliability Deployment Price Adders, Real-Time On-Line Reserve Price Adders and a Real-Time Off-Line Reserve Price Adders, ERCOT shall calculate Ancillary Service imbalance Settlement, which will make Resources indifferent to the utilization of their capacity for energy or Ancillary Service reserves, as set forth in this Section.

(2) The payment or charge to each QSE for Ancillary Service imbalance is calculated based on the price calculation set forth in paragraph (11) of Section 6.5.7.3, Security Constrained Economic Dispatch, and applied to the following amounts for each QSE:

(a) The amount of Real-Time Metered Generation from all Generation Resources, represented by the QSE for the 15-minute Settlement Interval;

(b) The amount of On-Line capacity based on the telemetered High Sustained Limit (HSL) for all On-Line Generation Resources, the telemetered consumption from Load Resources with a validated Ancillary Service Schedule for ~~RRS~~ECRS or ~~FRS~~RRS controlled by high-set under-frequency relay, and the capacity from Controllable Load Resources available to SCED;

(c) The amount of Ancillary Service Resource Responsibility for Reg-Up, ~~RRS~~ECRS, ~~FFRS~~RRS, and Non-Spin for all Generation and Load Resources represented by the QSE for the 15-minute Settlement Interval.

(3) Resources meeting one or more of the following conditions will be excluded from the amounts calculated pursuant to paragraphs (2)(a) and (b) above:

(a) Intermittent Renewable Resources (IRRs) excluding Wind-powered Generation Resources (WGRs);

[NPRR895: Delete paragraph (a) above upon system implementation and renumber accordingly.]

NPRR Comments

(b) Nuclear Resources;

(c) Resources with a telemetered ONTEST, STARTUP (except Resources with Non-Spin Ancillary Service Resource Responsibility greater than zero), or SHUTDOWN Resource Status excluding Resources telemetering both STARTUP Resource Status and greater than zero Non-Spin Ancillary Service Responsibility; or

(d) Resources with a telemetered net real power (in MW) less than 95% of their telemetered Low Sustained Limit (LSL) excluding Resources telemetering both STARTUP Resource Status and greater than zero Non-Spin Ancillary Service Responsibility.

(4) Reliability Must-Run (RMR) Units and Reliability Unit Commitment (RUC) Resources On-Line during the hour due to an ERCOT instruction, except for any RUC Resource committed by a RUC Dispatch Instruction where that Resource's QSE subsequently opted out of RUC Settlement pursuant to paragraph (11) of Section 5.5.2, Reliability Unit Commitment (RUC) Process, will be excluded from the amounts calculated for the 15-minute Settlement Interval pursuant to paragraphs (2)(a), (b), and (c) above.

[NPRR884: Replace paragraph (4) above with the following upon system implementation:]

(4) Reliability Must-Run (RMR) Units and Reliability Unit Commitment (RUC) Resources On-Line during the hour due to an ERCOT instruction, except for any RUC Resource committed by a RUC Dispatch Instruction where that Resource's QSE subsequently opted out of RUC Settlement pursuant to paragraph (12) of Section 5.5.2, Reliability Unit Commitment (RUC) Process, and any Combined Cycle Generation Resource that was RUC-committed from one On-Line configuration to a different configuration with additional capacity, as described in paragraph (3) of Section 5.5.2, will be excluded from the amounts calculated for the 15-minute Settlement Interval pursuant to paragraphs (2)(a), (b), and (c) above.

(5) The Real-Time Off-Line Reserve Capacity for the QSE (RTOFFCAP) shall be administratively set to zero when the SCED snapshot of the Physical Responsive Capability (PRC) is less than or equal to the PRC MW at which Energy Emergency Alert (EEA) Level 1 is initiated.

(6) Resources that have a Under Generation Volume (UGEN) greater than zero, and are not-exempt from a Base Point Deviation Charge, as set forth in Section 6.6.5, Base Point Deviation Charge, or are not already excluded in paragraphs (3) or (4) above, for the 15-minute Settlement Interval will have the UGEN amounts removed from the amounts calculated pursuant to paragraphs (2)(a) and (b) above.

(7) The payment or charge to each QSE for the Ancillary Service Imbalance for a given 15-minute Settlement Interval is calculated as follows:

NPRR Comments

$RTASIAMT_q$ = (-1) * [($RTASOLIMB_q$ * RTRSVPOR) + ($RTASOFFIMB_q$ * RTRSVPOFF)]

$RTRDASIAMT_q$ = (-1) * ($RTASOLIMB_q$ * RTRDP)

Where:

$RTASOLIMB_q$ = $RTOLCAP_q$ – [((SYS_GEN_DISCFACTOR * $RTASRESP_q$) * ¼) – $RTASOFF_q$ – $RTRUCNBBRESP_q$ – $RTCLRNSRESP_q$ – $RTRMRRESP_q$]

Where:

$RTASOFF_q$ = SYS_GEN_DISCFACTOR * $\sum_r \sum_p RTASOFFR_{q,r,p}$

$RTRUCNBBRESP_q$ = SYS_GEN_DISCFACTOR * $\sum_r RTRUCASA_{q,r}$ * ¼

$RTCLRNSRESP_q$ = SYS_GEN_DISCFACTOR * $\sum_r \sum_p RTCLRNSRESPR_{q,r,p}$

$RTRMRRESP_q$ = SYS_GEN_DISCFACTOR * $\sum_q \sum_r \sum_p$ (H<u>EC</u>~~R~~R$ADJ_{q,r,p}$ + H~~F~~R$RADJ_{q,r,p}$ + $HRUADJ_{q,r,p}$ + $HNSADJ_{q,r,p}$) * ¼

$RTOLCAP_q$ = ($RTOLHSL_q$ – $RTMGQ_q$ – SYS_GEN_DISCFACTOR * ($\sum_r \sum_p UGENA_{q,r,p}$)) + $RTCLRCAP_q$ + $RTNCLRCAP_q$

Where:

$RTNCLRCAP_q$ = Min (Max($RTNCLRNPC_q$ – $RTNCLRLPC_q$, 0.0), (RTNCLR<u>ECR</u>~~RR~~S$_q$ + RTNCLR~~FRS~~RRS$_q$) * 1.5)

RTNCLR<u>ECR</u>~~RR~~S$_q$ = SYS_GEN_DISCFACTOR * $\sum_r \sum_p$ RTNCLR<u>ECR</u>~~RR~~SR$_{q,r,p}$

<u>RTNCLR~~FRS~~RRS$_q$ = SYS_GEN_DISCFACTOR * $\sum_r \sum_p$ RTNCLR~~FRS~~RRSR$_{q,r,p}$</u>

$RTNCLRNPC_q$ = SYS_GEN_DISCFACTOR * $\sum_r \sum_p RTNCLRNPCR_{q,r,p}$

$RTNCLRLPC_q$ = SYS_GEN_DISCFACTOR * $\sum_r \sum_p RTNCLRLPCR_{q,r,p}$

$RTOLHSL_q$ = SYS_GEN_DISCFACTOR * $\sum_r \sum_p RTOLHSLRA_{q,r,p}$

NPRR Comments

$$RTMGQ_q = SYS\_GEN\_DISCFACTOR * \sum_r \sum_p RTMGA_{q,r,p}$$

If $RTMGA_{q,r,p} > RTOLHSLRA_{q,r,p}$

Then $RTMGA_{q,r,p} = RTOLHSLRA_{q,r,p}$

$$RTCLRCAP_q = RTCLRNPC_q - RTCLRLPC_q - RTCLRNS_q + RTCLRREG_q$$

Where:

$$RTCLRNPC_q = SYS\_GEN\_DISCFACTOR * \sum_r \sum_p RTCLRNPCR_{q,r,p}$$

$$RTCLRLPC_q = SYS\_GEN\_DISCFACTOR * \sum_r \sum_p RTCLRLPCR_{q,r,p}$$

$$RTCLRNS_q = SYS\_GEN\_DISCFACTOR * \sum_r \sum_p RTCLRNSR_{q,r,p}$$

$$RTCLRREG_q = SYS\_GEN\_DISCFACTOR * \sum_r \sum_p RTCLRREGR_{q,r,p}$$

$$RTRSVPOR = \sum_y (RNWF_y * RTORPA_y)$$

$$RTASOFFIMB_q = RTOFFCAP_q - (RTASOFF_q + RTCLRNSRESP_q)$$

$$RTOFFCAP_q = (SYS\_GEN\_DISCFACTOR * RTCST30HSL_q) + (SYS\_GEN\_DISCFACTOR * RTOFFNSHSL_q) + RTCLRNS_q$$

$$RTRSVPOFF = \sum_y (RNWF_y * RTOFFPA_y)$$

$$RTRDP = \sum_y (RNWF_y * RTORDPA_y)$$

$$RNWF_y = TLMP_y / \sum_y TLMP_y$$

The above variables are defined as follows:

Variable	Unit	Description
$RTASIAMT_q$	$	*Real-Time Ancillary Service Imbalance Amount*—The total payment or charge to QSE *q* for the Real-Time Ancillary Service imbalance associated with Operating Reserve Demand Curve (ORDC) for each 15-minute Settlement Interval.
$RTRDASIAMT_q$	$	*Real-Time Reliability Deployment Ancillary Service Imbalance Amount*—The total payment or charge to QSE *q* for the Real-Time Ancillary Service imbalance associated with Reliability Deployments for each 15-minute Settlement Interval.

NPRR Comments

Variable	Unit	Description
RTASOLIMB $_q$	MWh	*Real Time Ancillary Service On-Line Reserve Imbalance for the QSE*—The Real-Time Ancillary Service On-Line reserve imbalance for the QSE *q*, for each 15-minute Settlement Interval.
RTORPA $_y$	$/MWh	*Real-Time On-Line Reserve Price Adder per interval*—The Real-Time Price Adder for On-Line Reserves for the SCED interval *y*.
RTOFFPA $_y$	$/MWh	*Real-Time Off-Line Reserve Price Adder per interval*—The Real-Time Price Adder for Off-Line Reserves for the SCED interval *y*.
TLMP $_y$	second	*Duration of SCED interval per interval*—The duration of the SCED interval *y*.
RTRDP	$/MWh	*Real-Time On-Line Reliability Deployment Price*—The Real-Time price for the 15-minute Settlement Interval, reflecting the impact of reliability deployments on energy prices that is calculated from the Real-time On-Line Reliability Deployment Price Adder.
RTORDPA $_y$	$/MWh	*Real-Time On-Line Reliability Deployment Price Adder*—The Real-Time Price Adder that captures the impact of reliability deployments on energy prices for the SCED interval *y*.
RNWF $_y$	none	*Resource Node Weighting Factor per interval*—The weight used in the Resource Node Settlement Point Price calculation for the portion of the SCED interval *y* within the 15-minute Settlement Interval.
RTRSVPOR	$/MWh	*Real-Time Reserve Price for On-Line Reserves*—The Real-Time Reserve Price for On-Line Reserves for the 15-minute Settlement Interval.
RTRSVPOFF	$/MWh	*Real-Time Reserve Price for Off-Line Reserves*—The Real-Time Reserve Price for Off-Line Reserves for the 15-minute Settlement Interval.
RTOLCAP $_q$	MWh	*Real-Time On-Line Reserve Capacity for the QSE*—The Real-Time reserve capacity of On-Line Resources available for the QSE *q*, for the 15-minute Settlement Interval.
RTOLHSLRA $_{q, r, p}$	MWh	*Real-Time Adjusted On-Line High Sustained Limit for the Resource*—The Real-Time telemetered HSL for the Resource *r* represented by QSE *q* at Resource Node *p* that is available to SCED, integrated over the 15-minute Settlement Interval, and adjusted pursuant to paragraphs (3) and (4) above.
RTOLHSL $_q$	MWh	*Real-Time On-Line High Sustained Limit for the QSE*—The Real-Time telemetered HSL for all Generation Resources available to SCED, pursuant to paragraphs (3) and (4) above, integrated over the 15-minute Settlement Interval for the QSE *q*, discounted by the system-wide discount factor.
RTASRESP $_q$	MW	*Real-Time Ancillary Service Supply Responsibility for the QSE*—The Real-Time Ancillary Service Supply Responsibility for Reg-Up, ~~RRS~~ECRS, ~~PFRS~~RRS, and Non-Spin pursuant to Section 4.4.7.4, Ancillary Service Supply Responsibility, for all Generation and Load Resources for the QSE *q*, for the 15-minute Settlement Interval.
RTCLRCAP $_q$	MWh	*Real-Time Capacity from Controllable Load Resources for the QSE*—The Real-Time capacity and Reg-Up minus Non-Spin available from all Controllable Load Resources available to SCED for the QSE *q*, integrated over the 15-minute Settlement Interval.

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Variable	Unit	Description
RTNCLRCAP $_q$	MWh	*Real-Time Capacity from Non-Controllable Load Resources carrying ~~Responsive Reserve~~ERCOT Contingency Reserve ~~Service~~ or ~~Frequency Response Service~~Responsive Reserve for the QSE*—The Real-Time capacity for all Load Resources other than Controllable Load Resources that have a validated Real-Time ~~RRS~~ECRS or ~~FRS~~RRS Ancillary Service Schedule for the QSE q, integrated over the 15-minute Settlement Interval.
RTNCLRECR~~RRS~~ $_q$	MWh	*Real-Time Non-Controllable Load Resources ~~Responsive Reserve~~ERCOT Contingency Reserve ~~Service or Frequency Response~~ for the QSE*—The validated Real-Time telemetered ~~RRS~~ECRS ~~or FRS~~ Ancillary Service Supply Responsibility for all Load Resources other than Controllable Load Resources for QSE q discounted by the system-wide discount factor, integrated over the 15-minute Settlement Interval.
RTNCLRECR~~RRS~~SR $_{q, r, p}$	MWh	*Real-Time Non-Controllable Load Resource ~~Responsive Reserve~~ERCOT Contingency Reserve ~~Service or Frequency Response~~*—The validated Real-Time telemetered ~~RRS~~ECRS ~~or FRS~~ Ancillary Service Resource Responsibility for the Load Resource r (which is not a Controllable Load Resource) represented by QSE q at Resource Node p, integrated over the 15-minute Settlement Interval.
RTNCLR~~FRS~~RRS $_q$	MWh	*Real-Time Non-Controllable Load Resources ~~Frequency Response Service~~Responsive Reserve for the QSE*—The validated Real-Time telemetered ~~FRS~~RRS Ancillary Service Supply Responsibility for all Load Resources other than Controllable Load Resources for QSE q discounted by the system-wide discount factor, integrated over the 15-minute Settlement Interval.
RTNCLR~~FRS~~RRSR $_{q, r, p}$	MWh	*Real-Time Non-Controllable Load Resource ~~Frequency Response Service~~Responsive Reserve*—The validated Real-Time telemetered ~~FRS~~RRS Ancillary Service Resource Responsibility for the Load Resource r (which is not a Controllable Load Resource) represented by QSE q at Resource Node p, integrated over the 15-minute Settlement Interval.
RTNCLRNPCR $_{q, r, p}$	MWh	*Real-Time Non-Controllable Load Resource Net Power Consumption*—The Real-Time net real power consumption from the Load Resource r (which is not a Controllable Load Resource) represented by QSE q at Resource Node p that has a validated Real-Time ~~RRS~~ECRS or ~~FRS~~RRS Ancillary Service Schedule integrated over the 15-minute Settlement Interval.
RTNCLRLPCR $_{q, r, p}$	MWh	*Real-Time Non-Controllable Load Resource Low Power Consumption*—The Real-Time Low Power Consumption (LPC) from the Load Resource r (which is not a Controllable Load Resource) represented by QSE q at Resource Node p that has a validated Real-Time ~~RRS~~ECRS or ~~FRS~~RRS Ancillary Service Schedule integrated over the 15-minute Settlement Interval
RTNCLRNPC $_q$	MWh	*Real-Time Non-Controllable Load Resource Net Power Consumption for the QSE*—The Real-Time net real power consumption from all Load Resources other than Controllable Load Resources for QSE q that have a validated Real-Time ~~RRS~~ECRS or ~~FRS~~RRS Ancillary Service Schedule integrated over the 15-minute Settlement Interval discounted by the system-wide discount factor.

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Variable	Unit	Description
RTNCLRLPC $_q$	MWh	*Real-Time Non-Controllable Load Resource Low Power Consumption for the QSE*—The Real-Time LPC from all Load Resources other than Controllable Load Resources for QSE *q* that have a validated Real-Time ~~RRS~~ECRS or ~~FRS~~RRS Ancillary Service Schedule integrated over the 15-minute Settlement Interval discounted by the system-wide discount factor.
RTCLRNPCR $_{q, r, p}$	MWh	*Real-Time Net Power Consumption from the Controllable Load Resource*—The Real-Time net real power consumption from the Controllable Load Resource *r* represented by QSE *q* at Resource Node *p* available to SCED integrated over the 15-minute Settlement Interval.
RTCLRNPC $_q$	MWh	*Real-Time Net Power Consumption from Controllable Load Resources for the QSE*—The Real-Time net real power consumption from all Controllable Load Resources available to SCED integrated over the 15-minute Settlement Interval for the QSE *q* discounted by the system-wide discount factor.
RTCLRLPCR $_{q, r, p}$	MWh	*Real-Time Low Power Consumption for the Controllable Load Resource*—The Real-Time LPC from the Controllable Load Resource *r* represented by QSE *q* at Resource Node *p* available to SCED integrated over the 15-minute Settlement Interval.
RTCLRLPC $_q$	MWh	*Real-Time Low Power Consumption from Controllable Load Resources for the QSE*—The Real-Time LPC from Controllable Load Resources available to SCED integrated over the 15-minute Settlement Interval for the QSE *q* discounted by the system-wide discount factor.
RTCLRREG $_q$	MWh	*Real-Time Controllable Load Resources Regulation-Up Schedule for the QSE*—The Real-Time Reg-Up Ancillary Service Schedule from all Controllable Load Resources with Primary Frequency Response for the QSE *q*, integrated over the 15-minute Settlement Interval discounted by the system-wide discount factor.
RTCLRREGR $_{q, r, p}$	MWh	*Real-Time Controllable Load Resource Regulation-Up Schedule for the Resource*—The validated Real-Time Reg-Up Ancillary Service Schedule for the Controllable Load Resource *r* represented by QSE *q* at Resource Node *p* with Primary Frequency Response, integrated over the 15-minute Settlement Interval.
RTMGA $_{q, r, p}$	MWh	*Real-Time Adjusted Metered Generation per QSE per Settlement Point per Resource*—The adjusted metered generation, pursuant to paragraphs (3) and (4) above, of Generation Resource *r* represented by QSE *q* at Resource Node *p* in Real-Time for the 15-minute Settlement Interval. Where for a Combined Cycle Train, the Resource *r* is the Combined Cycle Train.
RTMGQ $_q$	MWh	*Real-Time Metered Generation per QSE*—The metered generation, discounted by the system-wide discount factor, of all generation Resources represented by QSE *q* in Real-Time for the 15-minute Settlement Interval, pursuant to paragraphs (3) and (4) above.
RTASOFFIMB $_q$	MWh	*Real-Time Ancillary Service Off-Line Reserve Imbalance for the QSE*—The Real-Time Ancillary Service Off-Line reserve imbalance for the QSE *q*, for each 15-minute Settlement Interval.
RTOFFCAP $_q$	MWh	*Real-Time Off-Line Reserve Capacity for the QSE*—The Real-Time reserve capacity of Off-Line Resources available for the QSE *q*, for the 15-minute Settlement Interval.

