

TAC Recommendation Report

NPRR Number	098	NPRR Title	Protocol Sections 4 and 6 Formula Clarifications and Related Revisions
Timeline	Normal	Recommended Action	Approval
Date of Decision	March 6, 2008		
Protocol Sections Requiring Revision	4.6.4.2, Charges for Ancillary Services Procurement in the DAM 6.6.7, Voltage Support Settlement 6.6.9.1, Payment for Emergency Power increase directed by ERCOT 6.7.3, Real Time Settlements calculations for Ancillary Services		
Proposed Effective Date	Upon Texas Nodal Market implementation		
Priority and Rank Assigned	Not applicable		
Revision Description	This Nodal Protocol Revision Request (NPRR) revises parts of Section 4.6.4.2 and Sections 6.6.7, 6.6.9.1 and 6.7.3 to add clarity to the formulas for charges related to certain Ancillary Services and variable definitions or data elements.		
Overall Market Benefit	Greater accuracy of the formulas and related data elements.		
Overall Market Impact	None.		
Consumer Impact	None.		
Credit Impacts	ERCOT credit staff and the Credit Work Group (Credit WG) have reviewed NPRR098 and do not believe that it requires changes to credit monitoring activity or the calculation of liability.		
Procedural History	<ul style="list-style-type: none"> ➤ NPRR098 was posted on 1/9/08. ➤ On 1/9/08, ERCOT Staff comments were posted. ➤ On 1/17/08, PRS considered NPRR098. ➤ On 2/14/08, ERCOT posted the Impact Analysis (IA). ➤ On 2/21/08, PRS reviewed the IA and this Recommendation Report. ➤ On 3/6/08, TAC considered NPRR098. 		
PRS Decision	<p>On 1/17/08, PRS unanimously voted to recommend approval of NPRR098 as revised by ERCOT Staff comments. All Market Segments were present for the vote.</p> <p>On 2/21/08, PRS unanimously voted to forward the IA and this Recommendation Report to TAC. All Market Segments were present for the vote.</p>		

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Summary of PRS Discussion	On 1/17/08, ERCOT Staff explained that their comments were editorial in nature. There was no discussion on 2/21/08.
TAC Decision	On 3/6/08, TAC unanimously voted to recommend approval of NPRR098 as recommended by PRS. All Market Segments were present for the vote.
Summary of TAC Discussion	No discussion preceded the vote on 3/6/08.

ERCOT/Market Segment Impacts and Benefits

Assumptions	1	<i>n/a</i>	
	2		
	3		
	4		
Market Cost		Impact Area	Monetary Impact
	1	<i>None known</i>	<i>None known</i>
	2		
	3		
Market Benefit		Impact Area	Monetary Impact
	1	<i>Improves accuracy of formulas</i>	<i>none</i>
	2	<i>Improves transparency of bill determinants</i>	<i>none</i>
	3		
Additional Qualitative Information	1		
	2		
	3		
	4		
Other Comments	1		
	2		
	3		
	4		

Comments Received

Comment Author	Comment Summary
ERCOT 010908	Proposed editorial changes.

Original Sponsor

Name	Trip Doggett on behalf of TPTF.
Company	ERCOT
Market Segment	N/A

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Proposed Protocol Language Revision

2.2 Acronyms

SASM Supplemental Ancillary Services Market
URL Unit Reactive Limit

[...]

4.6.4.2 Charges for Ancillary Services Procurement in the DAM

4.6.4.2.1 Regulation Up Service Charge

Each QSE shall pay to ERCOT a Regulation Up Service (Reg-Up)~~Service~~ charge for each hour as follows:

$$\text{DARUAMT}_q = \text{DARUPR} * \text{DARUQ}_q$$

Where:

$$\text{DARUPR} = (-1) * \text{PCRUAMTTOT}_{\text{DAM}} / \text{DARUQTOT}$$

$$\text{PCRUAMTTOT}_{\text{DAM}} = \sum_q \text{PCRUAMT}_{q, \text{DAM}}$$

$$\text{DARUQTOT} = \sum_q \text{DARUQ}_q$$

$$\text{DARUQ}_q = \text{DARUONET}_q - \text{DARUSQ}_{q, \text{DAM}}$$

$$\text{DARUONET}_q = \text{DARUO}_q + \text{DARUCS}_q - \text{DARUCP}_q$$

The above variables are defined as follows:

Variable	Unit	Definition
DARUAMT_q	\$	Day-Ahead Reg-Up Amount per QSE—QSE q 's share of the DAM cost for Reg-Up, for the hour.
DARUPR	\$/MW per hour	Day-Ahead Reg-Up Price—The Day-Ahead Reg-Up price for the hour.
DARUQ_q	MW	Day-Ahead Reg-Up Quantity per QSE—The portion of QSE q 's net Day-Ahead Ancillary Service obligation that is not self-supplied with its Resources capacity, for the hour.
$\text{PCRUAMTTOT}_{\text{DAM}}$	\$	Procured Capacity for Reg-Up Amount Total in DAM—The total of the DAM Reg-Up payments for all QSEs for the hour.
$\text{PCRUAMT}_{q, \text{DAM}}$	\$	Procured Capacity for Reg-Up Amount per QSE in DAM—The DAM Reg-Up payment for QSE q for the hour.

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Variable	Unit	Definition
DARUQTOT	MW	<i>Day-Ahead Reg-Up Quantity Total</i> —The sum of every QSE's portion of its net Day-Ahead Ancillary Service obligation that is not self-supplied with its Resource, for the hour.
DARUONET _q	MW	<i>Day-Ahead Reg-Up Obligation Net per QSE</i> —The net Day-Ahead Ancillary Service obligation of QSE <i>q</i> , for the hour.
DARUO _q	MW	<i>Day-Ahead Reg-Up Obligation per QSE</i> —The Reg-Up capacity obligation for QSE <i>q</i> for the DAM for the hour.
DARUCS _q	MW	<i>Reg-Up Capacity Sale per QSE <u>on or before 1430 in the Day-Ahead</u></i> —The total Reg-Up capacity shown in Ancillary Service Trades with QSE <i>q</i> as a seller <u>submitted on or before 1430 in the Day-Ahead for the DAM</u> , for the hour.
DARUCP _q	MW	<i>Reg-Up Capacity Purchase per QSE <u>on or before 1430 in the Day-Ahead</u></i> —The total Reg-Up capacity shown in Ancillary Service Trades with QSE <i>q</i> as a buyer <u>submitted on or before 1430 in the Day-Ahead for the DAM</u> , for the hour.
<u>DARUSQ</u> _{q-DAM}	MW	<i>Reg-Up Supplied Quantity per QSE in DAM</i> —The capacity for Reg-Up to be supplied with Resources represented by QSE <i>q</i> to meet its Ancillary Service Obligation and/or its Ancillary Service trades, for the DAM, for the hour.
<u>q</u>	<u>none</u>	<u>A QSE</u>

4.6.4.2.2 Regulation Down Service Charge

Each QSE shall pay to ERCOT a Regulation-Down Service (Reg-Down)~~Service~~ charge for each hour as follows:

$$\mathbf{DARDAMT}_q = \mathbf{DARDPR} * \mathbf{DARDQ}_q$$

Where:

$$\mathbf{DARDPR} = (-1) * \mathbf{PCRDAMTTOT}_{DAM} / \mathbf{DARDQTOT}$$

$$\mathbf{PCRDAMTTOT}_{DAM} = \sum_q \mathbf{PCRDAMT}_{q,DAM}$$

$$\mathbf{DARDQTOT} = \sum_q \mathbf{DARDQ}_q$$

$$\mathbf{DARDQ}_q = \mathbf{DARDONET}_q - \mathbf{DARDSQ}_{q-DAM}$$

$$\mathbf{DARDONET}_q = \mathbf{DARDO}_q + \mathbf{DARDCS}_q - \mathbf{DARDCP}_q$$

The above variables are defined as follows:

Variable	Unit	Definition
DARDAMT _q	\$	<i>Day-Ahead Reg-Down Amount per QSE</i> —QSE <i>q</i> 's share of the DAM cost for Reg-Down, for the hour.

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Variable	Unit	Definition
DARDPR	\$/MW per hour	<i>Day-Ahead Reg-Down Price</i> —The Day-Ahead Reg-Down price for the hour.
DARDQ _q	MW	<i>Day-Ahead Reg-Down Quantity per QSE</i> —The portion of QSE <i>q</i> 's net Day-Ahead Ancillary Service obligation that is not self-supplied with its Resources capacity, for the hour.
PCRDAMTTOT _{DAM}	\$	<i>Procured Capacity for Reg-Down Amount Total in DAM</i> —The total of the DAM Reg-Down payments for all QSEs for the hour.
PCRDAMT _{q, DAM}	\$	<i>Procured Capacity for Reg-Down Amount per QSE in DAM</i> —The DAM Reg-Down payment for QSE <i>q</i> for the hour.
DARDQTOT	MW	<i>Day-Ahead Reg-Down Quantity Total</i> —The sum of every QSE's portion of its net Day-Ahead Ancillary Service obligation that is not self-supplied with its Resource, for the hour.
DARDONET _q	MW	<i>Day-Ahead Reg-Down Obligation Net per QSE</i> —The net Day-Ahead Ancillary Service obligation of QSE <i>q</i> , for the hour.
DARDO _q	MW	<i>Day-Ahead Reg-Down Obligation per QSE</i> —The Reg-Down capacity obligation for QSE <i>q</i> for the DAM for the hour.
DARDCS _q	MW	<i>Reg-Down Capacity Sale per QSE <u>on or before 1430 in the Day-Ahead</u></i> —The total Reg-Down capacity shown in Ancillary Service Trades with QSE <i>q</i> as a seller <u>submitted on or before 1430 in the Day-Ahead for the DAM</u> , for the hour.
DARDCP _q	MW	<i>Reg-Down Capacity Purchase per QSE <u>on or before 1430 in the Day-Ahead</u></i> —The total Reg-Down capacity shown in Ancillary Service Trades with QSE <i>q</i> as a buyer <u>submitted on or before 1430 in the Day-Ahead for the DAM</u> , for the hour.
DARDSQ _{q-DAM}	MW	<i>Reg-Down Supplied Quantity per QSE in DAM</i> —The capacity for Reg-Down to be supplied with Resources represented by QSE <i>q</i> to meet its Ancillary Service Obligation and/or its Ancillary Service trades, for the DAM, for the hour.
<u>q</u>	<u>none</u>	<u>A QSE</u>

4.6.4.2.3 Responsive Reserve Service Charge

Each QSE shall pay to ERCOT a Responsive Reserve Service (RRS) charge for each hour as follows:

$$\mathbf{DARRAMT}_q = \mathbf{DARRPR} * \mathbf{DARRQ}_q$$

Where:

$$\mathbf{DARRPR} = (-1) * \mathbf{PCRRAMTTOT}_{DAM} / \mathbf{DARRQTOT}$$

$$\mathbf{PCRRAMTTOT}_{DAM} = \sum_q \mathbf{PCRRAMT}_{q, DAM}$$

$$\mathbf{DARRQTOT} = \sum_q \mathbf{DARRQ}_q$$

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$$\text{DARRQ}_q = \text{DARRONET}_q - \text{DARRSQ}_{q-\text{DAM}}$$

$$\text{DARRONET}_q = \text{DARRO}_q + \text{DARRCS}_q - \text{DARRCP}_q$$

The above variables are defined as follows:

Variable	Unit	Definition
DARRAMT _q	\$	Day-Ahead Responsive Reserve Amount per QSE—QSE <i>q</i> 's share of the DAM cost for Responsive Reserve, for the hour.
DARRPR	\$/MW per hour	Day-Ahead Responsive Reserve Price—The Day-Ahead Responsive Reserve price for the hour.
DARRQ _q	MW	Day-Ahead Responsive Reserve Quantity per QSE—The portion of QSE <i>q</i> 's net Day-Ahead Ancillary Service obligation that is not self-supplied with its Resources capacity, for the hour.
PCRRAMTTOT _{DAM}	\$	Procured Capacity for Responsive Reserve Amount Total in DAM—The total of the DAM Responsive Reserve payments for all QSEs for the hour.
PCRRAMT _{q, DAM}	\$	Procured Capacity for Responsive Reserve Amount per QSE for DAM—The DAM Responsive Reserve payment for QSE <i>q</i> for the hour.
DARRQTOT	MW	Day-Ahead Responsive Reserve Quantity Total—The sum of every QSE's portion of its net Day-Ahead Ancillary Service obligation that is not self-supplied with its Resource, for the hour.
DARRONET _q	MW	Day-Ahead Responsive Reserve Obligation Net per QSE—The net Day-Ahead Ancillary Service obligation of QSE <i>q</i> , for the hour.
DARRO _q	MW	Day-Ahead Responsive Reserve Obligation per QSE—The Responsive Reserve capacity obligation for QSE <i>q</i> for the DAM for the hour.
DARRCS _q	MW	Responsive Reserve Capacity Sale per QSE <u>on or before 1430 in the Day-Ahead</u> —The total Responsive Reserve capacity shown in Ancillary Service Trades with QSE <i>q</i> as a seller <u>submitted on or before 1430 in the Day-Ahead for the DAM</u> , for the hour.
DARRCP _q	MW	Responsive Reserve Capacity Purchase per QSE <u>on or before 1430 in the Day-Ahead</u> —The total Responsive Reserve capacity shown in Ancillary Service Trades with QSE <i>q</i> as a buyer <u>submitted on or before 1430 in the Day-Ahead for the DAM</u> , for the hour.
<u>DARRSQ</u> _{q-DAM}	MW	Responsive Reserve Supplied Quantity per QSE in DAM—The capacity for Responsive Reserve to be supplied with Resources represented by QSE <i>q</i> to meet its Ancillary Service Obligation and/or its Ancillary Service trades, for the DAM, for the hour.
<u>q</u>	<u>none</u>	<u>A QSE</u>

4.6.4.2.4 Non-Spinning Reserve Service Charge

Each QSE shall pay to ERCOT a Non-Spinning Reserve Service (Non-Spin) Service charge for each hour as follows:

$$\text{DANSAMT}_q = \text{DANSPR} * \text{DANSQ}_q$$

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Where:

$$\text{DANSPR} = (-1) * \text{PCNSAMTTOT}_{\text{DAM}} / \text{DANSQTOT}$$

$$\text{PCNSAMTTOT}_{\text{DAM}} = \sum_q \text{PCNSAMT}_{q, \text{DAM}}$$

$$\text{DANSQTOT} = \sum_q \text{DANSQ}_q$$

$$\text{DANSQ}_q = \text{DANSONET}_q - \text{DANSSQ}_{q, \text{DAM}}$$

$$\text{DANSONET}_q = \text{DANSO}_q + \text{DANSCS}_q - \text{DANSCP}_q$$

The above variables are defined as follows:

Variable	Unit	Definition
DANSAMT _q	\$	Day-Ahead Non-Spin Amount per QSE—QSE <i>q</i> 's share of the DAM cost for Non-Spin, for the hour.
DANSPR	\$/MW per hour	Day-Ahead Non-Spin Price—The Day-Ahead Non-Spin price for the hour.
DANSQ _q	MW	Day-Ahead Non-Spin Quantity per QSE—The portion of QSE <i>q</i> 's net Day-Ahead Ancillary Service obligation that is not self-supplied with its Resources capacity, for the hour.
PCNSAMTTOT _{DAM}	\$	Procured Capacity for Non-Spin Amount Total in DAM—The total of the DAM Non-Spin payments for all QSEs for the hour.
PCNSAMT _{q, DAM}	\$	Procured Capacity for Non-Spin Amount per QSE in DAM—The DAM Non-Spin payment for QSE <i>q</i> for the hour.
DANSQTOT	MW	Day-Ahead Non-Spin Quantity Total—The sum of every QSE's portion of its net Day-Ahead Ancillary Service obligation that is not self-supplied with its Resource, for the hour.
DANSONET _q	MW	Day-Ahead Non-Spin Obligation Net per QSE—The net Day-Ahead Ancillary Service obligation of QSE <i>q</i> , for the hour.
DANSO _q	MW	Day-Ahead Non-Spin Obligation per QSE—The Non-Spin capacity obligation for QSE <i>q</i> for the DAM for the hour.
DANSCS _q	MW	Non-Spin Capacity Sale per QSE <u>on or before 1430 in the Day-Ahead</u> — The total Non-Spin capacity shown in Ancillary Service Trades with QSE <i>q</i> as a seller <u>submitted on or before 1430 in the Day-Ahead</u> for the DAM, for the hour.
DANSCP _q	MW	Non-Spin Capacity Purchase per QSE <u>on or before 1430 in the Day-Ahead</u> —The total Non-Spin capacity shown in Ancillary Service Trades with QSE <i>q</i> as a buyer <u>submitted on or before 1430 in the Day-Ahead</u> for the DAM, for the hour.
<u>DANSSQ</u> _{q, DAM}	MW	Non-Spin Supplied Quantity per QSE in DAM—The capacity for Non-Spin to be supplied with Resources represented by QSE <i>q</i> to meet its Ancillary Service Obligation and/or its Ancillary Service trades, for the DAM, for the hour.
<u>q</u>	<u>none</u>	<u>A QSE</u>

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[...]