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Variable	Unit	Description
RTCST30HSL $_{q}$	MWh	*Real-Time Generation Resources with Cold Start Available in 30 Minutes*—The Real-Time telemetered HSLs of Generation Resources, excluding IRRs, that have telemetered an OFF Resource Status and can be started from a cold temperature state in 30 minutes for the QSE *q*, time-weighted over the 15-minute Settlement Interval.
RTOFFNSHSL $_{q}$	MWh	*Real-Time Generation Resources with Off-Line Non-Spin Schedule*—The Real-Time telemetered HSLs of Generation Resources that have telemetered an OFFNS Resource Status for the QSE *q*, time-weighted over the 15-minute Settlement Interval.
RTASOFFR $_{q, r, p}$	MWh	*Real-Time Ancillary Service Schedule for the Off-Line Generation Resource*—The validated Real-Time telemetered Ancillary Service Schedule for the Off-Line Generation Resource *r* represented by QSE *q* at Resource Node *p*, integrated over the 15-minute Settlement Interval.
RTASOFF $_{q}$	MWh	*Real-Time Ancillary Service Schedule for Off-Line Generation Resources for the QSE*—The Real-Time telemetered Ancillary Service Schedule for all Off-Line Generation Resources discounted by the system-wide discount factor for the QSE *q*, integrated over the 15-minute Settlement Interval.
HR<u>EC</u>RADJ $_{q, r, p}$	MW	*Ancillary Service Resource Responsibility Capacity for ~~Responsive Reserve~~<u>ERCOT Contingency Reserve Service</u> at Adjustment Period*—The ~~Responsive Reserve~~<u>ECRS</u> Ancillary Service Resource Responsibility for the Resource *r* represented by QSE *q* at Resource Node *p* as seen in the last Current Operating Plan (COP) and Trades Snapshot at the end of the Adjustment Period, for the hour that includes the 15-minute Settlement Interval.
<u>H~~F~~RRADJ $_{q, r, p}$</u>	<u>MW</u>	<u>*Ancillary Service Resource Responsibility Capacity for ~~Frequency Response Service~~Responsive Reserve at Adjustment Period*—The ~~FRS~~RRS Ancillary Service Resource Responsibility for the Resource *r* represented by QSE *q* at Resource Node *p* as seen in the last Current Operating Plan (COP) and Trades Snapshot at the end of the Adjustment Period, for the hour that includes the 15-minute Settlement Interval.</u>
HRUADJ $_{q, r, p}$	MW	*Ancillary Service Resource Responsibility Capacity for Reg-Up at Adjustment Period*—The Regulation Up Ancillary Service Resource Responsibility for the Resource *r* represented by QSE *q* at Resource Node *p* as seen in the last COP and Trades Snapshot at the end of the Adjustment Period, for the hour that includes the 15-minute Settlement Interval.
HNSADJ $_{q, r, p}$	MW	*Ancillary Service Resource Responsibility Capacity for Non-Spin at Adjustment Period*—The Non-Spin Ancillary Service Resource Responsibility for the Resource *r* represented by QSE *q* at Resource Node *p* as seen in the last COP and Trades Snapshot at the end of the Adjustment Period, for the hour that includes the 15-minute Settlement Interval.
RTRUCNBBRESP $_{q}$	MWh	*Real-Time RUC Ancillary Service Supply Responsibility for the QSE in Non-Buy-Back hours*—The Real-Time Ancillary Service Supply Responsibility for Reg-Up, ~~RRS~~<u>ECRS, ~~PFRS~~RRS,</u> and Non-Spin pursuant to the Ancillary Service awards, for the 15-minute Settlement Interval that falls within a RUC-Committed Hour, discounted by the system-wide discount factor for the QSE *q*.

NPRR Comments

Variable	Unit	Description
$RTRUCASA_{q, r}$	MW	*Real-Time RUC Ancillary Service Awards*—The Real-Time Ancillary Service award to the RUC Resource *r* for Reg-Up, ~~RRS~~ECRS, ~~PFRS~~RRS, and Non-Spin for the hour that includes the 15-minute Settlement Interval that falls within a RUC-Committed Hour for the QSE *q*.
$RTCLRNSRESP_{q}$	MWh	*Real-Time Controllable Load Resource Non-Spin Responsibility for the QSE*—The Real Time telemetered Non-Spin Ancillary Service Supply Responsibility for all Controllable Load Resources available to SCED discounted by the system-wide discount factor for the QSE *q*, integrated over the 15-minute Settlement Interval.
$RTCLRNSRESPR_{q, r, p}$	MWh	*Real-Time Controllable Load Resource Non-Spin Responsibility for the Resource*—The Real-Time telemetered Non-Spin Ancillary Service Resource Responsibility for the Controllable Load Resource *r* represented by QSE *q* at Resource Node *p* available to SCED, integrated over the 15-minute Settlement Interval.
$RTRMRRESP_{q}$	MWh	*Real-Time Ancillary Service Supply Responsibility for RMR Units represented by the QSE*—The Real-Time Ancillary Service Supply Responsibility as set forth in the end of the Adjustment Period COP for Reg-Up, ~~RRS~~ECRS, ~~PFRS~~RRS, and Non-Spin for all RMR Units discounted by the system-wide discount factor for the QSE *q*, integrated over the 15-minute Settlement Interval.
$RTCLRNSR_{q, r, p}$	MWh	*Real-Time Non-Spin Schedule for the Controllable Load Resource*—The validated Real Time telemetered Non-Spin Ancillary Service Schedule for the Controllable Load Resource *r* represented by QSE *q* at Resource Node *p*, integrated over the 15-minute Settlement Interval.
$RTCLRNS_{q}$	MWh	*Real-Time Non-Spin Schedule for Controllable Load Resources for the QSE*—The Real-Time telemetered Non-Spin Ancillary Service Schedule for all Controllable Load Resources for the QSE *q*, integrated over the 15-minute Settlement Interval discounted by the system-wide discount factor.
SYS_GEN_DISCFACTOR	none	*System-Wide Discount Factor* – The system-wide discount factor used to discount inputs used in the calculation of Real-Time Ancillary Services Imbalance payment or charge is calculated as the average of the currently approved Reserve Discount Factors (RDFs) applied to the temperatures from the current Season from the year prior.
$UGEN_{q, r, p}$	MWh	*Under Generation Volumes per QSE per Settlement Point per Resource*—The amount under-generated by the Generation Resource *r* represented by QSE *q* at Resource Node *p* for the 15-minute Settlement Interval.
$UGENA_{q, r, p}$	MWh	*Adjusted Under Generation Volumes per QSE per Settlement Point per Resource*—The amount under-generated by the Generation Resource *r* represented by QSE *q* at Resource Node *p* for the 15-minute Settlement Interval adjusted pursuant to paragraph (6) above.
r	none	A Generation or Load Resource.
y	none	A SCED interval in the 15-minute Settlement Interval. The summation is over the total number of SCED runs that cover the 15-minute Settlement Interval.
q	none	A QSE.

NPRR Comments

Variable	Unit	Description
p	none	A Resource Node Settlement Point.

(8) The payment to each QSE for the Ancillary Service reserves associated with RUC Resources that have received a RUC Dispatch to provide Ancillary Services in which the 15-minute Settlement Interval is part of a RUC Buy-Back Hour based on the RUC opt out provision set forth in paragraph (11) of Section 5.5.2 for a given 15-minute Settlement Interval is calculated as follows:

RTRUCRSVAMT $_q$ = (-1) * (RTRUCRESP $_q$ * RTRSVPOR)

RTRDRUCRSVAMT $_q$ = (-1) * (RTRUCRESP $_q$ * RTRDP)

Where:

$$RTRUCRESP_q = \sum_r RTRUCASA_{q,r} * ¼$$

The above variables are defined as follows:

Variable	Unit	Description
RTRUCRSVAMT $_q$	$	*Real-Time RUC Ancillary Service Reserve Amount*—The total payment to QSE *q* for the Real-Time RUC Ancillary Service Reserve payment associated with ORDC for each 15-minute Settlement Interval.
RTRDRUCRSVAMT $_q$	$	*Real-Time Reliability Deployment RUC Ancillary Service Reserve Amount*—The total payment to QSE *q* for the Real-Time RUC Ancillary Service Reserve payment associated with reliability deployments for each 15-minute Settlement Interval.
RTRUCRESP $_q$	MWh	*Real-Time RUC Ancillary Service Supply Responsibility for the QSE*—The Real-Time Ancillary Service Supply Responsibility pursuant to the Ancillary Service awards for Reg-Up, ~~RRS~~ECRS, ~~PFRS~~RRS, and Non-Spin for all RUC Resources that have opted out per paragraph (11) of Section 5.5.2 for the QSE *q*, for the 15-minute Settlement Interval.
RTRUCASA $_{q,r}$	MW	*Real-Time RUC Ancillary Service Awards*—The Real-Time Ancillary Service award to the RUC Resource *r* for Reg-Up, ~~RRS~~ECRS, ~~PFRS~~RRS, and Non-Spin for the 15-minute Settlement Interval that falls within a RUC-Committed Hour for the QSE *q*.
RTRSVPOR	$/MWh	*Real-Time Reserve Price for On-Line Reserves*—The Real-Time Reserve Price for On-Line Reserves for the 15-minute Settlement Interval.
RTRDP	$/MWh	*Real-Time On-Line Reliability Deployment Price* —The Real-Time price for the 15-minute Settlement Interval, reflecting the impact of reliability deployments on energy prices that is calculated from the Real-time On-Line Reliability Deployment Price Adder.
q	none	A QSE.
r	none	A Generation Resource.

NPRR Comments

6.7.7 Adjustments to Net Cost Allocations for Real-Time Ancillary Services

If ERCOT assigns Ancillary Service during a Watch, the incremental cost for assigned Ancillary Service is calculated in this section.

(1) For Reg-Up, if applicable:

(a) The total costs for Reg-Up for a given Operating Hour during a Watch is calculated as follows:

ARUCOSTTOT = (-1) * RTAURUAMTTOT + RUCOSTTOT

Where:

Total payment of Real-Time Ancillary Service Assignment procured capacity for un-deployed Reg-Up

$$\text{RTAURUAMTTOT} = \sum_{q} \sum_{r} \sum_{p} \sum_{i=1}^{4} \text{RTAURUAMT}_{q,r,p,i}$$

The above variables are defined as follows:

Variable	Unit	Description
ARUCOSTTOT	$	*Reg-Up Cost Total*—The total costs for Reg-Up that includes costs of assigned Ancillary Service during a Watch for the hour.
RUCOSTTOT	$	*Reg-Up Cost Total*—The net total costs for Reg-Up for the hour.
RTAURUAMTTOT	$	*Real-Time Assigned Un-Deployed Regulation Up Payment Amount Total for all QSEs*—The payments to all QSEs for the Real-Time un-deployed Reg-Up Ancillary Service Assignment for the hour.
$\text{RTAURUAMT}_{q,r,p,i}$	$	*Real-Time Assigned Un-Deployed Regulation Up Payment Amount per QSE*—The payment to QSE *q* for a Real-Time un-deployed Reg-Up Ancillary Service Assignment to Resource *r* at Settlement Point *p* for the 15-minute Settlement Interval *i*.
q	none	A QSE.
r	none	A Generation Resource that was allocated Reg-Up Ancillary Service Assignment by the QSE.
p	none	A Settlement Point for the Resource Node that was allocated Reg-Up Ancillary Service Assignment by the QSE.
i	none	A 15-minute Settlement Interval in the Operating Hour.

(b) Each QSE's share of the total costs for Reg-Up for the Operating Hour, including Ancillary Service costs assigned during a Watch is calculated as follows:

$$\text{ARUCOST}_{q} = \text{ARUPR} * \text{ARUQ}_{q}$$

Where:

ARUPR = ARUCOSTTOT / ARUQTOT

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NPRR Comments

$$ARUQTOT = \sum_{q} ARUQ_{q}$$

$$ARUQ_{q} = ARUO_{q} - SARUQ_{q}$$

$$ARUO_{q} = WAURUTOT * HLRS_{q} + RUO_{q}$$

$$WAURUTOT = \sum_{q} \sum_{r} \sum_{P} RTAURUR_{q,r,p}$$

The above variables are defined as follows:

Variable	Unit	Description
$ARUCOST_{q}$	$	*Reg-Up Cost per QSE*—QSE *q*'s share of the net total costs for Reg-Up that includes costs of assigned Ancillary Service during a Watch, for the hour.
ARUPR	$/MW per hour	*Reg-Up Price*—The price for Reg-Up calculated based on the net total costs for Reg-Up, for the hour.
ARUCOSTTOT	$	*Reg-Up Cost Total*—The total costs for Reg-Up that includes costs of assigned Ancillary Service during a Watch for the hour.
ARUQTOT	MW	*Reg-Up Quantity Total*—The sum of every QSE's portion of its Ancillary Service Obligation that is not self-arranged in either DAM or any SASM that includes assigned Ancillary Service, during a Watch, for the hour.
$ARUQ_{q}$	MW	*Reg-Up Quantity per QSE*—The portion of QSE *q*'s total Ancillary Service Obligation that is not self-arranged in either DAM or any SASM, that includes assigned Ancillary Service, during a Watch for the hour.
WAURUTOT	MW	*Watch Assigned Un-Deployed Regulation Up Quantity*- The total market wide quantity of un-deployed Reg-Up Ancillary Service Assignment for the hour.
$RTAURUR_{q,r}$	MW	*Real-Time Assigned Un-Deployed Regulation Up Quantity per Resource per QSE* - The quantity of un-deployed Reg-Up Ancillary Service Assignment to a QSE *q* for Resource *r* for the hour. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
$ARUO_{q}$	MW	*Reg-Up Obligation per QSE*—The Ancillary Service Obligation of QSE *q*, for the hour during a Watch.
RUO_{q}	MW	*Reg-Up Obligation per QSE*—The Ancillary Service Obligation of QSE *q*, for the hour.
$HLRS_{q}$	none	*The Hourly Load Ratio Share calculated for QSE q for the hour*. See Section 6.6.2.4, QSE Load Ratio Share for an Operating Hour.
$SARUQ_{q}$	MW	*Total Self-Arranged Reg-Up Quantity per QSE for all markets*—The sum of all self-arranged Reg-Up quantities submitted by QSE *q* for DAM and all SASMs.
q	none	A QSE.
r	none	A Generation Resource that was allocated Reg-Up Ancillary Service Assignment by the QSE.
p	none	A Settlement Point for the Resource Node that was allocated Reg-Up Ancillary Service Assignment by the QSE.

NPRR Comments

(c) The incremental cost to each QSE's for assigned Reg-Up for the Operating Hour, is calculated as follows:

$$\mathbf{NETARTRUAMT}_{q} = \mathbf{ARUCOST}_{q} - \mathbf{RUCOST}_{q}$$

The above variables are defined as follows:

Variable	Unit	Description
$NETARTRUAMT_q$	$	*Real-Time Reg-Up Amount per QSE*—The net adjustment to QSE *q*'s share of the costs for assigned Reg-Up, for the hour.
$ARUCOST_q$	$	*Reg-Up Cost per QSE*—QSE *q*'s share of the net total costs for Reg-Up that includes costs of assigned Ancillary Service during a Watch, for the hour.
$RUCOST_q$	$	*Reg-Up Cost per QSE*—QSE *q*'s share of the net total costs for Reg-Up, for the hour.
q	none	A QSE.

(2) For ~~RRS~~ECRS ~~Service~~, if applicable:

(a) The total costs for ~~RRS~~ECRS ~~Service~~ for a given Operating Hour during a Watch is calculated as follows:

A~~R~~ECRCOSTTOT = (-1) * RTAU~~R~~ECRAMTTOT + ~~R~~ECRCOSTTOT

Where:

Total payment of Real-Time Ancillary Service Assignment procured capacity for un-deployed ~~RRS~~ECRS

$$\text{RTAU}\sout{\text{R}}\text{ECRAMTTOT} = \sum_{q} \sum_{r} \sum_{p} \sum_{i=1}^{4} \text{RTAU}\sout{\text{R}}\text{ECRAMT}_{q,r,p,i}$$

The above variables are defined as follows:

Variable	Unit	Description
A~~R~~ECRCOSTTOT	$	~~*Responsive Reserve*~~*ERCOT Contingency Reserve Service Cost Total*—The net total costs for ~~RRS~~ECRS that includes costs of assigned Ancillary Service during a Watch for the hour.
~~R~~ECRCOSTTOT	$	~~*Responsive Reserve*~~*ERCOT Contingency Reserve Service Cost Total*—The net total costs for ~~RRS~~ECRS for the hour.
RTAU~~R~~ECRAMTTOT	$	*Real-Time Assigned Un-Deployed* ~~*Responsive Reserve*~~*ERCOT Contingency Reserve Service Payment Amount Total for all QSEs* - The payments to all QSEs for the Real-Time un-deployed ~~RRS~~ECRS Ancillary Service Assignment for the hour.
$RTAU\sout{R}ECRAMT_{q,r,p,i}$	$	*Real-Time Assigned Un-Deployed* ~~*Responsive Reserve*~~*ERCOT Contingency Reserve Service Payment Amount per QSE* - The payment to QSE *q* for a Real-Time un-deployed ~~RRS~~ECRS Ancillary Service Assignment to Resource *r* at Settlement Point *p* for the 15-minute Settlement Interval *i*.
q	none	A QSE.

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r	none	A Generation Resource that was allocated ~~RRS~~ECRS Ancillary Service Assignment by the QSE.
p	none	A Settlement Point for the Resource Node that was allocated ~~RRS~~ECRS Ancillary Service Assignment by the QSE.
i	none	A 15-minute Settlement Interval in the Operating Hour.

(b) Each QSE's share of the net total costs for ~~RRS~~ECRS for the Operating Hour, including Ancillary Service costs assigned during a Watch is calculated as follows:

$$A\text{~~R~~EC}RCOST_q = A\text{~~R~~EC}RPR * A\text{~~R~~EC}RQ_q$$

Where:

$$A\text{~~R~~EC}RPR = A\text{~~R~~EC}RCOSTTOT / A\text{~~R~~EC}RQTOT$$

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$$A\text{~~R~~EC}RQTOT = \sum_q A\text{~~R~~EC}RQ_q$$

$$A\text{~~R~~EC}RQ_q = A\text{~~R~~EC}RO_q - SA\text{~~R~~EC}RQ_q$$

$$A\text{~~R~~EC}RO_q = WAU\text{~~R~~EC}RTOT * HLRS_q + \text{~~R~~EC}RO_q$$

$$WAU\text{~~R~~EC}RTOT = \sum_q \sum_r \sum_p RTAU\text{~~R~~EC}RR_{q,r,p}$$

The above variables are defined as follows:

Variable	Unit	Description
A~~RR~~ECRCOST $_q$	$	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Cost per QSE*—QSE *q*'s share of the net total costs for ~~RRS~~ECRS, that includes costs of assigned Ancillary Service during a Watch for the hour.
A~~RR~~ECRPR	$/MW per hour	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Price*—The price for ~~RRS~~ECRS calculated based on the net total costs for ~~RRS~~ECRS that includes costs of assigned Ancillary Service during a Watch for the hour.
A~~RR~~ECRCOSTTOT	$	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Cost Total*—The net total costs for ~~RRS~~ECRS that includes costs of assigned Ancillary Service during a Watch for the hour.
A~~RR~~ECRQTOT	MW	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Quantity Total*—The sum of every QSE's portion of its Ancillary Service Obligation that is not self-arranged in either DAM or any SASM that includes assigned Ancillary Service, during a Watch,~~,~~ for the hour.
WAU~~RR~~ECRTOT	MW	*Watch Assigned Un-Deployed ~~Responsive Reserve~~ERCOT Contingency Reserve Service Quantity*—The total market wide quantity of un-deployed ~~RRS~~ECRS Ancillary Service Assignment for the hour.
RTAU~~RR~~ECRR $_{q,r}$	MW	*Real-Time Assigned Un-Deployed ~~Responsive Reserve~~ERCOT Contingency Reserve Service Quantity per Resource per QSE*—The quantity of un-deployed ~~RRS~~ECRS Ancillary Service Assignment to a QSE *q* for Resource *r* for the hour. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.

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A~~RR~~ECRQ $_q$	MW	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Quantity per QSE*—The portion of QSE *q*'s Ancillary Service Obligation that is not self-arranged in either DAM or any SASM, for the hour.
A~~RR~~ECRO $_q$	MW	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Obligation per QSE*—The Ancillary Service Obligation of QSE *q*, for the hour.
~~RR~~ECRO $_q$	MW	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Obligation per QSE*—The Ancillary Service Obligation of QSE *q*, for the hour.
HLRS $_q$	none	*The Hourly Load Ratio Share calculated for QSE q for the hour*. See Section 6.6.2.4.
SA~~R~~ECRQ $_q$	MW	*Total Self-Arranged ~~Responsive Reserve~~ERCOT Contingency Reserve Service Quantity per QSE for all markets*—The sum of all self-arranged ~~RRS~~ECRS quantities submitted by QSE *q* for DAM and all SASMs.
q	none	A QSE.
r	none	A Generation Resource that was allocated ~~RRS~~ECRS Ancillary Service Assignment by the QSE.
p	none	A Settlement Point for the Resource Node that was allocated ~~RRS~~ECRS Ancillary Service Assignment by the QSE.

(c) The incremental cost to each QSE's for assigned ~~RRS~~ECRS for the Operating Hour, is calculated as follows:

NETART~~R~~ECRAMT $_q$ = A~~R~~ECRCOST $_q$ – EC~~R~~RCOST $_q$

The above variables are defined as follows:

Variable	Unit	Description
NETART~~R~~ECRAMT $_q$	$	*Real-Time ~~Responsive Reserve~~ERCOT Contingency Reserve Service Amount per QSE*—The net adjustment to QSE *q*'s share of the costs for assigned ~~RRS~~ECRS, for the hour.
~~R~~ECRCOST $_q$	$	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Cost per QSE*—QSE *q*'s share of the net total costs for ~~RRS~~ECRS, for the hour.
A~~R~~ECRCOST $_q$	$	*~~Responsive Reserve~~ERCOT Contingency Reserve Service Cost per QSE*—QSE *q*'s share of the net total costs for ~~RRS~~ECRS that includes costs of assigned Ancillary Service during a Watch, for the hour.
q	none	A QSE.

(3) For ~~PFRS~~RRS, if applicable:

(a) The total costs for ~~PFRS~~RRS for a given Operating Hour during a Watch is calculated as follows:

A~~PF~~RR~~S~~COSTTOT = (-1) * RTAU~~PF~~RR~~S~~AMTTOT + ~~PF~~RR~~S~~COSTTOT

Where:

Total payment of Real-Time Ancillary Service Assignment procured capacity for un-deployed ~~PFRS~~RRS

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$$RTAUPFRRSAMTTOT = \sum_{q} \sum_{r} \sum_{p} \sum_{i=1}^{4} RTAUPFRRSAMT_{q,r,p,i}$$

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The above variables are defined as follows:

Variable	Unit	Description
APFRRSCOSTTOT	$	~~*Primary Frequency Response Service*~~*Responsive Reserve Cost Total*—The net total costs for ~~PFRS~~RRS that includes costs of assigned Ancillary Service during a Watch for the hour.
~~PFRS~~COSTTOT	$	~~*Primary Frequency Response Service*~~*Responsive Reserve Cost Total*—The net total costs for ~~PFRS~~RRS for the hour.
RTAUPFRRSAMTTOT	$	*Real-Time Assigned Un-Deployed ~~Primary Frequency Response Service~~Responsive Reserve Payment Amount Total for all QSEs* - The payments to all QSEs for the Real-Time un-deployed ~~PFRS~~RRS Ancillary Service Assignment for the hour.
$RTAUPFRRSAMT_{q,r,p,i}$	$	*Real-Time Assigned Un-Deployed ~~Primary Frequency Response Service~~Responsive Reserve Payment Amount per QSE* - The payment to QSE *q* for a Real-Time un-deployed ~~PFRS~~RRS Ancillary Service Assignment to Resource *r* at Settlement Point *p* for the 15-minute Settlement Interval *i*.
q	none	A QSE.
r	none	A Generation Resource that was allocated ~~PFRS~~RRS Ancillary Service Assignment by the QSE.
p	none	A Settlement Point for the Resource Node that was allocated ~~PFRS~~RRS Ancillary Service Assignment by the QSE.
i	none	A 15-minute Settlement Interval in the Operating Hour.

(b) Each QSE's share of the net total costs for ~~PFRS~~RRS for the Operating Hour, including Ancillary Service costs assigned during a Watch is calculated as follows:

$$APFRRSCOST_q = APFRRSPR * APFRRSQ_q$$

Where:

$$APFRRSPR = APFRRSCOSTTOT / APFRRSQTOT$$

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$$APFRRSQTOT = \sum_{q} APFRRSQ_q$$

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$$APFRRSQ_q = APFRRSO_q - SAPFRRSQ_q$$

$$APFRRSO_q = WAUPFRRSTOT * HLRS_q + PFRRSO_q$$

$$WAUPFRRSTOT = \sum_{q} \sum_{r} \sum_{p} RTAURPFRRRS_{q,r,p}$$

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The above variables are defined as follows:

Variable	Unit	Description

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APFRRSCOST $_q$	$	*Primary Frequency Response Service*Responsive Reserve Cost per QSE—QSE *q*'s share of the net total costs for PFRSRRS, that includes costs of assigned Ancillary Service during a Watch for the hour.
APFRRSPR	$/MW per hour	*Primary Frequency Response Service*Responsive Reserve Price—The price for PFRSRRS calculated based on the net total costs for PFRSRRS that includes costs of assigned Ancillary Service during a Watch for the hour.
APFRRSCOSTTOT	$	*Primary Frequency Response Service*Responsive Reserve Cost Total—The net total costs for PFRSRRS that includes costs of assigned Ancillary Service during a Watch for the hour.
APFRRSQTOT	MW	*Primary Frequency Response Service*Responsive Reserve Quantity Total—The sum of every QSE's portion of its Ancillary Service Obligation that is not self-arranged in either DAM or any SASM that includes assigned Ancillary Service, during a Watch, for the hour.
WAUPFRRSTOT	MW	*Watch Assigned Un-Deployed Primary Frequency Response Service*Responsive Reserve Quantity—The total market wide quantity of un-deployed PFRSRRS Ancillary Service Assignment for the hour.
RTAURPFRRRS $_{q,r}$	MW	*Real-Time Assigned Un-Deployed Primary Frequency Response Service*Responsive Reserve Quantity per Resource per QSE—The quantity of un-deployed PFRSRRS Ancillary Service Assignment to a QSE *q* for Resource *r* for the hour. Where for a Combined Cycle Train, the Resource *r* is a Combined Cycle Generation Resource within the Combined Cycle Train.
APFRRSQ $_q$	MW	*Primary Frequency Response Service*Responsive Reserve Quantity per QSE—The portion of QSE *q*'s Ancillary Service Obligation that is not self-arranged in either DAM or any SASM, for the hour.
APFRRSO $_q$	MW	*Primary Frequency Response Service*Responsive Reserve Obligation per QSE—The Ancillary Service Obligation of QSE *q*, for the hour.
PFRRSO $_q$	MW	*Primary Frequency Response Service*Responsive Reserve Obligation per QSE—The Ancillary Service Obligation of QSE *q*, for the hour.
HLRS $_q$	none	*The Hourly Load Ratio Share calculated for QSE q for the hour*. See Section 6.6.2.4.
SAPFRRSQ $_q$	MW	*Total Self-Arranged Primary Frequency Response Service*Responsive Reserve Quantity per QSE for all markets—The sum of all self-arranged PFRSRRS quantities submitted by QSE *q* for DAM and all SASMs.
q	none	A QSE.
r	none	A Generation Resource that was allocated PFRSRRS Ancillary Service Assignment by the QSE.
p	none	A Settlement Point for the Resource Node that was allocated PFRSRRS Ancillary Service Assignment by the QSE.

(c) The incremental cost to each QSE's for assigned PFRSRRS for the Operating Hour, is calculated as follows:

NETARTPFRRSAMT $_q$ = APFRRSCOST $_q$ – PFRRSCOST $_q$

The above variables are defined as follows:

Variable	Unit	Description
NETARTPFRRSAMT $_q$	$	*Real-Time Primary Frequency Response Service*Responsive Reserve Amount per QSE—The net adjustment to QSE *q*'s share of the costs for assigned PFRSRRS, for the hour.

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~~PF~~RRS~~C~~OST *a*	$	~~*Primary Frequency Response Service*~~*Responsive Reserve Cost per QSE*—QSE *q*'s share of the net total costs for ~~PFRS~~RRS, for the hour.
AP~~F~~RRS~~C~~OST *a*	$	~~*Primary Frequency Response Service*~~*Responsive Reserve Cost per QSE*—QSE *q*'s share of the net total costs for ~~PFRS~~RRS that includes costs of assigned Ancillary Service during a Watch, for the hour.
q	none	A QSE.

8.1 QSE and Resource Performance Monitoring

(1) ERCOT shall develop a Technical Advisory Committee (TAC)- and ERCOT Board-approved Qualified Scheduling Entity (QSE) and Resource monitoring program to be included in the Operating Guides. Nothing in this Section changes the process for amending the Operating Guides. The metrics developed by ERCOT and approved by TAC and the ERCOT Board must include the provisions of this Section.

(2) Each QSE and Resource shall meet performance measures as described in this Section and in the Operating Guides.

(3) ERCOT shall monitor and post the following categories of performance:

(a) Real-Time data, for QSEs:

(i) Telemetry performance

(b) Regulation control performance, for QSEs and as applicable, Resource-specific performance (see also Section 8.1.1, QSE Ancillary Service Performance Standards);

(c) ~~Hydro responsive t~~Testing for Generation Resources operating in the synchronous condenser fast-response mode;

(d) Supplying and validating data for generator models, as requested by ERCOT, for Generation Resources;

(e) Outage scheduling and coordination, for QSEs and Resources;

(f) Resource-specific ~~Responsive Reserve~~ERCOT Contingency Reserve Service (~~RRS~~ECRS) performance for QSEs and Resources;

(g) Resource-specific Non-Spinning Reserve (Non-Spin) performance, for QSEs and Resources;

(h) Resource-specific ~~Primary Frequency Response Service~~Responsive Reserve (~~PFRS~~RRS) performance, for QSEs and Resources;

(~~h~~i) Outage reporting, by QSEs for Resources;

(i) Current Operating Plan (COP) metrics, for QSEs; and

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(j) Day-Ahead Reliability Unit Commitment (DRUC) and Hourly Reliability Unit Commitment (HRUC) commitment performance by QSEs and Generation Resources.

[NPRR257: Replace paragraph (3) above with the following upon system implementation:]

(3) ERCOT shall monitor and post the following categories of performance:

(a) Net dependable real power capability testing, for Resources;

(b) Reactive testing, for Generation Resources, to validate Corrected Unit Reactive Limit (CURL) and Unit Reactive Limit (URL);

(c) Real-Time data, for QSEs:

(i) Telemetry performance;

(ii) Communications system performance;

(iii) Operational data requirements required under Section 6.5.5.2, Operational Data Requirements.

(d) Regulation control performance, for QSEs and as applicable, Resource-specific performance (see also Section 8.1.1, QSE Ancillary Service Performance Standards);

(e) ~~Hydro responsive t~~Testing for Generation Resources operating in the synchronous condenser fast-response mode;

(f) Black Start Service (BSS) test results for QSEs and Generation Resources posted to the Market Information System (MIS) Certified Area;

(g) Supplying and validating data for generator models, as requested by ERCOT, for Generation Resources;

(h) Outage scheduling and coordination, for QSEs and Resources;

(i) Resource-specific ~~Responsive Reserve~~ERCOT Contingency Reserve Service (~~RRS~~ECRS) performance for QSEs and Resources;

(j) The QSE backup control plan for Resource energy deployment in the event of the loss of a communication path with ERCOT. ERCOT will test these plans randomly at least once a year for QSEs representing Resources;

(k) Resource-specific Non-Spinning Reserve (Non-Spin) performance, for QSEs and Resources;

(l) Resource-specific ~~Primary Frequency Response Service~~Responsive Reserve

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(~~PFRS~~RRS) performance, for QSEs and Resources;

(~~l~~m) 24 hours per day, seven days per week qualified staffing requirement, as described in the Operating Guides, for QSEs;

(~~m~~n) Automatic Voltage Regulator (AVR) requirements, for QSEs and Generation Resources;

(~~n~~o) Staffing plan for a backup control facility or procedures in the event that the primary facility is unusable, for QSEs;

(~~o~~p) Outage reporting, by QSEs for -Resources;

(~~p~~q) Current Operating Plan (COP) metrics, for QSEs; and

(~~q~~r) Day-Ahead Reliability Unit Commitment (DRUC) and Hourly Reliability Unit Commitment (HRUC) commitment performance by QSEs and Generation Resources.

8.1.1.1 Ancillary Service Qualification and Testing

(1) Each QSE and the Resource providing Ancillary Service must meet qualification criteria to operate satisfactorily with ERCOT. ERCOT shall use the Ancillary Service qualification and testing program that is approved by TAC and included in the Operating Guides. Each QSE for the Resources that it represents may only provide Ancillary Services on those Resources for which it has met the qualification criteria.

(2) General capacity testing must be used to verify a Resource's Net Dependable Capability. Qualification tests allow the Resource and QSE to demonstrate the minimum capabilities necessary to deploy an Ancillary Service.

(3) A Resource may be provisionally qualified for a period of 90 days and may be eligible to participate as a Resource providing Ancillary Service. Resources that have installed the appropriate equipment with verifiable testing data may be provisionally qualified as providers of Ancillary Service.

(4) A Load Resource may be provisionally qualified for a period of 90 days to participate as a Resource providing Ancillary Service, if the Load Resource is metered with an Interval Data Recorder (IDR) to ERCOT's reasonable satisfaction. A Load Resource providing Ancillary Service in Real-Time must meet the following requirements:

(a) Electric Service Identifier (ESI ID) registration of Load Resources providing Ancillary Service by the QSE; and

(b) Load Resource telemetry is installed and tested between QSE and ERCOT.

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(5) Provisional qualification as described herein may be revoked by ERCOT at any time for any non-compliance with provisional qualification requirements.