6.6.7 Voltage Support Settlement

6.6.7.1 Voltage Support Service Payments

- (1) All other Generation Resources shall be eligible for compensation for Reactive Power production in accordance with Section 6.5.7.7, Voltage Support Service, only if ERCOT issues a Dispatch Instruction that results in the following unit operation:
 - (a) When ERCOT instructs the Generation Resource to exceed its Unit Reactive Limit (URL) and the Generation Resource provides additional Reactive Power, then ERCOT shall pay for the additional Reactive Power provided at a price that recognizes the avoided cost of reactive support Resources on the transmission network.
 - (b) Any real power reduction directed by ERCOT through Verbal Dispatch Instructions to provide for additional reactive capability for voltage support must be compensated as a lost opportunity payment
- (2) The payment for a given 15-minute Settlement Interval to each Qualified Scheduling Entity (QSE) representing a Generation Resource that operates in accordance with an ERCOT Dispatch Instruction is calculated as follows:

Depending on the Dispatch Instruction, payment for Volt Amps Reactive (var):

If $VSSVARLAG_{q,r} > 0$

$$VSSVARMT_{q,r} = (-1) * VSSVARPR * VSSVARLAG_{q,r}$$

If $VSSVARLEAD_{q,r} > 0$

$$VSSVARMT_{q,r} = (-1) * VSSVARPR * VSSVARLEAD_{q,r}$$

Where:

$$VSSVARLAG_{q,r} = \text{Max} [0, \text{Min} (\frac{1}{4} * VSSVARIOL_{q,r}, RTVAR_{q,r}) - (\frac{1}{4} * URLLAG_{q,r})]$$

$$VSSVARLEAD_{q,r} = \text{Max} \{ 0, [(\frac{1}{4} * URLLEAD_{q,r}) - \text{Max} ((\frac{1}{4} * VSSVARIOL_{q,r}), RTVAR_{q,r})] \}$$

$$URLLAG_{q,r} = 0.32868 * HSL_{q,r}$$

$$URLLEAD_{q,r} = (-1) * 0.32868 * HSL_{q,r}$$

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The above variables are defined as follows:

Variable	Unit	Definition
VSSVARAMT _{q,r}	\$	<i>Voltage Support Service var Amount per QSE per Generation Resource</i> - The payment to QSE <i>q</i> for the VSS provided by Generation Resource <i>r</i> , for the 15-minute Settlement Interval.
VSSVARPR	\$/Mvarh	<i>Voltage Support Service var Price</i> - The price for instructed Mvar beyond a Generation Resource's URL currently is \$2.65/Mvarh (based on \$50.00/installed kvar).
VSSVARLAG _{q,r}	Mvarh	<i>Voltage Support Service var Lagging per QSE per Generation Resource</i> - The instructed portion of the Reactive Power above the Generation Resource's lagging URL for Generation Resource <i>r</i> represented by QSE <i>q</i> , for the 15-minute Settlement Interval.
VSSVARLEAD _{q,r}	Mvarh	<i>Voltage Support Service var Leading per QSE per Generation Resource</i> - The instructed portion of the Reactive Power below the Generation Resource's leading URL for Generation Resource <i>r</i> represented by QSE <i>q</i> , for the 15-minute Settlement Interval.
VSSVARIOL _{q,r}	Mvar	<i>Voltage Support Service var Instructed Output Level per QSE per Generation Resource</i> —The instructed Reactive Power output level of Generation Resource <i>r</i> represented by QSE <i>q</i> , lagging Reactive Power if positive and leading Reactive Power if negative, for the 15-minute Settlement Interval.
RTVAR _{q,r}	MVARh	<i>Real-Time var per QSE per Resource</i> —The netted Reactive Energy measured for Generation Resource <i>r</i> represented by QSE <i>q</i> , for the 15-minute Settlement Interval.
URLLAG _{q,r}	Mvar	<i>Unit Reactive Limit Lagging per QSE per Resource</i> —The Unit Reactive Limit for lagging Reactive Power of the Generation Resource <i>r</i> represented by QSE <i>q</i> as determined in accordance with these Protocols. Its value is positive.
URLLEAD _{q,r}	Mvar	<i>Unit Reactive Limit Leading per QSE per Resource</i> —The Unit Reactive Limit for leading Reactive Power of the Generation Resource <i>r</i> represented by QSE <i>q</i> as determined in accordance with these Protocols. Its value is negative.
HSL _{q,r}	MW	<i>High Sustained Limit</i> — The High Sustained limit of a Generation Resource as defined in Section 2, Definitions, for the hour that includes the Settlement Interval <i>i</i> .
q	none	A QSE.
r	none	A Generation Resource.

- (3) The total additional compensation to each QSE for voltage support service for the 15-minute Settlement Interval is calculated as follows:

$$\text{VSSVARAMTQSETOT}_q = \sum_r \text{VSSVARAMT}_{q,r}$$

Variable	Unit	Definition
VSSVARAMT _{q,r}	\$	<i>Voltage Support Service var Amount per QSE per Generation Resource</i> - The payment to QSE <i>q</i> for the VSS provided by Generation Resource <i>r</i> , for the 15-minute Settlement Interval.

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Variable	Unit	Definition
VSSVARAMTQSETOT _q	\$	Voltage Support var Amount QSE total per QSE - The total of the payments to QSE <i>q</i> as compensation for voltage support service by this QSE for the 15-minute settlement interval.
q	none	A QSE.
r	none	A Generation Resource.

(4) The lost opportunity payment, if applicable:

$$VSSEAMT_{q,r} = (-1) * \text{Max}(0, RTSP_{p,r}) * \text{Max}(0, (HSL_{q,r} * \frac{1}{4} - RTMG_{q,r})) - (RTICHSL_{q,r} - RTVSSAIEC_{q,r} * (RTMG_{q,r} - LSL_{q,r} * \frac{1}{4})))$$

Where

$$RTICHSL_{q,r} = RTHSLAIEC_{q,r} * (\frac{1}{4} * HSL_{q,r} - \frac{1}{4} * LSL_{q,r})$$

The above variables are defined as follows:

Variable	Unit	Definition
VSSEAMT _{q,r}	\$	Voltage Support Service Energy Amount per QSE per Generation Resource—The lost opportunity payment to QSE <i>q</i> for ERCOT-directed VSS from Generation Resource <i>r</i> for the 15-minute Settlement Interval.
RTMG _{q,r}	MWh	Real-Time Metered Generation per QSE per Resource—The Real-Time metered generation of Generation Resource <i>r</i> represented by QSE <i>q</i> , for the 15-minute Settlement Interval.
RTSP _p	\$	Real-Time Settlement Point Price—The Real-Time Settlement Point Price at the Resource Node for the 15-minute Settlement Interval. -
RTVSSAIEC _{q,r}	\$/MWh	Real-Time Average Incremental Energy Cost per QSE per Resource—The average incremental cost to operate (not subject to cost cap) the Generation Resource <i>r</i> represented by QSE <i>q</i> from its LSL to its metered MW output, for the 15-minute Settlement Interval.
RTICHSL _{q,r}	\$	Real-Time Incremental Cost Corresponding with HSL per QSE per Resource—The incremental cost to operate (not subject to cost cap) Generation Resource <i>r</i> represented by QSE <i>q</i> from its LSL to its HSL, for the 15-minute Settlement Interval.
RTHSLAIEC _{q,r}	\$/MWh	Real-Time Average Incremental Energy Cost for the entire Energy Offer Curve through the HSL per QSE per Resource—The average incremental cost to operate (not subject to cost cap) the Generation Resource R-r represented by QSE Q-q from its LSL to its HSL, for the 15-minute Settlement Interval.
HSL _{q,r}	MW	High Sustainable Limit Generation per QSE per Settlement Point per Resource—The High Sustainable Limit of Generation Resource <i>r</i> represented by QSE <i>q</i> at Resource Node <i>p</i> for the hour that includes the 15-minute Settlement Interval.
LSL _{q,r}	MW	Low Sustainable Limit Generation per QSE per Settlement Point per Resource—The Low Sustainable Limit of Generation Resource <i>r</i> represented by QSE <i>q</i> at Resource Node <i>p</i> for the hour that includes the 15-minute Settlement Interval.
q	none	A QSE.
r	none	A Generation Resource.

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Variable	Unit	Definition
p	<u>none</u>	<u>A Resource Node Settlement Point</u>

- (5) The total of the payments to each QSE for -ERCOT-directed power reduction to provide VSS for a given 15-minute Settlement Interval is calculated as follows:

$$\text{VSSEAMTQSETOT}_q = \sum_r \text{VSSEAMT}_{q,r}$$

The above variables are defined as follows:

Variable	Unit	Definition
VSSEAMTQSETOT_q	\$	<i>Voltage Support Service Lost Opportunity Amount QSE Total per QSE</i> —The total of the lost opportunity payments to QSE q for providing VSS for providing ERCOT-directed VSS for the 15-minute Settlement Interval.
$\text{VSSEAMT}_{q,r}$	\$	<i>Voltage Support Service Energy Amount per QSE per Settlement Point per Generation Resource</i> —The lost opportunity payment to QSE q for ERCOT-directed VSS from Generation Resource r for the 15-minute Settlement Interval for the 15-minute Settlement Interval.
q	none	A QSE.
r	none	A Generation Resource.

[...]