(6) For those Settlement Intervals during which a Generation Resource or Load Resource behind the Generation Resource Node is engaged in testing in accordance with this Section, the provisions of Section 6.6.5, Generation Resource Base-Point Deviation Charge, will not apply to the Resource being tested beginning with the Settlement Interval immediately preceding the Settlement Interval in which ERCOT issues a Dispatch Instruction that begins the test and continuing until the end of the Settlement Interval in which the test completes. During the same Settlement Intervals for the testing period, the Generation Resource Energy Deployment Performance (GREDP) calculated in accordance with Section 8.1.1.4.1, Regulation Service and Generation Resource/Controllable Load Resource Energy Deployment Performance, will not apply.

(7) ERCOT may reduce the amount a Resource may contribute toward Ancillary Service if it determines unsatisfactory performance of the Resource as defined in Section 8.1.1, QSE Ancillary Service Performance Standards.

(8) To maintain qualification with ERCOT to provide ~~RRS~~RRS or ECRS service, each Load Resource, excluding Controllable Load Resources, will be subject to a Load interruption test at a date and time determined by ERCOT and known only to ERCOT and the affected Transmission Service Provider (TSP), to verify the ability to respond to an ERCOT Dispatch Instruction. To successfully pass this test, within ten minutes of the receipt of the ERCOT Dispatch Instruction by the Load Resource's QSE, the Load Resource's response shall not be less than 95% of the requested MW deployment, nor more than 150% of the lesser of the following:

(a) The Resource's Responsibility for ~~RRS~~ECRS and RRS, or

(b) The requested MW deployment.

The requested MW deployment will be the sum of the Resource's Responsibility for ~~RRS~~ECRS and RRS, and the telemetered additional capacity between the net power consumption and the Low Power Consumption (LPC). If a Load Resource has responded to an actual ERCOT Dispatch Instruction in compliance with (a) and (b) above in the rolling 365-day period, ERCOT will use that response in lieu of a Load interruption test. If a Load Resource has not responded to an ERCOT Dispatch Instruction in compliance with (a) and (b) above, either in a deployment event or a Load interruption test, in any rolling 365-day period, it is subject to a Load interruption test by ERCOT. QSEs may request to have individual Load Resources aggregated for the purposes of Load interruption tests. All performance evaluations will apply on an individual Resource basis.

(9) ERCOT may revoke the Ancillary Service qualification of any Load Resource, excluding Controllable Load Resources, for failure to comply with the required performance standards, based on the evaluation it performed under paragraph (be) of Section 8.1.1.4.2, ~~Responsive Reserve Service~~ERCOT Contingency Reserve Service Energy Deployment

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Criteria or under paragraph (4) of Section 8.1.1.4.4, ERCOT Responsive Reserve Energy Deployment Criteria. Specifically, if a Load Resource that is providing ~~RRS~~RRS or ECRS fails to respond with at least 95% of its Ancillary Service Resource Responsibility for ~~RRS~~ECRS or RRS within ten minutes of an ERCOT Dispatch Instruction, that response shall be considered a failure. Two Load Resource performance failures, either in a deployment event or a Load interruption test, within any rolling 365-day period shall result in disqualification of that Load Resource. After six months of disqualification, the Load Resource may reapply for qualification provided it submits a corrective action plan to ERCOT that identifies actions taken to correct performance deficiencies and the disqualified Load Resource successfully passes a new Load interruption test as specified in this Section 8.1.1.1.

(10) To maintain qualification with ERCOT to provide ~~PFRS~~RRS ~~or RRS~~ from Fast Frequency Response (FFR), each Resource will be subject to an FFR qualification test at a date and time determined by ERCOT and known only to ERCOT and the affected Transmission Service Provider (TSP) as applicable, to verify the ability to respond to an ERCOT Dispatch Instruction. To successfully pass this test, within ten minutes of the receipt of the ERCOT Dispatch Instruction by the Resource's QSE, the Resource's response shall not be less than 95% of the requested MW deployment, nor more than 105% of the lesser of the following:

(a) The Resource's Ancillary Service Resource Responsibility for ~~RRS and~~ ~~PFRS~~RRS; or

(b) The ~~requested~~ MW deployment.

The requested MW deployment for Resources capable of FFR will be the sum of the Resource's Ancillary Service Resource Responsibility for ~~RRS and PFRS~~RRS and the additional capacity between the telemetered HSL and the telemetered LSL. If a Resource has responded to an actual ~~ERCOT Dispatch Instruction~~event in compliance with items (a) and (b) above in the rolling 365-day period, ERCOT will use that response in lieu of an FFR test. If a Resource has not responded to an ERCOT Dispatch Instruction in compliance with items (a) and (b) above, in either a deployment event or an FFR test, in any rolling 365-day period, it is subject to an FFR test by ERCOT. All performance evaluations will apply on an individual Resource basis.

(11) ERCOT may revoke the Ancillary Service qualification of any Resource providing FFR if that Resource has two Resource performance failures, either in a manual deployment event or a frequency triggered event, within any rolling 365-day period. A performance failure is defined as a response less than 95% or more than 105% of the Resource's Ancillary Service Resource Responsibility for ~~RRSECRS or PFRS~~RRS within 15~~30~~ cycles of a triggering event or within ten minutes of an ERCOT Dispatch Instruction. This shall result in disqualification of that Resource. After six months of disqualification, a Resource may reapply for qualification provided it submits a corrective action plan to ERCOT that identifies actions taken to correct performance deficiencies and the disqualified Resource successfully passes a new test as specified in Section 8.1.1.2.1.6~~2.1~~, ~~Fast Frequency Response Service~~Responsive Reserve Qualification.

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8.1.1.2 General Capacity Testing Requirements

(1) Within the first 15 days of each Season, each QSE shall provide ERCOT a Seasonal High Sustained Limit (HSL) for any Generation Resource with a capacity greater than ten MW that will be operated during that Season. ERCOT shall provide an appropriate form for QSEs to submit their Seasonal HSL data. The Seasonal HSL form shall take into account auxiliary Load and gross and net real power capability of the Generation Resource. Each QSE shall update its COP and telemetry, as necessary, to reflect the HSL of each of its Generation Resources in a given operating interval as well as other operational limitations. The HSL shown in the COP for a Generation Resource may not be ramp rate-limited while the Real-Time telemetered value of HSL for the Generation Resource may be ramp rate-limited by the QSE representing the Generation Resource in order for the Generation Resource to meet its HSL using the testing process described in paragraph (2) below.

(2) To verify that the HSL reported by telemetry is achievable, ERCOT may, at its discretion, conduct an unannounced Generation Resource test. At a time determined solely by ERCOT, ERCOT will issue a Verbal Dispatch Instruction (VDI) to the QSE to operate the designated Generation Resource at its HSL as shown in the QSE's telemetry at the time the test is initiated. The QSE shall immediately upon receiving the VDI release all Ancillary Service obligations carried by the unit to be tested and shall telemeter Resource Status as "ONTEST." The QSE shall not be required to start the designated Generation Resource if it is not already On-Line when ERCOT announces its intent to test the Resource. If the designated Generation Resource is operating at its Low Sustained Limit (LSL) when ERCOT sends the VDI to begin the test, the QSE shall have up to 60 minutes to allow the Resource to reach 90% of its HSL as shown by telemetry and up to an additional 20 minutes for the Resource to reach the HSL shown by telemetry at the time the test is initiated. This time requirement does not apply to nuclear-fueled Generation Resources. If the designated Generation Resource is operating between its LSL and 50% of its HSL shown by telemetry when ERCOT begins the test, the QSE shall have 60 minutes for the Resource to reach its HSL. If the Resource is operating at or above 50% of its HSL shown by telemetry when ERCOT begins the test, the QSE shall have 30 minutes for the Resource to reach its HSL. Once the designated Generation Resource reaches its HSL, the QSE shall hold it at that output level for a minimum of 30 minutes. The HSL for the designated Generation Resource shall be determined based on the Real-Time averaged MW telemetered by the Resource during the 30 minutes of constant output. After each test, the QSE representing the Generation Resource will complete and submit the test form using the Net Dependable Capability and Reactive Capability (NDCRC) application located on the Market Information System (MIS) Secure Area within two Business Days.

(3) ERCOT may test multiple Generation Resources within a single QSE within a single 24-hour period. However, in no case shall ERCOT test more than two Generation Resources within one QSE simultaneously. All Resources On-Line in a Combined-Cycle Configuration will be measured on an aggregate capacity basis. All QSEs associated with a jointly owned unit will be tested simultaneously. Hydro, wind, and PhotoVoltaic (PV) generation will be excluded from unannounced generation capacity testing.

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ERCOT shall not perform an unannounced Generation Resource test during a Watch or Energy Emergency Alert (EEA) event. If an unannounced Generation Resource test is underway when a Watch or EEA event commences, ERCOT may cancel the test.

(4) Should the designated Generation Resource fail to reach its HSL shown in its telemetry within the time frame set forth herein, the Real-Time averaged MW telemetered during the test shall be the basis for the new HSL for the designated Generation Resource for that Season. The QSE shall have the opportunity to request another test as quickly as possible (at a time determined by ERCOT) and may retest up to two times per month. The QSE may also demonstrate an increased value of HSL by operating the Generation Resource at an Output Schedule for at least 30 minutes. In order to raise an output schedule above the Seasonal HSL, the QSE may set the Resource telemetered HSL equal to its output temporarily for the purposes of the demonstration tests. After either a retest or a demonstration test, the MW capability of the Generation Resource based on the average of the MW production telemetered during the test shall be the basis for the new HSL for the designated Generation Resource for that Season. Any requested retest must take place within three Business Days after the request for retest.

(5) The telemetered value of HSL for the Generation Resource shall only be used for testing purposes as described in this Section or for system reliability calculations.

(6) A Resource Entity owning a ~~hydro unit~~ Generation Resource operating in the synchronous condenser fast response mode to provide ~~hydro RRS~~ ~~FRS~~RRS or ECRS shall evaluate the maximum capability of the Resource each Season.

(7) ERCOT shall maintain historical records of unannounced Generation Resource test results, using the information contained therein to adjust the Reserve Discount Factor (RDF) subject to the approval of the appropriate TAC subcommittee. ERCOT shall report to the Reliability and Operations Subcommittee (ROS) annually or as requested by ROS the aggregated results of such unannounced testing (excluding retests), including, but not limited to, the number and total capacity of Resources tested, the percentage of Resources that met or exceeded their HSL reported by telemetry, the percentage that failed to meet their HSL reported by telemetry, and the total MW capacity shortfall of those Resources that failed to meet their HSL reported by telemetry.

(8) QSEs who receive a VDI to operate the designated Generation Resource for an unannounced Generation Resource test may be considered for additional compensation under Section 6.6.9, Emergency Operations Settlement. Any unannounced Generation Resource test VDI that ERCOT issues as a result of a QSE-requested retest will not be considered for additional compensation under Section 6.6.9.

(9) All unannounced Generation Resource test VDIs will be considered as an instructed deviation for compliance purposes.

(10) Before the start of each Season, a QSE shall provide ERCOT a list identifying each Controllable Load Resource that is expected to operate in a Season as a provider of Ancillary Service. Prior to the beginning of each Season, QSEs shall identify the

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Controllable Load Resources to be tested during the Season and the specific week of the test if known. Any Controllable Load Resource for which the QSE desires qualification to provide Ancillary Services shall have its Net Dependable Capability verified prior to providing Ancillary Services.

(11) ERCOT shall verify the telemetry attributes of each qualified Load Resource as follows:

(a) ERCOT shall annually verify the telemetry attributes of each Load Resource providing ~~RRS FRS~~RRS or ECRS using a high-set under-frequency relay. In addition, once every two years, any Load Resource qualified to provide ~~RRS FRS~~RRS or ECRS Service using a high-set under-frequency relay shall test the correct operation of the under-frequency relay or the output from the solid-state switch, whichever applies. However, if a Load Resource's performance has been verified through response to an actual event, the data from the event can be used to meet the annual telemetry verification requirement for that year and the biennial relay-testing requirement.

(b) ERCOT shall periodically validate the telemetry attributes of each Controllable Load Resource. In the case of an Aggregate Load Resource (ALR), ERCOT will follow the validation procedures described in the document titled "Requirements for Aggregate Load Resource Participation in the ERCOT Markets." If a QSE fails to meet its telemetry validation requirements, ERCOT may suspend the QSE and/or the Controllable Load Resource from participation in the applicable services or markets. If disqualified pursuant to this paragraph, a QSE or Controllable Load Resource may reestablish its qualification by submitting a corrective action plan to ERCOT that identifies actions taken to correct performance deficiencies and by successfully passing a new ERCOT telemetry validation test.

(12) Telemetry values of a Load Resource may be adjusted to reflect Distribution Losses, based on the ERCOT-forecasted Distribution Loss Factors (DLFs). Load Resources may be adjusted for Distribution Losses using the same distribution loss code as assigned to the ESI ID.

(13) A specific Load Resource to be used for the first time to provide Regulation, ~~RRSFRS~~RRS, ECRS, Non-Spin or energy by following Security-Constrained Economic Dispatch (SCED) Base Points, must be tested to ERCOT's reasonable satisfaction using actual Demand response as part of its qualification. The test must take place at a time mutually selected by the QSE representing the Load Resource and ERCOT. ERCOT shall make available its standard test document for Load Resource qualification required under this Section on the MIS Public Area.

(14) Any changes to a Load Resource including changes to its capability to provide Ancillary Service requires updates by the Load Resource to the registration information detailing the change. For Non-Opt-In Entities (NOIEs) representing specific Load Resources that are located behind the NOIE Settlement Metering points, the NOIE shall provide an alternative unique descriptor of the qualified Load Resource for ERCOT's records.

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(15) Qualification of a Resource, including a Load Resource, remains valid for that Resource in the event of a change of QSE for the Resource, provided that the new QSE demonstrates to ERCOT's reasonable satisfaction that the new QSE has adequate communications and control capability for the Resource.

(16) For purposes of qualifying Quick Start Generation Resources (QSGRs), ERCOT shall issue a unit-specific VDI for the MW amount that the QSE is requesting to qualify its QSGR to provide. The QSE shall telemeter an ONTEST Resource Status. The QSGR will only be qualified to provide an amount not to exceed the observed output at the end of a ten-minute test period.

(17) ERCOT may revoke the QSGR qualification of any QSGR for failure to comply with the following performance standard:

(a) A QSGR, available for deployment by SCED, is deemed to have failed to start for the purpose of this performance measure if the QSGR fails to achieve at least 90% of the minimum ERCOT SCED Base Point, including zero Base Points, within ten minutes of the initial ERCOT SCED Base Point that dispatched the QSGR above zero MW output.

(b) ERCOT may revoke a QSGR's qualification if within a rolling 90-day period the number of QSGR failures to start, as determined by paragraph (a) above, exceeds the higher of three failures or 10% of the number of quick start mode startups made in response to SCED deployments.

(18) If disqualified pursuant to paragraph (17) above, a QSGR may reestablish its QSGR qualification by submitting a corrective action plan to ERCOT that identifies actions taken to correct performance deficiencies and by successfully passing a new ERCOT QSGR test.

8.1.1.2.1.2 ~~Responsive Reserve Service~~ERCOT Contingency Reserve Service Qualification

(1) ~~RRS~~ECRS may be provided by:

(a) Unloaded Generation Resources that are On-Line;

(b) Quick Start Generation Resources (QSGRs);

~~(c) Resources capable of FFR;~~

(~~b~~c~~d~~) Load Resources that may or may not be controlled by high-set under-frequency relays;

(~~c~~d~~e~~) ~~Hydro RRS~~Generation Resources operating in the synchronous condenser fast-response mode; or

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(~~dc~~f) Controllable Load Resources.

(2) The amount of ~~RRS~~ECRS provided by individual Generation Resources and ~~Controllable~~ Load Resources is ~~specified in the Operating Guides~~limited to ten times its telemetered emergency ramp rate. Each Resource providing ~~RRS~~ECRS must be ~~On-Line and~~ capable of ramping the Resource's Ancillary Service Resources Responsibility for ~~RRS~~ECRS within ten minutes of the notice to deploy ~~RRS~~ECRS, ~~must be immediately responsive to system frequency,~~ and must be able to maintain the scheduled level of deployment for the period of service commitment. The amount of ~~RRS~~ECRS on a Generation Resource may be further limited by requirements of the Operating Guides.

(3) A ~~QSE's~~ Load Resource must be loaded and capable of unloading the scheduled amount of ~~RRS~~ECRS within ten minutes of instruction by ERCOT and must either be immediately responsive to system frequency or be interrupted by action of under-frequency relays with settings as specified by the Operating Guides.

~~(4) A Resource capable of FFR providing RRS must be capable of providing the scheduled amount of RRS within ten minutes of instruction by ERCOT and must either be immediately responsive to system frequency or be deployed by action of under-frequency relays with settings as specified in the Operating Guides.~~

(4~~5~~4) Any QSE providing ~~RRS~~ECRS shall provide communications equipment to receive ERCOT telemetered control deployments of ~~RRS~~ECRS.

~~(565) Generation Resources providing RRSECRS shall have their governors in service.~~

(6~~7~~56) Load Resources ~~on high set under frequency relays~~ providing ~~RRS~~ECRS must provide a telemetered output signal, including breaker status and status of the under-frequency relay, if applicable.

(7~~8~~67) Each QSE shall ensure that each Resource is able to meet the Resource's obligations to provide the Ancillary Service Resource Responsibility. Each Generation Resource~~:~~ ~~Resource capable of FFR,~~ and Load Resource providing ~~RRS~~ECRS must meet additional technical requirements specified in this Section.

(8~~9~~78) A qualification test for each Resource to provide ~~RRS~~ECRS is conducted during a continuous eight-hour period agreed to by the QSE and ERCOT. ERCOT shall confirm the date and time of the test with the QSE. ERCOT shall administer the following test requirements:

(a) At any time during the window (selected by ERCOT when market and reliability conditions allow and not previously disclosed to the QSE), ERCOT shall notify the QSE it is to provide an amount of ~~RRS~~ECRS from its Resource to be qualified equal to the amount that the QSE is requesting qualification. The QSE shall acknowledge the start of the test.

(b) For Generation Resources desiring qualification to provide ~~RRS~~ECRS, ERCOT shall send a signal to the Resource's QSE to deploy ~~RRS~~ECRS, indicating the

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MW amount. ERCOT shall monitor the QSEs telemetry of the Resource's Ancillary Service Schedule for an update within 15 seconds. ERCOT shall measure the test Resource's response as described under Section 8.1.1.4.2, ~~Responsive Reserve Service~~ERCOT Contingency Reserve Service Energy Deployment Criteria. ERCOT shall evaluate the response of the Generation Resource given the current operating conditions of the system and determine the Resource's qualification to provide ~~RRS~~ECRS.

(c) For Controllable Load Resources desiring qualification to provide ~~RRS~~ECRS, ERCOT shall send a signal to the Resource's QSE to deploy ~~RRS~~ECRS, indicating the MW amount. ERCOT shall measure the test Resource's response as described under Section 8.1.1.4.2. ERCOT shall evaluate the response of the Controllable Load Resource given the current operating conditions of the system and determine the Controllable Load Resource's qualification to provide ~~RRS~~ECRS.

(d) For Load Resources, excluding Controllable Load Resources, desiring qualification to provide ~~RRS~~ECRS, ERCOT shall deploy ~~RRS~~ECRS, indicating the MW amount. ERCOT shall measure the test Resource's response as described under Section 8.1.1.4.2.

~~(e) Each Resource capable of FFR seeking RRS qualification must be On-Line and shall also meet the following requirements:~~

~~(i) The under-frequency relay or similar trigger mechanism must have a delay of no more than 20 cycles (or 0.33 seconds for relays that do not count cycles). The total time from the time frequency first decays to a value low enough to initiate action up to the time when full Ancillary Service Resource Responsibility for RRS is delivered should be no more than 30 cycles, including all relay and breaker operating times;~~

~~(ii) The initiation setting of the under-frequency relay or similar trigger mechanism shall not be any lower than 59.80 Hz;~~

~~(iii) A Resource must demonstrate its ability to sustain the scheduled level of deployment for ten minutes at a minimum level of 95% but not more than a maximum level of 105% of the MW capacity for which the Resource seeks qualification for FFR; and~~

~~(iv) A Resource capable of FFR providing RRS shall be capable of measuring and recording ERCOT frequency (Hz) and MW output with a resolution of no less than 30 samples per second.~~

(~~e~~f) On successful demonstration of all test criteria, ERCOT shall qualify that the Resource is capable of providing ~~RRS~~ECRS and shall provide a copy of the certificate to the QSE and the Resource Entity.

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8.1.1.2.1.6 ~~Primary Frequency Response Service~~Responsive Reserve Qualification

(1) ~~PFRS~~RRS may be provided by:

(a) On-Line Generation Resource capacity; ~~and~~

(b) Resources capable of providing FFR;

(c) Generation Resources operating in the synchronous condenser fast-response mode; and

(c) Load Resources controlled by high-set under-frequency relays.

(2) The amount of ~~PFRS~~RRS provided by individual Generation Resources ~~and Resources capable of FFR is specified in the Operating Guides. Each Resource providing PFRS must be On-Line, must be immediately responsive to system frequency, and must be able to maintain the scheduled level of deployment for the period of service commitment. The amount of PFRS on a Resource may be further limited by requirements specified in the Operating Guides~~is limited by the ERCOT-calculated maximum MW amount of ~~FRS~~RRS for the Generation Resource subject to its verified droop performance as described in the Nodal Operating Guide. The default value for any newly qualified Generation Resource shall be 20% of its HSL. A Private Use Network with a registered Resource may use the gross HSL for qualification and establishing a limit on the amount of ~~FRS~~RRS capacity that the Resource within the Private Use Network can provide.

(3) Any QSE providing ~~PFRS~~RRS shall provide communications equipment to provide ERCOT with telemetry for the output of the Resource.

~~(4) Generation Resources providing PFRS shall have their Governors in service.~~

(~~5~~4) Resources capable of FFR providing ~~PFRS~~RRS must provide a telemetered output signal, including breaker status and status of the frequency detection device.

(~~6~~5) Each QSE shall ensure that each Resource is able to meet the Resource's obligations to provide the Ancillary Service Resource Responsibility. Each Resource providing ~~PFRS~~RRS must meet additional technical requirements specified in this Section.

(6) Generation Resources providing RRS shall have their Governors in service.

(~~7~~76) Generation Resources and Resources capable of FFR providing ~~PFRS~~RRS shall have a Governor droop setting that is no greater than 5.0%~~ and no less than 3.0%~~.

(~~8~~78) Resources may be provisionally qualified by ERCOT to provide ~~PFRS~~RRS for 90 days. Within the 90--day provisional window, a Resource must successfully complete one of the Governor tests identified in the Nodal Operating Guide Section 8, Attachment C, Turbine Governor Speed Tests, before being declared fully qualified to provide ~~PFRS~~RRS.

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~~(9) Resources providing PFRS whose average calculated droop performance is greater than 5.0% based on the previous eight Frequency Measurable Events (FME) shall be suspended from providing PFRS until the Resource can prove to the satisfaction of ERCOT, in its sole discretion, that mitigation measures have been implemented to improve the Governor droop performance to less than 5.0%. The calculations for droop performance shall be determined in the Operating Guides.~~

~~(9) If a Resource has not participated in at least eight FMEs in the prior 36 months, the Resource must complete one of the Governor tests as identified in the Operating Guides prior to providing PFRS.~~

~~(10) A Resource shall be limited to providing no more PFRS than a MW/0.1Hz amount equivalent to the calculated droop performance of the Resource. This amount may be no less than an amount equal to a 5.0% droop and no greater than an amount equal to a 3.0% droop. ERCOT shall calculate this amount and provide it to the QSE representing the Resource by November 1 of each calendar year for the preceding 12 months ending on September 30. If the Resource has participated in fewer than eight FMEs in the preceding 12 month period, ERCOT shall look back to the last eight FMEs for up to 36 months to calculate this PFRS limit. This amount shall be the maximum amount of PFRS that a Resource can schedule for the Resource for the next calendar year.~~

~~(11) If ERCOT, in its sole discretion, identifies a declining droop performance trend that indicates that the Resource is no longer meeting a minimum droop performance of 5.0%, ERCOT may immediately suspend the Resource's capability to provide PFRS and require that the Resource provide a mitigation plan that improves the PFRS capability of the Resource.~~

8.1.1.3.2 ~~Responsive Reserve Service~~ERCOT Contingency Reserve Service Capacity Monitoring Criteria

(1) ERCOT shall continuously monitor the capacity of each Resource to provide ~~Responsive Reserve~~ERCOT Contingency Reserve Service (~~RRS~~ECRS). ERCOT shall consider for each Resource providing ECRS~~RRS~~~~Responsive Reserve~~ capacity, the On-Line versus Off-Line status, actual generation~~,~~ or Load, the Ancillary Service Schedule for ~~RRS~~ECRS, the HSL, the LSL, ramp rates, relay status, and any other commitments of Ancillary Service capacity.

(2) For Load Resources not deployed by a Dispatch Instruction from ERCOT, the amount of ECRS~~RRS~~~~Responsive Reserve~~ capacity provided must be measured as the Load Resource's average Load level in the last five minutes.

(3) A ~~hydro~~ Resource that is capable of providing ~~hydro Responsive Reserve~~ECRS~~RRS~~ and that has a ~~s~~Resource Status code of ~~ONRR~~ ONECRS is considered to be providing ~~responsive~~ capability to the extent that it is not using that capacity to provide energy.

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8.1.1.3.4 ~~Frequency Response Service~~Responsive Reserve Capacity Monitoring Criteria

(1) ERCOT shall continuously monitor the capacity of each Resource to provide ~~Frequency~~ Responsive Reserve~~Service~~ (~~FRS~~RRS). ERCOT shall consider for each Resource providing ~~FRS~~RRS capacity, actual generation or Load, the Ancillary Service Schedule for ~~FRS~~RRS, the HSL, the LSL, and any other commitments of Ancillary Service capacity.

(2) For Load Resources not deployed by a Dispatch Instruction from ERCOT, the amount of ~~FRS~~RRS capacity provided must be measured as the Load Resource's average Load level in the last five minutes.

(3) A Resource that is capable of providing ~~FRS~~RRS and that has a Resource Status code of ON~~FRS~~RRS is considered to be providing frequency responsive capability to the extent that it is not using that capacity to provide energy.

8.1.1.4.1 Regulation Service and Generation Resource/Controllable Load Resource Energy Deployment Performance

(1) ERCOT shall limit the deployment of Regulation Service of each QSE for each LFC cycle equal to 125% of the total amount of Regulation Service in the ERCOT System divided by the number of control cycles in five minutes.

(2) For those Resources that do not have a Resource Status of ONDSR or ONDSRREG or IRR Groups with no member IRR having a status of ONDSR or ONDSRREG, ERCOT shall compute the GREDP for each Generation Resource that is On-Line and released to SCED Base Point Dispatch Instructions. The GREDP is calculated for each five-minute clock interval as a percentage and in MWs for those Resources with a Resource Status that is not ONDSR or ONDSRREG as follows:

GREDP (%) = ABS[((ATG – AEPFR)/(ABP + ARI)) – 1.0] * 100

GREDP (MW) = ABS(ATG – AEPFR – ABP - ARI)

Where:

ATG = Average Telemetered Generation = the average telemetered generation of the Generation Resource or for the aggregate of the IRRs within a IRR Group for the five-minute clock interval

ARI = Average Regulation Instruction = the amount of regulation that the Generation Resource or IRR Group should have produced based on the LFC deployment signals, calculated by LFC, during each five-minute clock interval

Δfrequency is actual frequency minus 60 Hz

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EPFR = Estimated Primary Frequency Response (MW) = if $|\Delta\text{frequency}| \leq$ Governor Dead-Band then EPFR = zero, if not then if Δfrequency > zero, EPFR = (Δfrequency - Governor Dead-Band)/((droop value * 60) – Governor Dead-Band) * HSL * -1, if not then if Δfrequency < zero, EPFR = (Δfrequency + Governor Dead-Band)/((droop value * 60) – Governor Dead-Band) * HSL * -1

AEPFR = Average Estimated Primary Frequency Response = the Estimated Primary Frequency Response (MW) will be calculated every four seconds using a Resource specific droop value where 5% droop = 0.05 the Governor Dead-Band (Hz) and Resource HSL (MW) provided by the Resource Entity, and the frequency deviation (Hz) from 60 Hz and averaged for the five-minute clock interval. For Combined Cycle Generation Resources, or Generation Resources that have been approved to telemeter Non-Frequency Responsive Capacity (NFRC), the HSL will be reduced by the telemetered NFRC MW to calculate the EPFR. For Combined Cycle Generation Resources, 5.78% Governor droop shall be used. The Resource-specific calculations will be aggregated for IRR Groups.

ABP = Average Base Point = the time-weighted average of a linearly ramped Base Point or sum of Base Points for IRR Groups, for the five-minute clock interval. The linearly ramped Base Point is calculated every four seconds such that it ramps from its initial value to the SCED Base Point over a five-minute period. The initial value of the linearly ramped Base Point will be the four-second value of the previous linearly ramped Base Point at the time the new SCED Base Point is received into the ERCOT Energy Management System (EMS). In the event that the SCED Base Point is received after the five-minute ramp period, the linearly ramped Base Point will continue at a constant value equal to the ending four-second value of the five-minute ramp.

(3) For all of a QSE's Resources that have a Resource Status of ONDSR or ONDSRREG ("Dynamically Scheduled Resource (DSR) Portfolio"), ERCOT shall calculate an aggregate GREDP as a percentage and in MWs for those Resources as follows:

GREDP (%) = ABS[($\sum_{DSR}$ ATG – $\sum_{DSR}$ DBPOS + Intra-QSE Purchase – Intra-QSE Sale – A~~R~~FRRDDSRLR - AECRDDSRLR – ANSDDSRLR – $\sum_{DSR}$ AEPFR) / (ATDSRL + $\sum_{DSR}$ ARI) – 1.0] * 100

GREDP (MW) = ABS($\sum_{DSR}$ ATG – $\sum_{DSR}$ DBPOS – ATDSRL– A~~R~~FRRDDSRLR - AECRDDSRLR – ANSDDSRLR + Intra-QSE Purchase - Intra-QSE Sale – $\sum_{DSR}$ AEPFR – $\sum_{DSR}$ ARI)

Where:

$\sum_{DSR}$ ATG = Sum of Average Telemetered Generation for all Resources with a Resource Status of ONDSR or ONDSRREG of the QSE for the five-minute clock interval

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$\sum_{DSR}$ ARI = Sum of Average Regulation Instruction for all Resources with a Resource Status of ONDSR or ONDSRREG of the QSE for the five-minute clock interval

ATDSRL = Average Telemetered DSR Load = the average telemetered DSR Load for the QSE for the five-minute clock interval

Intra-QSE Purchase = Energy Trade where the QSE is both the buyer and seller with the flag set to "Purchase"

Intra-QSE Sale = Energy Trade where the QSE is both the buyer and seller with the flag set to "Sale"

$\sum_{DSR}$ AEPFR = Sum of Average Estimated Primary Frequency Response for all Resources with a Resource Status of ONDSR or ONDSRREG of the QSE for the five-minute clock interval

$\sum_{DSR}$ DBPOS = Sum of the difference between a linearly ramped Base Point minus Output Schedule for all Resources with a Resource Status of ONDSR or ONDSRREG of the QSE for the five-minute clock interval. The linearly ramped Base Point is calculated every four seconds such that it ramps from its initial value to the SCED Base point over a five minute period

AR~~F~~FRRDDSRLR = Average ~~Responsive Frequency Response~~ Responsive Reserve Deployment DSR Load Resource = the average ~~RRS FRS~~RRS energy deployment for the five-minute clock interval from Load Resources that are part of the DSR Load

AECRDDSRLR = Average ERCOT Contingency Response Deployment DSR Load Resource = the average ECRS energy deployment for the five-minute clock interval from Load Resources that are part of the DSR Load

ANSDDSRLR = Average Non-Spin Deployment DSR Load Resource = the average Non-Spin energy deployment for the five-minute clock interval from Load Resources that are part of the DSR Load

(4) For Controllable Load Resources that have a Resource Status of ONRGL or ONCLR, ERCOT shall compute the CLREDP. The CLREDP will be calculated both as a percentage and in MWs as follows:

CLREDP (%) = ABS[((ATPC + AEPFR)/(ABP – ARI)) – 1.0] * 100

CLREDP (MW) = ABS(ATPC – (ABP – AEPFR – ARI))

Where:

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ATPC = Average Telemetered Power Consumption = the average telemetered power consumption of the Controllable Load Resource for the five-minute clock interval

ARI = Average Regulation Instruction = the amount of regulation that the Controllable Load Resource should have produced based on the LFC deployment signals, calculated by LFC, during each five-minute clock interval. Reg-Up is considered a positive value for this calculation

AEPFR = Average Estimated Primary Frequency Response = the Estimated Primary Frequency Response (MW) will be calculated every four seconds using a Resource specific droop value where 5% droop = 0.05, the Governor Dead-Band (Hz) and Resource HSL (MW) provided by the Resource Entity, and the frequency deviation (Hz) from 60 Hz and averaged for the five-minute clock interval

ABP = Average Base Point = the time-weighted average of a linearly ramped Base Point for the five-minute clock interval. The linearly ramped Base Point is calculated every four seconds such that it ramps from its initial value to the SCED Base Point over a five-minute period. The initial value of the linearly ramped Base Point will be the four second value of the previous linearly ramped Base Point at the time the new SCED Base Point is received into the ERCOT EMS. In the event that the SCED Base Point is received after the five minute ramp period, the linearly ramped Base Point will continue at a constant value equal to the ending four second value of the five-minute ramp.