6.6.9.1 Payment for Emergency Power Increase Directed by ERCOT

- (1) If the Emergency Base Point issued to a Generation Resource is higher than the SCED Base Point immediately before the Emergency Condition, then ERCOT shall pay the QSE an additional compensation for the Resource at its Resource Node Settlement Point. The payment for a given 15-minute Settlement Interval is calculated as follows:

$$\text{EMREAMT}_{q,r,p} = (-1) * \text{EMREPR}_{q,r,p} * \text{EMRE}_{q,r,p}$$

Where:

$$\text{EMREPR}_{q,r,p} = \text{Max} (0, \text{EBPWAPR}_{q,r,p} - \text{RTSPP}_p)$$

$$\text{EBPWAPR}_{q,r,p} = \frac{\sum_y (\text{EBPPR}_{q,r,p,y} * \text{EBP}_{q,r,p,y} * \text{TLMP}_y)}{\sum_y (\text{EBP}_{q,r,p,y} * \text{TLMP}_y)}$$

$$\text{EMRE}_{q,r,p} = \text{Max} (0, \text{Min} (\text{AEBP}_{q,r,p} * \frac{1}{4} \text{RTMG}_{q,r,p}) - \frac{1}{4} * \text{BP}_{q,r,p})$$

$$\text{AEBP}_{q,r,p} = \frac{\sum_y (\text{EBP}_{q,r,p,y} * \text{TLMP}_y / 3600)}$$

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The above variables are defined as follows:

Variable	Unit	Definition
EMREAMT _{q, r, p}	\$	<i>Emergency Energy Amount per QSE per Settlement Point per Resource</i> —The payment to QSE <i>q</i> as additional compensation for the additional energy produced by Generation Resource <i>r</i> at Resource Node <i>p</i> in Real-Time during the Emergency Condition, for the 15-minute Settlement Interval.
EMREPR _{q, r, p}	\$/MWh	<i>Emergency Energy Price per QSE per Settlement Point per Resource</i> —The compensation rate for the additional energy produced by Generation Resource <i>r</i> at Resource Node <i>p</i> represented by QSE <i>q</i> in Real-Time during the Emergency Condition, for the 15-minute Settlement Interval.
EMRE _{q, r, p}	MWh	<i>Emergency Energy per QSE per Settlement Point per Resource</i> —The additional energy produced by Generation Resource <i>r</i> at Resource Node <i>p</i> represented by QSE <i>q</i> in Real-Time during the Emergency Condition, for the 15-minute Settlement Interval.
EBPWAPR _{q, r, p}	\$/MWh	<i>Emergency Base Point Weighted Average Price per QSE per Settlement Point per Resource</i> —The weighted average of the energy prices corresponding with the Emergency Base Points on the Energy Offer Curve for Resource <i>r</i> at Resource Node <i>p</i> represented by QSE <i>q</i> , for the 15-minute Settlement Interval.
BP _{q, r, p}	MW	<i>Base Point per QSE per Settlement Point per Resource</i> —The Base Point of Resource <i>r</i> at Resource Node <i>p</i> represented by QSE <i>q</i> from the SCED prior to the Emergency Condition.
AEBP _{q, r, p}	MW	<i>Aggregated Emergency Base Point</i> — The Generation Resource's aggregated Emergency Base Point, for the 15-minute Settlement Interval.
EBP _{q, r, p, y}	MW	<i>Emergency Base Point per QSE per Settlement Point per Resource by interval</i> —The Emergency Base Point of Resource <i>r</i> at Resource Node <i>p</i> represented by QSE <i>q</i> for the Emergency Base Point interval or SCED interval <i>y</i> . If a Base Point instead of an Emergency Base Point is effective during the interval <i>y</i> , its value equals the Base Point.
EBPPR _{q, r, p, y}	\$/MWh	<i>Emergency Base Point Price per QSE per Settlement Point per Resource by interval</i> —The Real-Time energy offer price corresponding with the Emergency Base Point of Resource <i>r</i> at Resource Node <i>p</i> represented by QSE <i>q</i> , for the Emergency Base Point interval or SCED interval <i>y</i> .
RTSPP _p	\$/MWh	<i>Real-Time Settlement Point Price per Settlement Point</i> —The Real-Time Settlement Point Price at Settlement Point <i>p</i> , for the 15-minute Settlement Interval.
RTMG _{q, r, p}	MWh	<i>Real-Time Metered Generation per QSE per Settlement Point per Resource</i> —The metered generation of Resource <i>r</i> at Resource Node <i>p</i> represented by QSE <i>q</i> in Real-Time for the 15-minute Settlement Interval.
TLMP _y	second	<i>Duration of Emergency Base Point interval or SCED interval per interval</i> —The duration of the portion of the Emergency Base Point interval or SCED interval <i>y</i> within the 15-minute Settlement Interval.
q	none	A QSE.
p	none	A Resource Node Settlement Point.
r	none	A Generation Resource.
y	none	An Emergency Base Point interval or SCED interval that overlaps the 15-minute Settlement Interval.

- (2) The total additional compensation to each QSE for emergency power increases of Generation Resources for the 15-minute Settlement Interval is calculated as follows:

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$$\text{EMREAMTQSETOT}_q = \sum_r \sum_p \text{EMREAMT}_{q,r,p}$$

The above variables are defined as follows:

Variable	Unit	Definition
EMREAMTQSETOT_q	\$	<i>Emergency Energy Amount QSE Total per QSE</i> —The total of the payments to QSE q as additional compensation for emergency power increases of the non-RMR Generation Resources represented by this QSE for the 15-minute Settlement Interval.
$\text{EMREAMT}_{q,r,p}$	\$	<i>Emergency Energy Amount per QSE per Settlement Point per Resource</i> —The payment to QSE q as additional compensation for the additional energy produced by Generation Resource r at Resource Node p in Real-Time during the Emergency Condition, for the 15-minute Settlement Interval.
q	N one	A QSE.
p	none	A Resource Node Settlement Point.
r	none	A Generation Resource.

[...]

6.7.3 Adjustments to Cost Allocations for Ancillary Services Procurement

Each Qualified Scheduling Entity (QSE), for which ERCOT purchases Ancillary Service capacity in the Day-Ahead Market (DAM) and Supplemental Ancillary Services Markets (SASMs) (if any), 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 both DAM and SASMs less its DAM charge is calculated in this section.

(1) For Regulation Up Service (Reg-Up), if applicable:

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

$$\text{RUCOSTTOT} = (-1) * (\sum_m (\text{RTPCRUAMTTOT}_m + \text{PCRUAMTTOT}_m) + \text{RUFQAMTTOT})$$

Where:

Total payment of DAM or SASM procured capacity for Reg-Up by market

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

$$\text{PCRUAMTTOT}_m = \sum_q (\text{PCRUAMT}_{q,m})$$

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$$\text{Total charge of failure on Ancillary Service Supply Responsibility for Reg-Up} \\ \text{RUFQAMTTOT} = \sum_q \text{RUFQAMT}_q$$

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

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

The above variables are defined as follows:

Variable	Unit	Description
RUCOSTTOT	\$	<i>Reg-Up Cost Total</i> —The net total costs for Reg-Up for the hour.
RTPCRUAMTTOT _m	\$	<i>Procured Capacity for Reg-Up Amount Total by market</i> —The total payments to all QSEs for the Ancillary Service Offers cleared in the market <i>m</i> for Reg-Up, for the hour.
RTPCRUAMT _{q, m}	\$	<i>Procured Capacity for Reg-Up Amount per QSE by market</i> —The payment to QSE <i>q</i> for its Ancillary Service Offers cleared in the market <i>m</i> for Reg-Up, for the hour.
RUFQAMTTOT	\$	<i>Reg-Up Failure Quantity Amount Total</i> —The total charges to all QSEs for their capacity associated with failures on their Ancillary Service Supply Responsibilities for Reg-Up, for the hour.
RUFQAMT _q	\$	<i>Reg-Up Failure Quantity Amount per QSE</i> —The charge to QSE <i>q</i> for its total capacity associated with failures on its Ancillary Service Supply Responsibility for Reg-Up, for the hour.
RTPCRUAMTQSETOT _q	\$	<i>Procured Capacity for Reg-Up Amount Total per QSE</i> —The total payments to a QSE in all SASM markets for the Ancillary Service Offers cleared for Reg-Up Service, for the hour.
PCRUAMT _{q, m}	\$	<i>Procured Capacity for Reg-Up Amount per QSE in DAM</i> —The DAM Reg-Up Service payment for QSE <i>q</i> for the hour.
q	none	A QSE.
m	none	The DAM or a SASM for the given Operating Hour.
<u>PCRUAMTTOT_m</u>	<u>\$</u>	<u><i>Procured Capacity for Reg-Up Amount Total in DAM</i>—The total of the DAM Reg-Up payments for all QSEs for the hour.</u>

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

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

Where:

$$\text{RUPR} = \text{RUCOSTTOT} / \text{RUQTOT}$$

$$\text{RUQTOT} = \sum_q \text{RUQ}_q$$

$$\text{RUQ}_q = \text{RUONET}_q - \frac{\sum \text{RUSQ}_{q \neq m}}{\text{DAMorSASMT total}}$$