(5) ERCOT shall post to the MIS Certified Area for each QSE and for all Generation Resources or WGR Groups that are not part of a DSR Portfolio, for the DSR Portfolios, and for all Controllable Load Resources:

(a) The percentage of the monthly five-minute clock intervals during which the Generation Resource or IRR Group was On-Line and released to SCED Base Point Dispatch Instructions;

(b) The percentage of the monthly five-minute clock intervals during which the Controllable Load Resource had a Resource Status of either ONRGL or ONCLR;

(c) The percentage of the monthly five-minute clock intervals during which the Generation Resource, IRR or Controllable Load Resource was providing Regulation Service;

(d) The percentage of the monthly five-minute clock intervals during which the Generation Resource, the IRR Group, or the DSR Portfolio was released to SCED that the GREDP was less than 2.5% and the percentage of the monthly five-minute clock intervals during which the Generation Resource, the IRR Group, or the DSR Portfolio was released to SCED that the GREDP was less than 2.5 MW;

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(e) The percentage of the monthly five-minute clock intervals during which the Controllable Load Resource had a Resource Status of either ONRGL or ONCLR that the CLREDP was less than 2.5% and the percentage of the monthly five-minute clock intervals during which the Controllable Load Resource had a Resource Status of either ONRGL or ONCLR that the CLREDP was less than 2.5 MW;

(f) The percentage of the monthly five-minute clock intervals during which the Generation Resource, the IRR Group, or the DSR Portfolio was released to SCED that the GREDP was equal to or greater than 2.5% and equal to or less than 5.0% and the percentage of the monthly five-minute clock intervals during which the Generation Resource, the IRR Group, or the DSR Portfolio was released to SCED that the GREDP was equal to or greater than 2.5 MW and equal to or less than 5.0 MW;

(g) The percentage of the monthly five-minute clock intervals during which the Controllable Load Resource had a Resource Status of either ONRGL or ONCLR that the CLREDP was equal to or greater than 2.5% and equal to or less than 5.0% and the percentage of the monthly five-minute clock intervals during which the Controllable Load Resource had a Resource Status of either ONRGL or ONCLR that the CLREDP was equal to or greater than 2.5 MW and equal to or less than 5.0 MW;

(h) The percentage of the monthly five-minute clock intervals during which the Generation Resource, the IRR Group, or the DSR Portfolio was released to SCED that the GREDP was greater than 5.0% and the percentage of the monthly five-minute clock intervals during which the Generation Resource, the IRR Group, or the DSR Portfolio was released to SCED that the GREDP was greater than 5.0 MW;

(i) The percentage of the monthly five-minute clock intervals during which the Controllable Load Resource had a Resource Status of either ONRGL or ONCLR that the CLREDP was greater than 5.0% and the percentage of the monthly five-minute clock intervals during which the Controllable Load Resource had a Resource Status of either ONRGL or ONCLR that the CLREDP was greater than 5.0 MW;

(j) The percentage of the monthly five-minute clock intervals during which the Generation Resource, the IRR, or the DSR Portfolio was providing Regulation Service that the GREDP was less than 2.5% and the percentage of the monthly five-minute clock intervals during which the Generation Resource, the IRR, or the DSR Portfolio was providing Regulation Service that the GREDP was less than 2.5 MW;

(k) The percentage of the monthly five-minute clock intervals during which the Controllable Load Resource was providing Regulation Service that the CLREDP was less than 2.5% and the percentage of the monthly five-minute clock intervals

during which the Controllable Load Resource was providing Regulation Service that the CLREDP was less than 2.5 MW;

(l) The percentage of the monthly five-minute clock intervals during which the Generation Resource, the IRR, or the DSR Portfolio was providing Regulation Service that the GREDP was equal to or greater than 2.5% and equal to or less than 5.0% and the percentage of the monthly five-minute clock intervals during which the Generation Resource, the IRR, or the DSR Portfolio was providing Regulation Service that the GREDP was equal to or greater than 2.5 MW and equal to or less than 5.0 MW;

(m) The percentage of the monthly five-minute clock intervals during which the Controllable Load Resource was providing Regulation Service that the CLREDP was equal to or greater than 2.5% and equal to or less than 5.0% and the percentage of the monthly five-minute clock intervals during which the Controllable Load Resource was providing Regulation Service that the CLREDP was equal to or greater than 2.5 MW and equal to or less than 5.0 MW;

(n) The percent of the monthly five-minute clock intervals during which the Generation Resource, the IRR, or the DSR Portfolio was providing Regulation Service that the GREDP was greater than 5.0% and the percentage of the monthly five-minute clock intervals during which the Generation Resource, the IRR, or the DSR Portfolio was providing Regulation Service that the GREDP was greater than 5.0 MW; and

(o) The percentage of the monthly five-minute clock intervals during which the Controllable Load Resource was providing Regulation Service that the CLREDP was greater than 5.0% and the percentage of the monthly five-minute clock intervals during which the Controllable Load Resource was providing Regulation Service that the CLREDP was greater than 5.0 MW.

(6) ERCOT shall calculate the GREDP/CLREDP under normal operating conditions. ERCOT shall not consider five-minute clock intervals during which any of the following events has occurred:

(a) The five-minute intervals within the 20-minute period following an event in which ERCOT has experienced a Forced Outage causing an ERCOT frequency deviation of greater than 0.05 Hz;

(b) Five-minute clock intervals in which ERCOT has issued Emergency Base Points to the QSE;

(c) The five-minute clock interval following the Forced Outage of any Resource within the QSE's DSR Portfolio that has a Resource Status of ONDSR or ONDSRREG;

(d) The five-minute clock intervals following a documented Forced Derate or Startup Loading Failure of a Generation Resource or any member IRR of an IRR Group.

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Upon request of the reliability monitor, the QSE shall provide the following documentation regarding each Forced Derate or Startup Loading Failure:

(i) Its generation log documenting the Forced Outage, Forced Derate or Startup Loading Failure;

(ii) QSE (COP) for the intervals prior to, and after the event; and

(iii) Equipment failure documentation which may include, but not be limited to, Generation Availability Data System (GADS) reports, plant operator logs, work orders, or other applicable information;

(e) The five-minute clock intervals where the telemetered Resource Status is set to ONTEST such as intervals during Ancillary Service Qualification and Testing as outlined in Section 8.1.1.1, Ancillary Service Qualification and Testing, or the five-minute clock intervals during general capacity testing requirements as outlined in Section 8.1.1.2, General Capacity Testing Requirements;

(f) The five-minute clock intervals where the telemetered Resource Status is set to STARTUP;

(g) The five-minute clock intervals where a Generation Resource's ABP is below the average telemetered LSL;

(h) Certain other periods of abnormal operations as determined by ERCOT in its sole discretion; and

(i) For a Controllable Load Resource, the five-minute clock intervals in which the computed Base Points are equal to the snapshot of its telemetered power consumption.

(7) All Generation Resources that are not part of a DSR Portfolio, excluding IRRs, and all DSR Portfolios shall meet the following GREDP criteria for each month. ERCOT will report non-compliance of the following performance criteria to the reliability monitor:

(a) A Generation Resource or DSR Portfolio, excluding an IRR, must have a GREDP less than the greater of X% or Y MW for 85% of the five-minute clock intervals in the month during which GREDP was calculated.

(b) If at the end of the month during which GREDP was calculated a DSR Portfolio has a GREDP less than X% or Y MW for 85% of the five-minute clock intervals, the reliability monitor shall, at the request of the QSE with the DSR Portfolio, recalculate GREDP excluding the five-minute clock intervals following the Forced Outage of any Resource within the QSE's DSR Portfolio that has a Resource Status of ONDSR or ONDSRREG continuing until the start of the next Operating Hour for which the QSE is able to adjust. If the Forced Outage of the Resource occurs within ten minutes of the start of the next Operating Hour, then the reliability monitor shall not consider any of the five-minute intervals between the time of the Forced Outage and continuing until the start of the second

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Operating Hour for which the QSE is able to adjust. The requesting QSE shall provide to the reliability monitor information validating the Forced Outage including the time of the occurrence of the Forced Outage and documentation of the last submitted COP status prior to the Forced Outage of the Resource for the intervals in dispute.

(c) Additionally, all Generation Resources that are not part of a DSR Portfolio, excluding IRRs, and all DSR Portfolios will also be measured for performance specifically during intervals in which ERCOT has declared EEA Level 1 or greater. These Resources must meet the following GREDP criteria for the time window that includes all five-minute clock intervals during which EEA was declared. ERCOT will report non-compliance of the following performance criteria to the reliability monitor:

(i) A Generation Resource or DSR Portfolio, excluding an IRR, must have a GREDP less than the greater of X% or Y MW. A Generation Resource or DSR Portfolio cannot fail this criteria more than three five-minute clock intervals during which EEA was declared and GREDP was calculated. The performance will be measured separately for each instance in which ERCOT has declared EEA.

(8) All IRRs and IRR Groups shall meet the following GREDP criteria for each month. ERCOT will report non-compliance of the following performance criteria to the reliability monitor:

(a) An IRR or IRR Group must have a GREDP less than Z% or the ATG must be less than the expected MW output for 95% of the five-minute clock intervals in the month when the Resource or a member IRR of an IRR Group received a Base Point Dispatch Instruction in which the Base Point was two MW or more below the IRR's HSL used by SCED. The expected MW output includes the Resource's Base Point, Regulation Service instructions, and any expected Primary Frequency Response.

(b) Additionally, all IRRs and IRR Groups will also be measured for performance specifically during intervals in which ERCOT has declared EEA Level 1 or greater. These Resources and IRR Groups must meet the following GREDP criteria for the time window that includes all five-minute clock intervals during which EEA was declared. ERCOT will report non-compliance of the following performance criteria to the reliability monitor:

(i) An IRR or IRR Group must have a GREDP less than Z% or the ATG must be less than the expected MW output. An IRR or IRR Group cannot fail this criteria more than three five-minute clock intervals during which EEA was declared and the Resource or a member of an IRR Group received a Base Point Dispatch Instruction in which the Base Point was two MW or more below the IRR's HSL used by SCED. The performance will be

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measured separately for each instance in which ERCOT has declared EEA.

[NPRR879: Replace paragraph (8) above with the following upon system implementation:]

(8) All IRRs and IRR Groups shall meet the following GREDP criteria for each month. ERCOT will report non-compliance of the following performance criteria to the reliability monitor:

(a) An IRR or IRR Group must have a GREDP less than Z% or the ATG must be less than the expected MW output for 95% of the five-minute clock intervals in the month when the Resource or a member IRR of an IRR Group was not carrying an Ancillary Service Resource Responsibility and received a Base Point Dispatch Instruction in which the Base Point was two MW or more below the IRR's HSL used by SCED. The expected MW output includes the Resource's Base Point, Regulation Service instructions, and any expected Primary Frequency Response.

(b) An IRR or IRR Group must have a GREDP less than the greater of X% or Y MW for 85% of the five-minute clock intervals in the month during which the Resource or a member IRR of an IRR Group was carrying an Ancillary Service Resource Responsibility.

(c) Additionally, all IRRs and IRR Groups will also be measured for performance specifically during intervals in which ERCOT has declared EEA Level 1 or greater. These Resources and IRR Groups must meet the following GREDP criteria for the time window that includes all five-minute clock intervals during which EEA was declared. ERCOT will report non-compliance of the following performance criteria to the reliability monitor:

(i) An IRR or IRR Group must have a GREDP less than Z% or the ATG must be less than the expected MW output. An IRR or IRR Group cannot fail this criteria more than three five-minute clock intervals during which EEA was declared and the Resource or a member of an IRR Group was not carrying an Ancillary Service Resource Responsibility and received a Base Point Dispatch Instruction in which the Base Point was two MW or more below the IRR's HSL used by SCED. The performance will be measured separately for each instance in which ERCOT has declared EEA.

(ii) An IRR or IRR Group must have a GREDP less than the greater of X% or Y MW when the Resource or a member IRR of an IRR Group was carrying an Ancillary Service Resource Responsibility. An IRR or IRR Group cannot fail this criteria more than three five-minute clock intervals during which EEA was declared. The performance will be measured separately for each instance in which ERCOT has declared EEA.

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(9) All Controllable Load Resources shall meet the following CLREDP criteria each month. ERCOT will report non-compliance of the following performance criteria to the reliability monitor:

(a) A Controllable Load Resource must have a CLREDP less than the greater of X% or Y MW for 85% of the five-minute clock intervals in the month during which CLREDP was calculated.

(b) Additionally, all Controllable Load Resources will also be measured for performance specifically during intervals in which ERCOT has declared EEA Level 1 or greater. These Resources must meet the following CLREDP criteria for the time window that includes all five-minute clock intervals during which EEA was declared. ERCOT will report non-compliance of the following Performance criteria to the reliability monitor:

(i) A Controllable Load Resource must have a CLREDP less than the greater of X% or Y MW. A Controllable Load Resource cannot fail this criteria more than three five-minute clock intervals during which EEA was declared and CLREDP was calculated. The performance will be measured separately for each instance in which ERCOT has declared EEA.

(c) For Controllable Load Resources which are providing ~~RRS~~ ~~FRS~~RRS, ECRS, or Non-Spin, the following intervals will be excluded from these calculations:

(i) Five-minute clock intervals which begin ten minutes or less after a deployment of ~~RRS~~ ~~FRS~~RRS or ECRS was deployed to the Resource;

(ii) Five-minute clock intervals which begin ten minutes or less after a recall of ~~RRS~~ RRS or ECRS when the Resource was deployed for ~~RRS~~RRS or ECRS;

(iii) Five-minute clock intervals which begin 30 minutes or less after a deployment of Non-Spin was deployed to the Resource; and

(iv) Five-minute clock intervals which begin 30 minutes or less after a recall of Non-Spin when the Resource was deployed for Non-Spin.

(10) The GREDP/CLREDP performance criteria in paragraphs (7) through (9) above shall be subject to review and approval by TAC. The GREDP/CLREDP performance criteria variables X, Y, and Z shall be posted to the MIS Public Area no later than three Business Days after TAC approval.

(11) If at the end of the month during which GREDP was calculated, a non-DSR Resource or a QSE with DSR Resources, has a GREDP less than X% or Y MW for 85% of the five-minute clock intervals, the reliability monitor shall, at the request of the QSE, recalculate GREDP excluding the five-minute clock intervals when a Resource is deployed above the unit's ramp rate due to ramp rate sharing between energy and Regulation Service, as described in Section 6.5.7.2, Resource Limit Calculator. The requesting QSE shall

provide to the reliability monitor information validating the ramp rate violation for the intervals in dispute.

8.1.1.4.2 ~~Responsive Reserve Service~~ERCOT Contingency Reserve Service Energy Deployment Criteria

Commented [CP6]: Please note NPRR921 also proposes revisions to this section.

(1) Each QSE providing ~~RRS~~ECRS shall so indicate by appropriate entries in the Resource's Ancillary Service Schedule and the Ancillary Service Resource Responsibility providing that service. ERCOT shall adjust the Generation Resource's Base Point for any requested ~~RRS~~ECRS energy in the next cycle of SCED as specified in Section 6.5.7.6.2.2, Deployment of ~~Responsive Reserve Service~~ERCOT Contingency Reserve Service. For Controllable Load Resources, the QSE shall control its Resources to operate to the Resource's Scheduled Power Consumption minus any Ancillary Service deployments. Control performance during periods in which ERCOT has deployed ~~RRS~~ECRS shall be based on the requirements below and failure to meet any one of these requirements shall be reported to the Reliability Monitor as non-compliance:

(a) Within one minute following a deployment instruction, the QSE must update the telemetered Ancillary Service Schedule for ~~RRS~~ECRS for Generation Resources, ~~Resources capable of FFR providing RRS,~~ and Load Resources to reflect the deployment amount. The difference between the sum of the QSE's Resource ~~RRS~~ECRS schedules and the sum of the QSE's Resource ~~RRS~~ECRS responsibilities must be equal to the QSE's total ~~RRS~~ECRS deployment instruction, excluding the deployment to Load Resources which are not Controllable Load Resources.

~~(b) A QSE providing RRS must reserve sufficient frequency responsive capacity on each Generation Resource with a RRS responsibility to supply the full amount of RRS scheduled for that Generation Resource. The QSE shall not use NFRC, such as power augmentation capacity on a Generation Resource, to provide RRS.~~

~~(c) ERCOT shall evaluate the Primary Frequency Response of all RRS providers as calculated in Nodal Operating Guide Section 8, Attachment J, Initial and Sustained Measurements for Primary Frequency Response.~~

~~(b) ERCOT shall evaluate the Primary Frequency Response of all RRS providers as calculated in Nodal Operating Guide Section 8, Attachment J, Initial and Sustained Measurements for Primary Frequency Response.~~

(~~d~~b~~e~~b) For QSEs with Load Resources, excluding Controllable Load Resources, ten minutes following deployment instruction the sum of the QSE's Load Resource response shall not be less than 95% of the requested MW deployment, nor more than 150% of the lesser of the following:

(i) The QSE's Responsibility for ~~RRS~~ECRS from non-Controllable Load Resources; or

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(ii) The requested MW deployment.

The QSE's portfolio shall maintain this response until recalled or the Resource's obligation to provide ~~RRS~~ECRS expires. The combination of the QSE's ~~RRS~~ECRS responsibility and additional available capacity shall not exceed 150% of the sum of the QSE's Ancillary Service Resource Responsibility for ~~RRS~~ECRS from non-Controllable Load Resources. Any additional available capacity from Load Resources other than Controllable Load Resources shall be deployed concurrently with ~~RRS~~ECRS ~~Service~~.

(~~cc~~dc) For Load Resources, excluding Controllable Load Resources, associated with a QSE that does not successfully deploy as defined under this Section, ERCOT shall evaluate, identify and investigate each Load Resource that contributed to such failure, in order to determine failure under paragraph (9) of Section 8.1.1.1, Ancillary Service Qualification and Testing.

(~~fd~~ed) A Load Resource providing ~~RRS~~ECRS excluding Controllable Load Resources must return to at least 95% of its Ancillary Service Resource Responsibility for ~~RRS~~ECRS within three hours following a recall instruction unless replaced by another Resource as described below. However, the Load Resource should attempt to return to at least 95% of its Ancillary Service Resource Responsibility for ~~RRS~~ECRS as soon as practical considering process constraints. For a Load Resource that is not a Controllable Load Resource that is unable to return to its Ancillary Service Resource Responsibility within three hours of recall instruction, its QSE may replace the quantity of deficient ~~RRS~~ECRS capacity within that same three hours using other Generation Resources or other Load Resources not previously committed to provide ~~RRS~~ECRS.

(~~ge~~fe) During periods when the Load level of a Load Resource (excluding Controllable Load Resources) has been affected by a Dispatch Instruction from ERCOT, the performance of a Load Resource in response to a Dispatch Instruction must be determined by subtracting the Load Resource's actual Load response from its Baseline. "Baseline" capacity is calculated by measuring the average of the real power consumption for five minutes before the Dispatch Instruction if the Load level of a Load Resource had not been affected by a Dispatch Instruction from ERCOT. The actual Load response is the average of the real power consumption data being telemetered to ERCOT during the Settlement Interval indicated in the Dispatch Instruction.

~~(fg) For Resources capable of FFR providing RRS, ten minutes following deployment the response shall not be less than 95% of the requested MW deployment, nor more than 105% of the requested MW deployment.~~

~~(2) For all Frequency Measurable Events (FMEs), ERCOT shall use the recorded data for each two-second scan rate value of real power output for each All-Inclusive Generation Resource, and Controllable Load Resource. ERCOT shall use the recorded MW data beginning one minute before the start of the frequency excursion event until ten minutes~~

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~~after the start of the frequency excursion event. Satisfactory performance must be measured by comparing actual Primary Frequency Responseoutput~~Primary Frequency Response delivered ~~to the expected Primary Frequency Response as required in the Operating Guides~~expected Primary Frequency Response as required in the Operating Guides~~telemetered Base Point.~~

~~(3) ERCOT shall monitor the Primary Frequency Response that is delivered during FMEs of All-Inclusive Generation Resources and Controllable Load Resources using the methodology specified in the Operating Guides. ERCOT shall monitor the Primary Frequency Response that is delivered during FMEs of Controllable Load Resources, relay response for Loads and hydro ERRS at the frequency specified in paragraph (3)(b) of Section 3.18, Resource Limits in Providing Ancillary Service.~~

8.1.1.4.3 Non-Spinning Reserve Service Energy Deployment Criteria

(1) ERCOT shall, as part of its Ancillary Service deployment procedure under Section 6.5.7.6.2.~~43~~, Non-Spinning Reserve Service Deployment, include all performance metrics for a Resource receiving a Non-Spin recall instruction from ERCOT.

(2) A Non-Spin Dispatch Instruction from ERCOT must respect the minimum runtime of a Generation Resource. After the recall of a Non-Spin Dispatch Instruction, any Generation Resource previously Off-Line providing Non-Spin is allowed to remain On-Line for 30 minutes following the recall. During that time period, the On-Line Generation Resource is treated as if the Non-Spin is being provided.

(3) Control performance during periods in which ERCOT has deployed Non-Spin shall be based on the requirements below and failure to meet any one of these requirements for the greater of one or 5% of Non-Spin deployments during a month shall be reported to the Reliability Monitor as non-compliance:

(a) Within 20 minutes following a deployment instruction, the QSE must update the telemetered Ancillary Service Schedule for Non-Spin for Generation Resources and Controllable Load Resources to reflect the deployment amount.

(b) Off-Line Generation Resources, within 25 minutes following a deployment instruction, must be On-Line with an Energy Offer Curve and the telemetered net generation must be greater than or equal to the Resource's telemetered LSL multiplied by P1 where P1 is defined in the "ERCOT and QSE Operations Business Practices During the Operating Hour." The Resource Status that must be telemetered indicating that the Resource has come On-Line with an Energy Offer Curve is ON as described in paragraph (5)(b)(i) of Section 3.9.1, Current Operating Plan (COP) Criteria.

(c) If an Off-Line Generation Resource experiences a Startup Loading Failure (excluding those caused by operator error), the Resource may be considered for exclusion from performance non-compliance if the QSE provides to ERCOT the following documentation regarding the incident:

(i) Its generation log documenting the Startup Loading Failure; and

(ii) Equipment failure documentation such as, but not limited to, GADS reports, plant operator logs, work orders, or other applicable information.

(d) Controllable Load Resources must be available to SCED, and within 25 minutes following a deployment instruction must have a Real-Time Market (RTM) Energy Bid and the telemetered net real power consumption must be greater than or equal to the Resource's telemetered LPC.

8.1.1.4.4 ~~Primary Frequency Response Service~~Responsive Reserve Energy Deployment Criteria

(1) Each QSE providing ~~PFRS~~RRS shall so indicate by appropriate entries in the Resource's Ancillary Service Schedule and the Ancillary Service Resource Responsibility providing that service. When manually deployed as specified in Nodal Operating Guide Section 4.8, Responsive Reserve Service During Scarcity Conditions, SCED shall adjust the Generation Resource's Base Point for any requested RRS energy in the next cycle of SCED as specified in Section 6.5.7.6.2.2, Deployment of Responsive Reserve Service. ~~ERCOT shall adjust the Generation Resource's Base Point for any self-deployed PFRS energy in the next cycle of SCED.~~ For Controllable Load Resources, the QSE shall control its Resources to operate to the Resource's Scheduled Power Consumption minus any Ancillary Service deployments. Control performance during periods in which ~~PFRS~~RRS has been self-deployed shall be based on the requirements below and failure to meet any one of these requirements may be reported to the Reliability Monitor as non-compliance:

(a) Following a manual deployment instruction, within one minute, the QSE must update the telemetered Ancillary Service Schedule for RRS for Generation Resources and Load Resources to reflect the deployment amount. The difference between the sum of the QSE's Resource RRS schedules and the sum of the QSE's Resource RRS responsibilities must be equal to the QSE's total RRS deployment instruction, excluding the deployment to Load Resources which are not Controllable Load Resources.~~(a) Within one minute following a PFRS self-deployment, the QSE must update the telemetered Ancillary Service Schedule for PFRS for Generation Resources, Resources capable of FFR providing PFRS, and Load Resources providing FRS to reflect the deployment amount. The difference between the sum of the QSE's Resource PFRS schedules and the sum of the QSE's Resource PFRS responsibilities must be equal to the QSE's total PFRS self-deployment amounts.~~

(~~a~~b) A QSE providing ~~PFRS~~RRS must reserve sufficient PFR capable~~frequency responsive~~ capacity on each Generation Resource with a ~~PFRS~~RRS responsibility or must reserve sufficient ~~Resource~~capacity capable of FFR ~~with a PFRS responsibility~~ to supply the full amount of ~~PFRS~~RRS scheduled for that Resource.

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The QSE shall not use NFRC, such as power augmentation capacity on a Generation Resource, to provide ~~PFRS~~RRS.

(c~~b~~e) ERCOT shall evaluate the Primary Frequency Response of all ~~PFRS~~RRS providers as calculated in Nodal Operating Guide Section 8, Attachment J, Initial and Sustained Measurements for Primary Frequency Response.

(2) For all Frequency Measurable Events (FMEs), ERCOT shall use the recorded data for each two-second scan rate value of real power output for each All-Inclusive Generation Resource, Resource capable of FFR providing ~~PFRS~~RRS, and Controllable Load Resource. ERCOT shall use the recorded MW data beginning one minute before the start of the frequency excursion event until ten minutes after the start of the frequency excursion event. Satisfactory performance for those Resources with a ~~PFRS~~RRS responsibility must be measured by comparing actual Primary Frequency Response to the expected Primary Frequency Response as required in the Operating Guides.

(3) ERCOT shall monitor the Primary Frequency Response that is delivered during FMEs of All-Inclusive Generation Resources, Resources capable of FFR, and Controllable Load Resources with ~~PFRS~~RRS responsibilities using the methodology specified in the Operating Guides. ERCOT shall monitor the Primary Frequency Response that is delivered during FMEs of Controllable Load Resources, relay response for Loads and ~~hydro~~ Generation Resources operating in the synchronous condenser fast-response mode providing R~~F~~FRRS at the frequency specified in paragraph (3)(b) of Section 3.18, Resource Limits in Providing Ancillary Service.

(4) For QSEs with Load Resources, excluding Controllable Load Resources, ten minutes following deployment instruction the sum of the QSE's Load Resource response shall not be less than 95% of the requested MW deployment, nor more than 150% of the lesser of the following:

(i) The QSE's Responsibility for ~~FRS~~RRS from non-Controllable Load Resources; or

(ii) The requested MW deployment.

The QSE's portfolio shall maintain this response until recalled or the Resource's obligation to provide ~~FRS~~RRS expires. The combination of the QSE's ~~FRS~~RRS responsibility and additional available capacity shall not exceed 150% of the sum of the QSE's Ancillary Service Resource Responsibility for ~~FRS~~RRS from non-Controllable Load Resources. Any additional available capacity from Load Resources other than Controllable Load Resources shall be deployed concurrently with ~~FRS~~RRS.

(5) For Load Resources, excluding Controllable Load Resources, associated with a QSE that does not successfully deploy as defined under this Section, ERCOT shall evaluate, identify and investigate each Load Resource that contributed to such failure, in order to determine failure under paragraph (9) of Section 8.1.1.1, Ancillary Service Qualification and Testing.

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(6) A Load Resource providing ~~FRS~~RRS excluding Controllable Load Resources must return to at least 95% of its Ancillary Service Resource Responsibility for ~~FRS~~RRS within three hours following a recall instruction unless replaced by another Resource as described below. However, the Load Resource should attempt to return to at least 95% of its Ancillary Service Resource Responsibility for ~~FRS~~RRS as soon as practical considering process constraints. For a Load Resource that is not a Controllable Load Resource that is unable to return to its Ancillary Service Resource Responsibility within three hours of recall instruction, its QSE may replace the quantity of deficient ~~FRS~~RRS capacity within that same three hours using other Generation Resources or other Load Resources not previously committed to provide ~~FRS~~RRS.

(7) During periods when the Load level of a Load Resource (excluding Controllable Load Resources) has been affected by a Dispatch Instruction from ERCOT, the performance of a Load Resource in response to a Dispatch Instruction must be determined by subtracting the Load Resource's actual Load response from its Baseline. "Baseline" capacity is calculated by measuring the average of the real power consumption for five minutes before the Dispatch Instruction if the Load level of a Load Resource had not been affected by a Dispatch Instruction from ERCOT. The actual Load response is the average of the real power consumption data being telemetered to ERCOT during the Settlement Interval indicated in the Dispatch Instruction.

8.5.1.1 Governor in Service

Commented [CP7]: Please note NPRRs 919 and 921 also propose revisions to this section.

(1) At all times an All-Inclusive Generation Resource is On-Line~~is On-Linehas a Primary Frequency Response Service (PFRS) Ancillary Service Resource Responsibility~~, its Governor must remain in service and be allowed to respond to all changes in system frequency except during startup, shutdown, or testing. A Generation Entity ~~with a PFRS Ancillary Service Resource Responsibility~~ may not reduce Primary Frequency Response on an individual All-Inclusive Generation Resource even during abnormal conditions without ERCOT's consent (conveyed by way of the Resource Entity's Qualified Scheduling Entity (QSE)) unless equipment damage is imminent. All All-Inclusive Generation Resources that have capacity available to either increase output or decrease output in Real-Time must provide Primary Frequency Response, which may make use of that available capacity.~~All All-Inclusive Generation Resources that have capacity available to either increase output or decrease output in Real-Time must provide Primary Frequency Response, which may make use of that available capacity.~~ Only Generation Resources providing ~~Frequency Response Service (FRS)~~Responsive Reserve (RRS), Regulation Up (Reg-Up), Regulation Down (Reg-Down), ~~Responsive Reserve~~ERCOT Contingency Reserve Service (~~RRS~~ECRS), or Non-Spinning Reserve (Non-Spin) from On-Line Resources, as specified in Section 8.1.1, QSE Ancillary Service Performance Standards, shall be required to reserve capacity that may also be used to provide Primary Frequency Response. All-inclusive Generation Resources that do not have an ~~PFRS~~RRS ~~Ancillary Service Resource Responsibility~~ or Regulation Service Ancillary Service Resource Responsibility shall set their Governor D~~d~~ead-B~~b~~and no greater than ±0.036 Hz

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from nominal frequency of 60 Hz. An All-Inclusive Generation Resource that widens its Governor Dead-Band greater than what is prescribed in Nodal Operating Guide Section 2.2.7, Turbine Speed Governors, must update its Resource Registration data with the new dead-band value. ~~be responsive to frequency deviations greater than 60.037 Hz and less than 59.963 Hz.are exempted by ERCOT from providing Primary Frequency Response.~~

8.5.1.3 Wind-powered Generation Resource (WGR) Primary Frequency Response

(1) Wind-powered Generation Resources (WGRs) with Standard Generation Interconnection Agreements (SGIAs) signed after January 1, 2010 shall provide Primary Frequency Response to frequency deviations from 60 Hz ~~when they have a PFRS Ancillary Service Resource Responsibility~~. The WGR automatic control system design shall have an adjustable dead band that can be set as specified in the Operating Guides. The Primary Frequency Response shall be specified in the Operating Guides. For WGRs with SGIAs executed on or prior to January 1, 2010, those not already equipped with Primary Frequency Response shall by December 1, 2011 acquire that capability. Those WGRs that cannot technically be retrofitted with Primary Frequency Response capability shall submit an attestation to ERCOT by June 1, 2010 explaining the technical infeasibility. At ERCOT's sole discretion, those WGRs for which Primary Frequency Response is technically infeasible may be granted a permanent exemption from the requirement. ERCOT shall make a determination within 180 days of receipt of the attestation. If ERCOT does not grant an exemption, the WGR shall acquire the capability to provide Primary Frequency Response within 24 months of being notified of that determination. If ERCOT grants the exemption, then ERCOT may require the WGR to install alternate measures, such as over-frequency relays, that are technically feasible and would approximate Primary Frequency Response to events above 60.1 Hz.

8.5.2 Primary Frequency Response Measurements

Commented [CP8]: Please note NPRR921 also proposes revisions to this section.

(1) ERCOT, with the assistance of the appropriate Technical Advisory Committee (TAC) subcommittee, shall analyze the performance of All-Inclusive Generation Resources, Resources capable of Fast Frequency Response (FFR), and Controllable Load Resources for all Frequency Measurable Events (FMEs) in accordance with the Operating Guides. In support of this analysis, ERCOT shall post the following:

(a) ERCOT shall post on the Market Information System (MIS) Public Area the occurrence of an FME within 14 calendar days of occurrence.

(b) ERCOT shall post on the MIS Certified Area for Performance, Disturbance, Compliance Working Group (PDCWG) analysis, the Primary Frequency Response Unit Performance for each All-Inclusive Generation Resource and Controllable Load Resource that is measured in the FME.

(c) ERCOT shall post on the MIS Public Area a monthly report that displays the frequency response of the ERCOT System for a rolling average of the last six FMEs.

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(d) ERCOT shall post on the MIS Public Area an annual report that displays the minimum frequency response computation methodology of the ERCOT System.

(e) ERCOT shall post on the MIS Certified Area the Primary Frequency Response 12-month rolling average for each All-Inclusive Generation Resource, Resources capable of FFR, and Controllable Load Resource.

8.5.2.1 ERCOT Required Primary Frequency Response

Commented [CP9]: Please note NPRR921 also proposes revisions to this section.

(1) All All-Inclusive Generation Resources, Resources capable of FFR, and Controllable Load Resources shall provide Primary Frequency Response in accordance with the requirements established in the Operating Guides ~~when they have a PFRS Ancillary Service Resource Responsibility~~.

~~(2) Resources that do not have a PFRS Ancillary Service Resource Responsibility are exempted by ERCOT from providing Primary Frequency Response.~~

(~~2~~3) ERCOT shall evaluate, with the assistance of the appropriate TAC subcommittee, Primary Frequency Response during FMEs. The actual Generation Resource response must be compiled to determine if adequate Primary Frequency Response was provided.

(~~3~~4) ERCOT and the appropriate TAC subcommittee shall review each FME, verifying the accuracy of data. Data that is in question may be requested from the QSE for comparison or individual Generation Resource data may be retrieved from ERCOT's database.

9.2.3 DAM Settlement Charge Types

(1) ERCOT shall provide, on each Settlement Statement, the dollar amount for each DAM Settlement charge and payment. The DAM settlement "Charge Types" are:

(a) Section 4.6.2.1, Day-Ahead Energy Payment;

(b) Section 4.6.2.2, Day-Ahead Energy Charge;

(c) Section 4.6.2.3.1, Day-Ahead Make-Whole Payment;

(d) Section 4.6.2.3.2, Day-Ahead Make-Whole Charge;

(e) Section 4.6.3, Settlement for PTP Obligations Bought in DAM;

(f) Section 4.6.4.1.1, Regulation Up Service Payment;

(g) Section 4.6.4.1.2, Regulation Down Service Payment;

(h) Section 4.6.4.1.3, ~~Responsive Reserve Service~~ERCOT Contingency Reserve Service Payment;

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(i) Section 4.6.4.1.4, Non-Spinning Reserve Service Payment;

(j) Section 4.6.4.1.5, ~~Frequency Response Service~~Responsive Reserve Payment;

(k~~j~~) Section 4.6.4.2.1, Regulation Up Service Charge;

(l~~k~~) Section 4.6.4.2.2, Regulation Down Service Charge;

(m~~l~~) Section 4.6.4.2.3, ~~Responsive Reserve Service~~ERCOT Contingency Reserve Service Charge;

(n~~m~~) Section 4.6.4.2.4, Non-Spinning Reserve Service Charge;

(o) Section 4.6.4.2.5, ~~Frequency Response Service~~Responsive Reserve Charge;

(~~n~~p) Section 7.9.1.1, Payments and Charges for PTP Obligations Settled in DAM;

(q~~o~~) Section 7.9.1.2, Payments for PTP Options Settled in DAM;

(r~~p~~) Section 7.9.1.4, Payments for FGRs Settled in DAM;

(s~~q~~) Section 7.9.1.5, Payments and Charges for PTP Obligations with Refund Settled in DAM;

(t~~r~~) Section 7.9.1.6, Payments for PTP Options with Refund Settled in DAM; and

(u~~s~~) Paragraph (2) of Section 7.9.3.3, Shortfall Charges to CRR Owners.

9.5.3 Real-Time Market Settlement Charge Types

Commented [CP10]: Please note NPRRs 885 and 917 also propose revisions to this section.

(1) ERCOT shall provide, on each RTM Settlement Statement, the dollar amount for each RTM Settlement charge and payment. The RTM Settlement "Charge Types" are:

(a) Section 5.7.1, RUC Make-Whole Payment;

(b) Section 5.7.2, RUC Clawback Charge;

(c) Section 5.7.3, Payment When ERCOT Decommits a QSE-Committed Resource;

(d) Section 5.7.4.1, RUC Capacity-Short Charge;

(e) Section 5.7.4.2, RUC Make-Whole Uplift Charge;

(f) Section 5.7.5, RUC Clawback Payment;

(g) Section 5.7.6, RUC Decommitment Charge;

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(h) Section 6.6.3.1, Real-Time Energy Imbalance Payment or Charge at a Resource Node;

(i) Section 6.6.3.2, Real-Time Energy Imbalance Payment or Charge at a Load Zone;

(j) Section 6.6.3.3, Real-Time Energy Imbalance Payment or Charge at a Hub;

(k) Section 6.6.3.4, Real-Time Energy Payment for DC Tie Import;

(l) Section 6.6.3.5, Real-Time Payment for a Block Load Transfer Point;

(m) Section 6.6.3.6, Real-Time Energy Charge for DC Tie Export Represented by the QSE Under the Oklaunion Exemption;

[NPRR664: Insert items (n) and (o) below upon system implementation and renumber accordingly:]

(n) Section 6.6.3.7, Real-Time Make-Whole Payment for Exceptional Fuel Cost;

(o) Section 6.6.3.8, Real-Time Make-Whole Charge for Exceptional Fuel Cost;

[NPRR847: Delete items (n) and (o) above upon system implementation.]