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$$RUONET_q = \left(\sum_q (\text{RUSQ}_q - \sum_m \text{RUSQ}_{q,m}) + \sum_m (\text{RTPCRU}_{q,m} + \text{PCRU}_{q,m}) - \sum_m \text{RURP}_{q,m} - \text{RUFQ}_q \right) * \text{HLRS}_q + \text{RUCS}_q - \text{RUCP}_q + \sum_m \text{RURP}_{q,m}$$

$$\text{RUCS}_q = \text{DARUCS}_q + \text{RTRUCS}_q$$

$$\text{RUCP}_q = \text{DARUCP}_q + \text{RTRUCP}_q$$

$$\text{RUSQ}_q = \text{DARUSQ}_q + \text{RTRUSQ}_q$$

The above variables are defined as follows:

Variable	Unit	Description
RUCOST _q	\$	<i>Reg-Up Cost per QSE</i> —QSE <i>q</i> 's share of the net total costs for Reg-Up, for the hour.
RUPR	\$/MW per hour	<i>Reg-Up Price</i> —The price for Reg-Up calculated based on the net total costs for Reg-Up, for the hour.
RUCOSTTOT	\$	<i>Reg-Up Cost Total</i> —The net total costs for Reg-Up for the hour. See item (a) above.
RUQTOT	MW	<i>Reg-Up Quantity Total</i> —The sum of every QSE's portion of its net Ancillary Service Obligation that is not self-supplied with its Resource capacity in either DAM or any SASM, for the hour.
RUQ _q	MW	<i>Reg-Up Quantity per QSE</i> —The portion of QSE <i>q</i> 's net Ancillary Service Obligation that is not self-supplied with its Resources capacity in either DAM or any SASM, for the hour.
RUONET _q	MW	<i>Reg-Up Obligation Net per QSE</i> —The net Ancillary Service Obligation of QSE <i>q</i> , for the hour.
<u>DARUSQ_q</u>	<u>MW</u>	<u><i>Reg-Up Supplied Quantity per QSE for DAM</i>—The capacity for Reg-Up to be supplied with Resources represented by QSE <i>q</i> to meet its Ancillary Service Obligation and/or its Ancillary Service Trades, for the DAM, for the hour.</u>
<u>RTRUSQ_{q,m}</u>	<u>MW</u>	<u><i>Reg-Up Supplied Quantity per QSE for all SASMs</i></u> per market —The capacity for Reg-Up to be supplied with Resources represented by QSE <i>q</i> to meet its Ancillary Service Obligation and/or its Ancillary Service Trades, for the market <u>the total of all SASMs</u> <i>m</i> , for the hour.
RTPCRU _{q,m}	MW	<i>Procured Capacity for Reg-Up per QSE by market</i> —The MW portion of QSE <i>q</i> 's Ancillary Service Offers cleared in the market <i>m</i> to provide Reg-Up, for the hour.
RUFQ _q	MW	<i>Reg-Up Failure Quantity per QSE</i> —QSE <i>q</i> 's total capacity associated with failures on its Ancillary Service Supply Responsibility for Reg-Up, for the hour.
HLRS _q	none	The hourly Load Ratio Share calculated for QSE <i>q</i> for the hour. See Section 6.6.2.3, QSE Load Ratio Share for an Operating Hour.
RUCS _q	MW	<i>Reg-Up Capacity Sale per QSE</i> —The total Reg-Up capacity shown in Ancillary Service Trades <u>for all markets</u> with QSE <i>q</i> as a seller, for the hour.
RUCP _q	MW	<i>Reg-Up Capacity Purchase per QSE</i> —The total Reg-Up capacity shown in Ancillary Service Trades <u>for all markets</u> with QSE <i>q</i> as a buyer, for the hour.
RURP _{q,m}	MW	<i>Reg-Up Replacement per QSE</i> per market —The <u>total</u> Reg-Up capacity that was a portion of the Ancillary Service Supply Responsibility of QSE <i>q</i> but is replaced in <u>at the SASM</u> market <i>m</i> , for the hour.
PCRU _{q,m}	MW	<i>Procured Capacity for Reg-Up per QSE in DAM</i> —The total Reg-Up Service capacity quantity awarded to QSE <i>q</i> in the DAM for all the Resources represented by

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Variable	Unit	Description
		the QSE for the hour.
q	none	A QSE.
m	none	The DAM or a SASM for the given Operating Hour.
RTRUCS _q	MW	<u>Reg-Up Capacity Sale per QSE submitted after 1430 in the Day-Ahead</u> —The total Reg-Up capacity shown in Ancillary Service Trades with QSE q as a seller, submitted after 1430 in the Day-Ahead, for the hour.
RTRUCP _q	MW	<u>Reg-Up Capacity Purchase per QSE submitted after 1430 in the Day-Ahead</u> —The total Reg-Up capacity shown in Ancillary Service Trades with QSE q as a buyer, submitted after 1430 in the Day-Ahead, for the hour.
DARUCP _q	MW	<u>Reg-Up Capacity Purchase per QSE on or before 1430 in the Day-Ahead</u> —The total Reg-Up capacity shown in Ancillary Service Trades with QSE q as a buyer submitted on or before 1430 in the Day-Ahead for the hour.
DARUCS _q	MW	<u>Reg-Up Capacity Sale per QSE on or before 1430 in the Day-Ahead</u> —The total Reg-Up capacity shown in Ancillary Service Trades with QSE q as a seller submitted on or before 1430 in the Day-Ahead for the hour.
RUSQ _q m	MW	<u>Reg-Up Supplied Quantity per QSE for all markets</u> —The capacity for Reg-Up to be supplied with Resources represented by QSE q to meet its Ancillary Service Obligation and/or its Ancillary Service Trades, for all the markets _m , for the 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	\$	<u>Real-Time Reg-Up Amount per QSE</u> —The adjustment to QSE q's share of the costs for Reg-Up, for the hour.
RUCOST _q	\$	<u>Reg-Up Cost per QSE</u> —QSE q's share of the net total costs for Reg-Up, for the hour.
DARUAMT _q	\$	<u>Day-Ahead Reg-Up Amount per QSE</u> —QSE q's share of the DAM cost for Reg-Up, for the hour.
q	none	A QSE.

- (2) For **Regulation-Down Service (Reg-Down)**, if applicable:

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

$$RDCOSTTOT = (-1) * (\sum_m (RTPCRDAMTTOT_m + PCRDAMTTOT_m) + RDFQAMTTOT)$$

Where:

Total payment of DAM or SASM procured capacity for Reg-Down by market

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$$\text{RTPCRDAMTTOT}_m = \sum_q \text{RTPCRDAMT}_{q,m}$$

$$\underline{\text{PCRDAMTTOT}_m} = \underline{\sum_q \text{PCRDAMT}_{q,m}}$$

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

$$\text{RDFQAMTTOT} = \sum_q \text{RDFQAMT}_q$$

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

$$\text{RTPCRDAMTQSETOT}_q = \sum_m \text{RTPCRDAMT}_{q,m}$$

The above variables are defined as follows:

Variable	Unit	Description
RDCOSTTOT	\$	<i>Reg-Down Cost Total</i> —The net total costs for Reg-Down for the hour.
RTPCRDAMTTOT_m	\$	<i>Procured Capacity for Reg-Down Amount Total by market</i> —The total payments to all QSEs for the Ancillary Service Offers cleared in the market m for Reg-Down, for the hour.
$\text{RTPCRDAMT}_{q,m}$	\$	<i>Procured Capacity for Reg-Down Amount per QSE by market</i> —The payment to QSE q for its Ancillary Service Offers cleared in the market m for Reg-Down, for the hour.
RDFQAMTTOT	\$	<i>Reg-Down Failure Quantity Amount Total</i> —The total charges to all QSEs for their capacity associated with failures on their Ancillary Service Supply Responsibilities for Reg-Down, for the hour.
RDFQAMT_q	\$	<i>Reg-Down Failure Quantity Amount per QSE</i> —The charge to QSE q for its total capacity associated with failures on its Ancillary Service Supply Responsibility for Reg-Down, for the hour.
RTPCRDAMTQSETOT_q	\$	<i>Procured Capacity for Reg-Down Amount Total per QSE</i> —The total payments to a QSE in all SASM markets for the Ancillary Service Offers cleared for Reg-Down Service, for the hour.
$\text{PCRDAMT}_{q,m}$	\$	<i>Procured Capacity for Regulation Down Amount per QSE for DAM</i> —The DAM Reg-Down Service payment for QSE q for the hour.
q	none	A QSE.
m	none	The DAM or a SASM for the given Operating Hour.
$\underline{\text{PCRDAMTTOT}_m}$	$\underline{\$}$	<i>Procured Capacity for Reg-Down Amount Total in DAM</i> —The total of the DAM Reg-Down payments for all QSEs for the hour.