(n) Section 6.6.3.7, Real-Time High Dispatch Limit Override Energy Payment;

(o) Section 6.6.3.8, Real-Time High Dispatch Limit Override Energy Charge;

(p) Section 6.6.4, Real-Time Congestion Payment or Charge for Self-Schedules;

(q) Section 6.6.5.1.1.1, Base Point Deviation Charge for Over Generation;

(r) Section 6.6.5.1.1.2, Base Point Deviation Charge for Under Generation;

(s) Section 6.6.5.2, IRR Generation Resource Base Point Deviation Charge;

(t) Section 6.6.5.4, Base Point Deviation Payment;

(u) Section 6.6.6.1, RMR Standby Payment;

(v) Section 6.6.6.2, RMR Payment for Energy;

(w) Section 6.6.6.3, RMR Adjustment Charge;

(x) Section 6.6.6.4, RMR Charge for Unexcused Misconduct;

(y) Section 6.6.6.5, RMR Service Charge;

NPRR Comments

(z) Section 6.6.6.6, Method for Collecting and Distributing RMR and MRA Contributed Capital Expenditures;

(aa) Paragraph (2) of Section 6.6.7.1, Voltage Support Service Payments;

(bb) Paragraph (4) of Section 6.6.7.1;

(cc) Section 6.6.7.2, Voltage Support Charge;

(dd) Section 6.6.8.1, Black Start Hourly Standby Fee Payment;

(ee) Section 6.6.8.2, Black Start Capacity Charge;

(ff) Section 6.6.9.1, Payment for Emergency Power Increase Directed by ERCOT;

(gg) Section 6.6.9.2, Charge for Emergency Power Increases;

(hh) Section 6.6.10, Real-Time Revenue Neutrality Allocation;

(ii) Paragraph (1)(a) of Section 6.7.1, Payments for Ancillary Service Capacity Sold in a Supplemental Ancillary Services Market (SASM) or Reconfiguration Supplemental Ancillary Services Market (RSASM);

(jj) Paragraph (1)(b) of Section 6.7.1;

(kk) Paragraph (1)(c) of Section 6.7.1;

(ll) Paragraph (1)(d) of Section 6.7.1;

(mm~~ll~~) Paragraph (1)(e) of Section 6.7.1;

(nn~~mm~~) Paragraph (1)(a) of Section 6.7.2, Payments for Ancillary Service Capacity Assigned in Real-Time Operations;

(oo~~nn~~) Paragraph (1)(b) of Section 6.7.2;

(pp~~oo~~) Paragraph (1)(c) of Section 6.7.2;

(qq~~oo~~) Paragraph (1)(a) of Section 6.7.2.1, Charges for Infeasible Ancillary Service Capacity Due to Transmission Constraints;

(rr~~pp~~) Paragraph (1)(b) of Section 6.7.2.1;

(ss~~qq~~) Paragraph (1)(c) of Section 6.7.2.1;

(tt~~rr~~) Paragraph (1)(d) of Section 6.7.2.1;

(uu~~ttss~~) Paragraph (1)(e) of Section 6.7.2.1;

NPRR Comments

[NPRR841: Insert item (vyss) below upon system implementation and renumber accordingly:]

(vyss) Paragraph (3) of Section 6.7.2.2, Real-Time Adjustments to Day-Ahead Make-Whole Payments due to Ancillary Services Infeasibility Charges;

(vyss) Paragraph (1)(a) of Section 6.7.3, Charges for Ancillary Service Capacity Replaced Due to Failure to Provide;

(wwtt) Paragraph (1)(b) of Section 6.7.3;

(xxuu) Paragraph (1)(c) of Section 6.7.3;

(yyvv) Paragraph (1)(d) of Section 6.7.3;

(zzyyuu) Paragraph (1)(e) of Section 6.7.3;

(aaaww) Paragraph (2) of Section 6.7.4, Adjustments to Cost Allocations for Ancillary Services Procurement;

(bbbxx) Paragraph (3) of Section 6.7.4;

(cccyy) Paragraph (4) of Section 6.7.4;

(dddzz) Paragraph (5) of Section 6.7.4;

(eeedddbbb) Paragraph (6) of Section 6.7.4;

(fffaaa) Paragraph (7) of Section 6.7.5, Real-Time Ancillary Service Imbalance Payment or Charge (Real-Time Ancillary Service Imbalance Amount);

(gggbbb) Paragraph (7) of Section 6.7.5, (Real-Time Reliability Deployment Ancillary Service Imbalance Amount);

(hhhccc) Paragraph (8) of Section 6.7.5, (Real-Time RUC Ancillary Service Reserve Amount);

(iiiddd) Paragraph (8) of Section 6.7.5, (Real-Time Reliability Deployment RUC Ancillary Service Reserve Amount);

(jjjeee) Section 6.7.6, Real Time Ancillary Service Imbalance Revenue Neutrality Allocation (Load-Allocated Ancillary Service Imbalance Revenue Neutrality Amount);

(kkkfff) Section 6.7.6, (Load-Allocated Reliability Deployment Ancillary Service Imbalance Revenue Neutrality Amount);

(lllggg) Section 7.9.2.1, Payments and Charges for PTP Obligations Settled in Real-Time; and

NPRR Comments

(mmm~~lll~~) Section 9.16.1, ERCOT System Administration Fee.

(2) In the event that ERCOT is unable to execute the Day-Ahead Market (DAM), ERCOT shall provide, on each RTM Settlement Statement, the dollar amount for the following RTM Congestion Revenue Right (CRR) Settlement charges and payments:

(a) Section 7.9.2.4, Payments for FGRs in Real-Time; and

(b) Section 7.9.2.5, Payments and Charges for PTP Obligations with Refund in Real-Time.

To:
Notice_Operations@lists.ercot.com,Notice_Credit@lists.ercot.com,Notice_Settlements@lists.ercot.com

Sent: 6/7/23, 3:19 PM

Subject: M-A060723-01 Market readiness support for QSEs during implementation of the ERCOT Contingency Reserve Service (ECRS)

NOTICE DATE: June 7, 2023

NOTICE TYPE: M-A060723-01 Operations

SHORT DESCRIPTION: Market readiness support for QSEs during implementation of the ERCOT Contingency Reserve Service (ECRS)

INTENDED AUDIENCE: Qualified Scheduling Entities (QSEs)

DAYS AFFECTED: June 8, 2023 through June 10, 2023

LONG DESCRIPTION: Details are provided below to summarize and assist QSEs during the operational and system cutover activities this week in support of the ECRS project launch and accompanying interface changes.

Timing:

- The system upgrade supporting ECRS is planned to occur between 3:30 pm and 5:00 pm on Thursday, June 8, 2023 to support the first Operating Day (OD) with ECRS on June 10, 2023.

Communication:

- ERCOT will post an Operations Message after the upgrade is complete reminding all QSEs that ECRS procurement will begin with Day-Ahead activities on June 9, 2023 for OD June 10, 2023.
- Market Participants can email questions about technical issues to ServiceDesk@ercot.com. In addition, ERCOT will provide 24-hour coverage using ECRSCutover@ercot.com to assist with market submission and other issues from June 8, 2023 3:00pm to June 11, 2023 5:00 pm.

Reminder of transitional changes between the system update and first OD:

- After the upgrade is complete Thursday, June 8, 2023:
  - QSEs do not need to take any immediate action.
  - ECRS will be available for Ancillary Service (AS) Offers, Self-Arranged AS, AS Trades, and Current Operating Plans (COPs) for OD June 10, 2023 and forward.
  - ERCOT will re-publish Day Ahead Non-Controllable Load Resource (NCLR) grouping report for OD June 9, 2023 (re-published grouping will be used for any Responsive Reserve Service (RRS) Deployments on June 9th).
- June 9, 2023:
  - AS Plan published for Day-Ahead Market (DAM) OD June 10 will include ECRS quantities.
  - QSEs can submit AS Self Arrangements and AS Offers into DAM to include ECRS.
  - DAM Awards for OD June 10 will include ECRS Awards and should be reflected in COP for June 10 Day-Ahead Reliability Unit Commitment (DRUC).
  - DAM activities will include ECRS.
- June 10, 2023:
  - First OD with ECRS.
  - Starting at 12:01 am, telemetry should include ECRS values.

Support and mitigation during cutover:

- As noted above, Market Participants can email questions about technical issues to ServiceDesk@ercot.com. In addition, ERCOT will provide 24-hour coverage using the ECRSCutover@ercot.com to assist with market submission and other issues from June 8, 2023 3:00pm to June 11, 2023 5:00 pm. Please include your XML submission and error message(s) in your request.

- QSEs that are experiencing submission issues can also utilize the Market Management User Interface (MMS-UI) as an alternate data entry tool.

Further support information is available:

- ERCOT hosted a workshop on April 3, 2023 to outline the implementation details related to this project. Documentation with reference information is available at the workshop link.
- Weekly Market Readiness Meetings have been providing further details. The link to the most recent Weekly Market Readiness meeting is located here.

CONTACT: If you have any questions, please contact your ERCOT Account Manager. You may also call the general ERCOT Client Services phone number at (512) 248-3900 or contact ERCOT Client Services via email at ClientServices@ercot.com.

dg

PUCT
Judicial Notice
Item No. 6

Control Number: 52373

Item Number: 336

PROJECT NO. 52373

REVIEW OF WHOLESALE ELECTRIC MARKET DESIGN	§ § §	**PUBLIC UTILITY COMMISSION OF TEXAS**

APPROVAL OF BLUEPRINT FOR WHOLESALE ELECTRIC MARKET DESIGN AND DIRECTIVES TO ERCOT

The Commission approves the attached blueprint for the design of the wholesale electric market filed in this project on December 6, 2021. The blueprint is a compilation of directives and concepts designed to reform the Electric Reliability Council of Texas's (ERCOT) wholesale electricity market presented in two phases.

Phase I of the blueprint provides enhancements to current wholesale market mechanisms to enhance ancillary services and improve price signals and operational reliability. Because phase I directives and concepts relate to current ERCOT market features, the Commission directs ERCOT to undertake the actions identified below:

1. The Commission directs ERCOT to modify the operating reserve demand curve as described in phase I of the blueprint no later than January 1, 2022.

2. The Commission orders ERCOT to implement all other items identified in phase I of the blueprint under ERCOT's control as soon as practicable.

3. The Commission directs ERCOT to evaluate phase I of the blueprint and file a report in this project by January 10, 2022 with the following information:
   a. A project plan for implementing all phase 1 items that identifies which projects ERCOT plans to start first and how the implementation would overlap, including opportunities for synergies of implementation and constraints created by dual implementation.
   b. A description of changes to ERCOT's information technology systems needed for implementation of each action item, where applicable.

c. An estimate of the amount of time each action item will take to implement, including time estimates of significant milestones within each action item, where applicable.

d. A description of human-resource needs to implement the phase I action items, including information on how the progress of current ERCOT projects and activities may be impacted by implementation of phase I action items.

e. A description of any impediments to implementation of the phase I action items with recommendations on how to remove or mitigate those impediments.

4. The Commission directs ERCOT to prepare any nodal protocol revision request necessary to facilitate phase I of the blueprint.

5. The Commission directs ERCOT to implement the framework in Commissioner McAdam's memorandum filed in this project on December 14, 2021.

Phase II of the blueprint incorporates long-term market design reforms to promote the supply of dispatchable generation and develop a backstop reliability service. The Commission will continue to develop and refine phase II of the blueprint, but here memorializes the Commission's commitment to the phase II redesign principles. Because phase II directives and concepts require additional decisions before implementation, the Commission directs ERCOT to undertake the action identified below:

6. The Commission directs ERCOT to work with Commission Staff to identify and articulate the specifications, decision points, and other metrics needed to develop the products described in phase II of the blueprint and provide those items to the Commission by February 15, 2021. However, ERCOT must first develop the items related to the backstop reliability service and deliver that to the Commission as soon as practicable.

Public Utility Commission of Texas

Memorandum

TO: Chairman Peter M. Lake
Commissioner Will McAdams
Commissioner Lori Cobos
Commissioner Jimmy Glotfelty

Interested Parties

FROM: Ben Haguewood, Market Analysis

DATE: December 6, 2021

RE: Project No. 52373, *Review of Wholesale Electric Market Design*

At the December 2, 2021 work session, the Commission agreed, in principle, to pursue and continue the implementation of the following Phase I market design changes and have committed to the development of the following Phase II market design elements: a load-side reliability mechanism and a backstop reliability service. The Commission has identified and agreed that both of those concepts will be based on the principles outlined below.

Commission staff requests written comment on the following Phase II market design concepts and principles by noon on December 10, 2021. The Phase I market design changes are included for reference only, and written comment is not requested on these changes. Comments should include a clearly marked Executive Summary up to one page, labeled with the commenter's name, attached as the final page of the submission. Please limit responses to 5 pages, excluding the Executive Summary.

Signed at Austin, Texas the 13th day of January 2022.

PUBLIC UTILITY COMMISSION OF TEXAS

PETER M. LAKE, CHAIRMAN

WILL MCADAMS, COMMISSIONER

LORI COBOS, COMMISSIONER

JIMMY GLOTFELTY, COMMISSIONER

W2013
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Phase I – Enhancements to the Current Market Design

Improving price signals and operational reliability

Operating Reserve Demand Curve (ORDC). Modify ORDC to reward reliable generation assets that are able to be dispatched as the reserve margin in ERCOT decreases. The enhanced ORDC will bring generation units online and prompt consumer demand response earlier to help enhance regular market operations and avoid conservation appeals.

- **Immediately actionable:** Changes to the ORDC should be made effective January 1, 2022 to set the Minimum Contingency Level (MCL) at 3,000 megawatts (MW) and set the high system-wide offer cap (HCAP) and value of lost load (VOLL) to $5,000 per megawatt-hour (MWh). These ORDC changes will enable market-based dispatch of reliable generation units earlier to help maintain grid reliability in the upcoming 2022 winter season and future.
- **Next steps:**
  - The system-wide offer cap and VOLL will be decoupled.
  - Establish a new VOLL based on quantitative analysis of new revenue to the market that would be directed to reliable generation assets during scarcity events.
  - Require a report from ERCOT to the Commission due November 1st of every even numbered year analyzing the efficacy, utilization, related costs and contribution of the ORDC to grid reliability in ERCOT.

Demand Response. Adopt changes that allow for more targeted demand response to increase utilization of load resources for grid reliability.

- **Next steps:**
  - Pursue market modifications and technical measures to improve transparency of price signals for load resources, such as changing demand response pricing from zonal to locational marginal pricing (LMP).
  - Set higher performance standards for energy efficiency programs.
  - Direct ERCOT to evaluate actions that have already been taken to accommodate customer aggregation participation—i.e., virtual power plants (VPPs)—in the ERCOT market, determine how much customer aggregations currently participate in the ERCOT market, and identify current barriers for VPP participation in the ERCOT real-time and ancillary services markets.

Emergency Response Service (ERS) Reform. ERS is an operational reliability tool that should be deployed earlier to allow participating large commercial and industrial consumers, distributed generation (DG) facilities, and aggregated customers to curtail their electricity consumption to reduce demand on the grid to help avoid conservation appeals and emergency conditions.

- **Immediately actionable:** Codify good cause exception ordered by the Commission in the Fall of 2021 directing ERCOT to deploy ERS at MCL.
- **Next steps:**
  - Determine whether the ERS procurement methodology should be changed to provide for the procurement of a specific MW quantity or some other measure than a fixed dollar amount.
  - Determine whether the ERS program should include seasonal apportionment.

Enhancing Ancillary Services

Fast Frequency Response Service (FFRS) (New Grid Frequency Ancillary Service Product). ERCOT is currently developing FFRS to help stabilize grid frequency in the future.

- **Immediately actionable:** ERCOT will continue to pursue its current implementation schedule for this new reliability product.

Loads in Non-Spinning Reserve Service. Expansion of ERCOT's existing Non-Spinning Reserve Service (Non-Spin) to allow loads to participate in the service to provide additional versatility for addressing forecast error or ramping issues in the future.

- **Immediately actionable:** ERCOT will continue to pursue its current implementation schedule for this new reliability product.

Firm Fuel Product. The Commission should direct ERCOT to develop a discrete firm fuel-based reliability service pursuant to Senate Bill (SB) 3. This reliability service would provide additional grid reliability and resiliency during extreme cold weather and compensate generation resources that meet a higher resiliency standard.

- **Next steps:**
  - Determine whether this stand-alone, discrete service can be incorporated into a load-side reliability mechanism in the future.
  - Determine whether this product should be procured by ERCOT through a competitive auction, competitive request for proposal (RFP) process (similar to ERCOT's current Black Start program), or some other competitive procurement method.

Voltage Support Compensation. The ERCOT market will develop a product to compensate valuable voltage support services that will help maintain grid stability as more inverter-based resources enter the market.

- **Immediately actionable:** Analyze and develop a product to compensate resources for providing voltage support.

ERCOT Contingency Reserve Service (ECRS) (New Ramping Ancillary Service Product). ERCOT is currently developing ECRS to serve as an additional operational reliability tool to help maintain grid reliability by managing increasing variability and ramping issues associated with higher renewable generation penetration on the grid in the future.

- **Immediately actionable:** ERCOT will accelerate the implementation of this new reliability product.
- **Next steps:**
  - Determine options for sizing the product.
  - Allocate cost of ECRS consistent with cost-causation principles, in a non-discriminatory manner pursuant to SB 3.

Additional tasks: The Commission will open rulemaking proceedings and other projects to request technical feedback and provide rate recovery of reasonable and necessary distribution voltage reduction costs and review DG interconnection procedures.