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

$$\text{RDCOST}_q = \text{RDPR} * \text{RDQ}_q$$

Where:

$$\text{RDPR} = \text{RDCOSTTOT} / \text{RDQTOT}$$

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$$RDQTOT = \sum_q RDQ_q$$

$$RDQ_q = RDONET_q - \sum_m RDSQ_{q,m}$$

$$RDONET_q = \left(\sum_q (RDSQ_q - \sum_m RDSQ_{q,m}) + \sum_m (RTPCRD_{q,m} + PCRD_{q,m}) - \sum_m RDRP_{q,m} - RDFQ_q \right) * HLRS_q + RDCS_q - RDCP_q + \sum_m RDRP_{q,m}$$

$$RDCS_q = DARDCS_q + RTRDCS_q$$

$$RDCP_q = DARDCP_q + RTRDCP_q$$

$$RDSQ_q = DARDSQ_q + RTRDSQ_q$$

The above variables are defined as follows:

Variable	Unit	Description
RDCOST _q	\$	<i>Reg-Down Cost per QSE</i> —QSE <i>q</i> 's share of the net total costs for Reg-Down, for the hour.
RDPR	\$/MW per hour	<i>Reg-Down Price</i> —The price for Reg-Down calculated based on the net total costs for Reg-Down, for the hour.
RDCOSTTOT	\$	<i>Reg-Down Cost Total</i> —The net total costs for Reg-Down for the hour. See item (a) above.
RDQTOT	MW	<i>Reg-Down Quantity Total</i> —The sum of every QSE's portion of its net Ancillary Service Obligation that is not self-supplied with its Resource capacity in either DAM or any SASM, for the hour.
RDQ _q	MW	<i>Reg-Down Quantity per QSE</i> —The portion of QSE <i>q</i> 's net Ancillary Service Obligation that is not self-supplied with its Resources capacity in either DAM or any SASM, for the hour.
RDONET _q	MW	<i>Reg-Down Obligation Net per QSE</i> —The net Ancillary Service Obligation of QSE <i>q</i> , for the hour.
<u>DARDSQ_q</u>	<u>MW</u>	<u><i>Reg-Up Supplied Quantity per QSE for DAM</i>—The capacity for Reg-Down to be supplied with Resources represented by QSE <i>q</i> to meet its Ancillary Service Obligation and/or its Ancillary Service Trades, for the DAM, for the hour.</u>
<u>RTRDSQ_{q,m}</u>	<u>MW</u>	<u><i>Reg-Down Supplied Quantity per QSE for all SASMs per market</i>—The capacity for Reg-Down to be supplied with Resources represented by QSE <i>q</i> to meet its Ancillary Service Obligation and/or its Ancillary Service Trades, for <u>the total of all SASMs</u>the market <i>m</i>, for the hour.</u>
RTPCRD _{q,m}	MW	<i>Procured Capacity for Reg-Down per QSE by market</i> —The MW portion of QSE <i>q</i> 's Ancillary Service Offers cleared in the market <i>m</i> to provide Reg-Down, for the hour.
RDFQ _q	MW	<i>Reg-Down Failure Quantity per QSE</i> —QSE <i>q</i> 's total capacity associated with failures on its Ancillary Service Supply Responsibility for Reg-Down, for the hour.
HLRS _q		The hourly Load Ratio Share calculated for QSE <i>q</i> for the hour. See Section 6.6.2.3, QSE Load Ratio Share for an Operating Hour.
RDCS _q	MW	<i>Reg-Down Capacity Sale per QSE</i> —The total Reg-Down capacity shown in Ancillary Service Trades <u>for all markets</u> with QSE <i>q</i> as a seller, for the hour.

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Variable	Unit	Description
RDCP _q	MW	<i>Reg-Down Capacity Purchase per QSE</i> —The total Reg-Down capacity shown in Ancillary Service Trades <u>for all markets</u> with QSE <i>q</i> as a buyer, for the hour.
RDRP _{q, m}	MW	<i>Reg-Down Replacement per QSE per market</i> —The <u>total</u> Reg-Down capacity that was a portion of the Ancillary Service Supply Responsibility of QSE <i>q</i> but is replaced in <u>a SASM</u> the market <i>m</i> , for the hour.
PCRD _{q, m}	MW	<i>Procured Capacity for Reg-Down per QSE in DAM</i> —The total Reg-Down Service capacity quantity awarded to QSE <i>q</i> in the DAM for all the Resources represented by the QSE for the hour.
q	none	A QSE.
m	none	The DAM or a SASM for the given Operating Hour.
<u>RTRDCS_q</u>	<u>MW</u>	<u><i>Reg-Down Capacity Sale per QSE submitted after 1430 in the Day-Ahead</i>—The total Reg-Down capacity shown in Ancillary Service Trades with QSE <i>q</i> as a seller, submitted after 1430 in the Day-Ahead, for the hour.</u>
<u>RTRDCP_q</u>	<u>MW</u>	<u><i>Reg-Down Capacity Purchase per QSE submitted after 1430 in the Day-Ahead</i>—The total Reg-Down capacity shown in Ancillary Service Trades with QSE <i>q</i> as a buyer, submitted after 1430 in the Day-Ahead, for the hour.</u>
<u>DARDCP_q</u>	<u>MW</u>	<u><i>Reg-Down Capacity Purchase per QSE on or before 1430 in the Day-Ahead</i>—The total Reg-Down capacity shown in Ancillary Service Trades with QSE <i>q</i> as a buyer submitted on or before 1430 in the Day-Ahead for the hour.</u>
<u>DARDCS_q</u>	<u>MW</u>	<u><i>Reg-Down Capacity Sale per QSE on or before 1430 in the Day-Ahead</i>—The total Reg-Down capacity shown in Ancillary Service Trades with QSE <i>q</i> as a seller submitted on or before 1430 in the Day-Ahead for the hour.</u>
RDSQ _{q, m}	MW	<i>Reg-Down Supplied Quantity per QSE</i> for all markets —The capacity for Reg-Down to be supplied with Resources represented by QSE <i>q</i> to meet its Ancillary Service Obligation and/or its Ancillary Service Trades, for the all market <i>m</i> s, for the 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:

$$\mathbf{RTRDAMT}_q = \mathbf{RDCOST}_q - \mathbf{DARDAMT}_q$$

The above variables are defined as follows:

Variable	Unit	Description
RTRDAMT _q	\$	<i>Real-Time Reg-Down Amount per QSE</i> —The adjustment to QSE <i>q</i> 's share of the costs for Reg-Down, for the hour.
RDCOST _q	\$	<i>Reg-Down Cost per QSE</i> —QSE <i>q</i> 's share of the net total costs for Reg-Down, for the hour.
DARDAMT _q	\$	<i>Day-Ahead Reg-Down Amount per QSE</i> —QSE <i>q</i> 's share of the DAM cost for Reg-Down, for the hour.
q	none	A QSE.

- (3) For Responsive Reserve Service (RRS), if applicable:

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

$$\text{RRCOSTTOT} = (-1) * (\sum_m (\text{RTPCRRAMTTOT}_m + \text{PCRRAMTTOT}_m) + \text{RRFQAMTTOT})$$

Where:

Total payment of DAM or SASM procured capacity for Responsive Reserve by market

$$\text{RTPCRRAMTTOT}_m = \sum_q (\text{RTPCRRAMT}_{q,m})$$

$$\text{PCRRAMTTOT}_m = \sum_q (\text{PCRRAMT}_{q,m})$$

Total charge of failure on Ancillary Service Supply Responsibility for Responsive Reserve

$$\text{RRFQAMTTOT} = \sum_q \text{RRFQAMT}_q$$

Total payment of SASM procured capacity for Responsive Reserve Service by QSE

$$\text{RTPCRRAMTQSETTOT}_q = \sum_m \text{RTPCRRAMT}_{q,m}$$

The above variables are defined as follows:

Variable	Unit	Description
RRCOSTTOT	\$	<i>Responsive Reserve Cost Total</i> —The net total costs for Responsive Reserve for the hour.
RTPCRRAMTTOT _m	\$	<i>Procured Capacity for Responsive Reserve Amount Total by market</i> —The total payments to all QSEs for the Ancillary Service Offers cleared in the market <i>m</i> for Responsive Reserve, for the hour.
RTPCRRAMT _{q, m}	\$	<i>Procured Capacity for Responsive Reserve Amount per QSE by market</i> —The payment to QSE <i>q</i> for its Ancillary Service Offers cleared in the market <i>m</i> for Responsive Reserve, for the hour.
RRFQAMTTOT	\$	<i>Responsive Reserve Failure Quantity Amount Total</i> —The total charges to all QSEs for their capacity associated with failures on their Ancillary Service Supply Responsibilities for Responsive Reserve, for the hour.
RRFQAMT _q	\$	<i>Responsive Reserve Failure Quantity Amount per QSE</i> —The charge to QSE <i>q</i> for its total capacity associated with failures on its Ancillary Service Supply Responsibility for Responsive Reserve, for the hour.
RTPCRRAMTQSETTOT _q	\$	<i>Procured Capacity for Responsive Reserve Amount Total per QSE</i> —The total payments to a QSE in all SASM markets for the Ancillary Service Offers cleared for Responsive Reserve, for the hour.
PCRRAMT _{q, m}	\$	<i>Procured Capacity for Responsive Reserve Amount per QSE for DAM</i> —The DAM Responsive Reserve payment for QSE <i>q</i> for the hour.
q	none	A QSE.
m	none	The DAM or a SASM for the given Operating Hour.
PCRRAMTTOT _m	\$	<i>Procured Capacity for Responsive Reserve Amount Total in DAM</i> —The total of the DAM Responsive Reserve payments for all QSEs for the hour.

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

$$\mathbf{RRCOST}_q = \mathbf{RRPR} * \mathbf{RRQ}_q$$

Where:

$$\mathbf{RRPR} = \mathbf{RRCOSTTOT} / \mathbf{RRQTOT}$$

$$\mathbf{RRQTOT} = \sum_q \mathbf{RRQ}_q$$

$$\mathbf{RRQ}_q = \mathbf{RRONET}_q - \sum_m \mathbf{RRSQ}_{q,m}$$

$$\mathbf{RRONET}_q = \left(\sum_q (\mathbf{RRSQ}_q - \sum_m \mathbf{RRSQ}_{q,m}) + \sum_m (\mathbf{RTPCRR}_{q,m} + \mathbf{PCRR}_{q,m}) - \sum_m \mathbf{RRRP}_{q,m} - \mathbf{RRFQ}_q \right) * \mathbf{HLRS}_q + \mathbf{RRCS}_q - \mathbf{RRCP}_q + \sum_m \mathbf{RRRP}_{q,m}$$

$$\mathbf{RRCS}_q = \mathbf{DARRCS}_q + \mathbf{RTRRCS}_q$$

$$\mathbf{RRCP}_q = \mathbf{DARRCP}_q + \mathbf{RTRRCP}_q$$

$$\mathbf{RRSQ}_q = \mathbf{DARRSQ}_q + \mathbf{RTRRSQ}_q$$

The above variables are defined as follows:

Variable	Unit	Description
\mathbf{RRCOST}_q	\$	<i>Responsive Reserve Cost per QSE</i> —QSE q 's share of the net total costs for Responsive Reserve, for the hour.
\mathbf{RRPR}	\$/MW per hour	<i>Responsive Reserve Price</i> —The price for Responsive Reserve calculated based on the net total costs for Responsive Reserve, for the hour.
$\mathbf{RRCOSTTOT}$	\$	<i>Responsive Reserve Cost Total</i> —The net total costs for Responsive Reserve for the hour. See item (a) above.
\mathbf{RRQTOT}	MW	<i>Responsive Reserve Quantity Total</i> —The sum of every QSE's portion of its net Ancillary Service Obligation that is not self-supplied with its Resource capacity in either DAM or any SASM, for the hour.
\mathbf{RRQ}_q	MW	<i>Responsive Reserve Quantity per QSE</i> —The portion of QSE q 's net Ancillary Service Obligation that is not self-supplied with its Resources capacity in either DAM or any SASM, for the hour.
\mathbf{RRONET}_q	MW	<i>Responsive Reserve Obligation Net per QSE</i> —The net Ancillary Service Obligation of QSE q , for the hour.
\mathbf{DARRSQ}_q	MW	<i>Responsive Reserve Supplied Quantity per QSE for DAM</i> —The capacity for Responsive Reserve to be supplied with Resources represented by QSE q to meet its Ancillary Service Obligation and/or its Ancillary Service Trades, for the DAM, for the hour.
$\mathbf{RTRRSQ}_{q,m}$	MW	<i>Responsive Reserve Supplied Quantity per QSE per market for all SASMs</i> —The capacity for Responsive Reserve to be supplied with Resources represented by QSE

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Variable	Unit	Description
		<i>q</i> to meet its Ancillary Service Obligation and/or its Ancillary Service Trades, for <u>the total of all SASMs</u> the market <i>m</i> , for the hour.
RTPCRR _{<i>q, m</i>}	MW	<i>Procured Capacity for Responsive Reserve per QSE by market</i> —The MW portion of QSE <i>q</i> 's Ancillary Service Offers cleared in the market <i>m</i> to provide Responsive Reserve, for the hour.
RRFQ _{<i>q</i>}	MW	<i>Responsive Reserve Failure Quantity per QSE</i> —QSE <i>q</i> 's total capacity associated with failures on its Ancillary Service Supply Responsibility for Responsive Reserve, for the hour.
HLRS _{<i>q</i>}	none	The hourly Load Ratio Share calculated for QSE <i>q</i> for the hour. See Section 6.6.2.3, QSE Load Ratio Share for an Operating Hour.
RRCS _{<i>q</i>}	MW	<i>Responsive Reserve Capacity Sale per QSE</i> —The total Responsive Reserve capacity shown in Ancillary Service Trades <u>for all markets</u> with QSE <i>q</i> as a seller, for the hour.
RRCP _{<i>q</i>}	MW	<i>Responsive Reserve Capacity Purchase per QSE</i> —The total Responsive Reserve capacity shown in Ancillary Service Trades <u>for all markets</u> with QSE <i>q</i> as a buyer, for the hour.
RRRP _{<i>q, m</i>}	MW	<i>Responsive Reserve Replacement per QSE per market</i> —The <u>total</u> Responsive Reserve capacity that was a portion of the Ancillary Service Supply Responsibility of QSE <i>q</i> but is replaced in <u>a SASM</u> the market <i>m</i> , for the hour.
PCRR _{<i>q, m</i>}	MW	<i>Procured Capacity for Responsive Reserve per QSE in DAM</i> —The total Responsive Reserve capacity quantity awarded to QSE <i>q</i> in the DAM for all the Resources represented by the QSE for the hour.
<i>q</i>	none	A QSE.
<i>m</i>	none	The DAM or a SASM for the given Operating Hour.
<u>RTRRCS_{<i>q</i>}</u>	<u>MW</u>	<u><i>Responsive Reserve Capacity Sale per QSE submitted after 1430 in the Day-Ahead</i>—The total Responsive Reserve capacity shown in Ancillary Service Trades with QSE <i>q</i> as a seller, submitted after 1430 in the Day-Ahead, for the hour.</u>
<u>RTRRCP_{<i>q</i>}</u>	<u>MW</u>	<u><i>Responsive Reserve Capacity Purchase per QSE submitted after 1430 in the Day-Ahead</i>—The total Responsive Reserve capacity shown in Ancillary Service Trades with QSE <i>q</i> as a buyer, submitted after 1430 in the Day-Ahead, for the hour.</u>
<u>DARRCS_{<i>q</i>}</u>	<u>MW</u>	<u><i>Responsive Reserve Capacity Sale per QSE on or before 1430 in the Day-Ahead</i>—The total Responsive Reserve capacity shown in Ancillary Service Trades with QSE <i>q</i> as a seller submitted on or before 1430 in the Day-Ahead for the hour.</u>
<u>DARRCP_{<i>q</i>}</u>	<u>MW</u>	<u><i>Responsive Reserve Capacity Purchase per QSE on or before 1430 in the Day-Ahead</i>—The total Responsive Reserve capacity shown in Ancillary Service Trades with QSE <i>q</i> as a buyer submitted on or before 1430 in the Day-Ahead for the hour.</u>
RRSQ _{<i>q, m</i>}	MW	<i>Responsive Reserve Supplied Quantity per QSE</i> per all markets —The capacity for Responsive Reserve to be supplied with Resources represented by QSE <i>q</i> to meet its Ancillary Service Obligation and/or its Ancillary Service Trades, for <u>all</u> the market <i>m</i> _{<i>s</i>} , for the hour.

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

$$\text{RTRRAMT}_q = \text{RRCOST}_q - \text{DARRAMT}_q$$

The above variables are defined as follows:

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Variable	Unit	Description
RTRRAMT _q	\$	<i>Real-Time Responsive Reserve Amount per QSE</i> —The adjustment to QSE <i>q</i> 's share of the costs for Responsive Reserve, for the hour.
RRCOST _q	\$	<i>Responsive Reserve Cost per QSE</i> —QSE <i>q</i> 's share of the net total costs for Responsive Reserve, for the hour.
DARRAMT _q	\$	<i>Day-Ahead Responsive Reserve Amount per QSE</i> —QSE <i>q</i> 's share of the DAM cost for Responsive Reserve, for the hour.
q	none	A QSE.

(4) For Non-Spinning Reserve Service (Non-Spin), if applicable:

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

$$\text{NSCOSTTOT} = (-1) * (\sum_m (\text{RTPCNSAMTTOT}_m + \text{PCNSAMTTOT}_m) + \text{NSFQAMTTOT})$$

Where:

Total payment of DAM or SASM procured capacity for Non-Spin by market

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

$$\text{PCNSAMTTOT}_m = \sum_q \text{PCNSAMT}_{q,m})$$

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

$$\text{NSFQAMTTOT} = \sum_q \text{NSFQAMT}_q$$

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

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

The above variables are defined as follows:

Variable	Unit	Description
NSCOSTTOT	\$	<i>Non-Spin Cost Total</i> —The net total costs for Non-Spin for the hour.
RTPCNSAMTTOT _m	\$	<i>Procured Capacity for Non-Spin Amount Total by market</i> —The total payments to all QSEs for the Ancillary Service Offers cleared in the market <i>m</i> for Non-Spin, for the hour.
RTPCNSAMT _{q,m}	\$	<i>Procured Capacity for Non-Spin Amount per QSE by market</i> —The payment to QSE <i>q</i> for its Ancillary Service Offers cleared in the market <i>m</i> for Non-Spin, for the hour.
NSFQAMTTOT	\$	<i>Non-Spin Failure Quantity Amount Total</i> —The total charges to all QSEs for their capacity associated with failures on their Ancillary Service Supply Responsibilities for Non-Spin, for the hour.

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Variable	Unit	Description
NSFQAMT _q	\$	<i>Non-Spin Failure Quantity Amount per QSE</i> —The charge to QSE <i>q</i> for its total capacity associated with failures on its Ancillary Service Supply Responsibility for Non-Spin, for the hour.
RTPCNSAMTQSETOT _q	\$	<i>Procured Capacity for Non-Spin Amount Total per QSE</i> —The total payments to a QSE in all SASM markets for the Ancillary Service Offers cleared for Non-Spin, for the hour.
PCNSAMT _{q, m}	\$	<i>Procured Capacity for Non-Spin Amount per QSE in DAM</i> —The DAM Non-Spin payment for QSE <i>q</i> for the hour.
q	none	A QSE.
m	none	The DAM or a SASM for the given Operating Hour.
<u>PCNSAMTTOT_m</u>	<u>\$</u>	<u><i>Procured Capacity for Non-Spin Amount Total in DAM</i>—The total of the DAM Non-Spin payments for all QSEs for the hour.</u>

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

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

Where:

$$\text{NSPR} = \text{NSCOSTTOT} / \text{NSQTOT}$$

$$\text{NSQTOT} = \sum_q \text{NSQ}_q$$

$$\text{NSQ}_q = \text{NSONET}_q - \sum_m \text{NSSQ}_{q, m}$$

$$\begin{aligned} \text{NSONET}_q = & \left(\sum_q (\text{NSQ}_q - \sum_m \text{NSSQ}_{q, m}) + \sum_m (\text{RTPCNS}_{q, m} + \text{PCNS}_{q, m}) - \right. \\ & \left. \sum_m \text{NSRP}_{q, m} - \text{NSFQ}_q \right) * \text{HLRS}_q + \text{NSCS}_q - \text{NSCP}_q + \\ & \sum_m \text{NSRP}_{q, m} \end{aligned}$$

$$\text{NSCS}_q = \text{DANSCS}_q + \text{RTNSCS}_q$$

$$\text{NSCP}_q = \text{DANSCP}_q + \text{RTNSCP}_q$$

$$\text{NSSQ}_q = \text{DANSSQ}_q + \text{RTNSSQ}_q$$

The above variables are defined as follows:

Variable	Unit	Description
NSCOST _q	\$	<i>Non-Spin Cost per QSE</i> —QSE <i>q</i> 's share of the net total costs for Non-Spin, for the hour.
NSPR	\$/MW per hour	<i>Non-Spin Price</i> —The price for Non-Spin calculated based on the net total costs for Non-Spin, for the hour.
NSCOSTTOT	\$	<i>Non-Spin Cost Total</i> —The net total costs for Non-Spin for the hour. See item (a) above.

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Variable	Unit	Description
NSQTOT	MW	<i>Non-Spin Quantity Total</i> —The sum of every QSE's portion of its net Ancillary Service Obligation that is not self-supplied with its Resource capacity in either DAM or any SASM, for the hour.
NSQ _q	MW	<i>Non-Spin Quantity per QSE</i> —The portion of QSE <i>q</i> 's net Ancillary Service Obligation that is not self-supplied with its Resources capacity in either DAM or any SASM, for the hour.
NSONET _q	MW	<i>Non-Spin Obligation Net per QSE</i> —The net Ancillary Service Obligation of QSE <i>q</i> , for the hour.
<u>DANSSQ_q</u>	<u>MW</u>	<u><i>Non-Spin Supplied Quantity per QSE for DAM</i>—The capacity for Non-Spin to be supplied with Resources represented by QSE <i>q</i> to meet its Ancillary Service Obligation and/or its Ancillary Service Trades, for the DAM, for the hour.</u>
NSSQ_{q,m}	MW	<i>Non-Spin Supplied Quantity per QSE per for all markets</i>—The capacity for Non-Spin to be supplied with Resources represented by QSE <i>q</i> to meet its Ancillary Service Obligation and/or its Ancillary Service Trades, for the all markets, for the hour.
RTNSSQ_{q,m}	MW	<i>Non-Spin Supplied Quantity per QSE for all SASM per market</i>—The capacity for Non-Spin to be supplied with Resources represented by QSE <i>q</i> to meet its Ancillary Service Obligation and/or its Ancillary Service Trades, for the total of all SASMs market <i>m</i>, for the hour.
RTPCNS _{q,m}	MW	<i>Procured Capacity for Non-Spin per QSE by market</i> —The MW portion of QSE <i>q</i> 's Ancillary Service Offers cleared in the market <i>m</i> to provide Non-Spin, for the hour.
NSFQ _q	MW	<i>Non-Spin Failure Quantity per QSE</i> —QSE <i>q</i> 's total capacity associated with failures on its Ancillary Service Supply Responsibility for Non-Spin, for the hour.
HLRS _q	none	The hourly Load Ratio Share calculated for QSE <i>q</i> for the hour. See Section 6.6.2.3, QSE Load Ratio Share for an Operating Hour.
NSCS _q	MW	<i>Non-Spin Capacity Sale per QSE</i> —The total Non-Spin capacity shown in Ancillary Service Trades <u>for all markets</u> with QSE <i>q</i> as a seller, for the hour.
NSCP _q	MW	<i>Non-Spin Capacity Purchase per QSE</i> —The total Non-Spin capacity shown in Ancillary Service Trades <u>for all markets</u> with QSE <i>q</i> as a buyer, for the hour.
NSRP _{q,m}	MW	<i>Non-Spin Replacement per QSE per market</i> —The <u>total</u> Non-Spin capacity that was a portion of the Ancillary Service Supply Responsibility of QSE <i>q</i> but is replaced in <u>a SASM</u> the market <i>m</i> , for the hour.
PCNS _{q,m}	MW	<i>Procured Capacity for Non-Spin Service per QSE in DAM</i> —The total Non-Spin capacity quantity awarded to QSE <i>q</i> in the DAM for all the Resources represented by the QSE for the hour.
q	none	A QSE.
m	none	The DAM or a SASM for the given Operating Hour.
<u>RTNSCS_q</u>	<u>MW</u>	<u><i>Non-Spin Capacity Sale per QSE submitted after 1430 in the Day-Ahead</i>—The total Non-Spin capacity shown in Ancillary Service Trades with QSE <i>q</i> as a seller, submitted after 1430 in the Day-Ahead, for the hour.</u> <i>Non-Spin Capacity Sale per QSE in a SASM</i>—The total Non-Spin capacity shown in Ancillary Service Trades with QSE <i>q</i> as a seller, in SASM <i>m</i>, for the hour.
<u>RTNSCP_q</u>	<u>MW</u>	<u><i>Non-Spin Capacity Purchase per QSE submitted after 1430 in the Day-Ahead</i>—The total Non-Spin capacity shown in Ancillary Service Trades with QSE <i>q</i> as a buyer, submitted after 1430 in the Day-Ahead, for the hour.</u> <i>Non-Spin Capacity Purchase per QSE in a SASM</i>—The total Non-Spin capacity shown in Ancillary Service Trades with QSE <i>q</i> as a buyer, in SASM <i>m</i> for the hour.
NSSQ_{q,m}	MW	<i>Non-Spin Supplied Quantity per QSE per for all markets</i>—The capacity for Non-Spin to be supplied with Resources represented by QSE <i>q</i> to meet its Ancillary Service

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Variable	Unit	Description
		<i>Obligation and/or its Ancillary Service Trades, for the<u>all</u> markets—m, for the hour.</i>
<u>DANSCS_q</u>	<u>MW</u>	<i><u>Non-Spin Capacity Sale per QSE on or before 1430 in the Day-Ahead —The total Non-Spin capacity shown in Ancillary Service Trades with QSE q as a seller submitted on or before 1430 in the Day-Ahead for the hour.</u></i>
<u>DANSCP_q</u>	<u>MW</u>	<i><u>Non-Spin Capacity Purchase per QSE on or before 1430 in the Day-Ahead —The total Non-Spin capacity shown in Ancillary Service Trades with QSE q as a buyer submitted on or before 1430 in the Day-Ahead for the hour.</u></i>

- (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:

$$\mathbf{RTNSAMT}_q = \mathbf{NSCOST}_q - \mathbf{DANSAMT}_q$$

The above variables are defined as follows:

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