

## **Automatic Generation Control (AGC)/Regulation due SC**

<b>Charge # 005</b>	<b>Day-Ahead (DA) AGC/Regulation Up due SC</b>
<b>Charge # 006</b>	<b>Day-Ahead (DA) AGC/Regulation Down due SC</b>
<b>Charge # 055</b>	<b>Hour-Ahead (HA) AGC/Regulation Up due SC</b>
<b>Charge # 056</b>	<b>Hour-Ahead (HA) AGC/Regulation Down due SC</b>

### **Description**

AGC/Regulation is the online, synchronized, generation capacity that is available to respond to the ISO's AGC control signals on a second-by-second basis. This capacity enables a continuous balancing of resources and load within the ISO-controlled grid, as well as maintains frequency during normal operating conditions. AGC is procured and settled separately for Regulation Up and Regulation Down.

### **Requirement**

AGC/Regulation is a percentage of the aggregate load for each SC, which can range from 5% to 12% (combined Regulation Up and Down). This percentage is an operator entered field and may vary from hour to hour depending on system conditions. Each SC's obligation for AGC/Regulation will be calculated based on the ratio of metered Demand for each SC in a particular Trading Interval by zone, to the total metered Demand for that Trading Interval in the respective zone. This obligation is reduced by a SC's ability to Self-Provide (either by owned Generation or Inter SC trades) AGC/Regulation reserve. The obligation calculations will be reviewed in the next section.

### **Purpose**

Charge types 005, 006, 055 and 056 provide for the payment to a SC, by the ISO for a SC's final accepted bids for AGC/Regulation capacity scheduled in the DA or the HA Market. When the ISO purchases AGC/Regulation capacity in the DA or HA Market, SCs who represent the providers of this capacity will be paid for each Trading Interval during which the capacity is accepted and provided in the DA or HA Market. The quantities procured by the ISO, through the Rational Buyer process, are the quantities which will be reflected on the final schedules.

### **Charge Calculation and Calculation Components**

The payment to a SC who provides AGC/Regulation capacity in the DA or HA Market will be the total quantity of AGC/Regulation capacity provided multiplied by the Zonal Market Clearing Price (MCP) for that Trading Interval. This calculation is done by zone for each Trading Interval. The MCP is derived through the Rational Buyer procurement process.

**Equation**

$$\begin{array}{l} \text{Amount due} \\ \text{SC} \end{array} = \begin{array}{l} \text{Total quantity of} \\ \text{AGC/Regulation} \\ \text{capacity} \\ \text{provided} \end{array} * \begin{array}{l} \text{MCP} \\ \text{Through} \\ \text{Rational Buyer} \end{array}$$

**Components of the Equation****Total quantity of AGC/Regulation capacity provided:**

This is determined by the AGC/Regulation final accepted bids for Regulation Up and Down quantities per SC, per generator. Regulation Up and Regulation Down are settled separately.

**The Zonal MCP**

The MCP is based on the final procurement process for which Rational Buyer has been run.

**Amount due SC:**

This is determined by summing all payments due to a SC for all resources that it represents during a given Trading Interval and in a given zone.

To view the AGC/Regulation due SC equation in the ISO Settlements and Billing Protocol (SABP), see SABP Appendix C, section 2.1.1 (DA) and section 2.1.2 (HA).

## Verifying the Charge

Charge component	How to verify
AGC/Regulation capacity provided	Download the final schedule from the WEnet for the requested Trading Interval for the Day-Ahead and/or Hour-Ahead Market. This information is only available on the WEnet for seven days following the initial trading day.
MCP for AGC/Regulation capacity	Information will be posted in the Public Market Information (PMI) section under Day-Ahead, Final Market Information on the ISO web site at <a href="http://caiso.com/marketops/OASIS/pubmkt2.html">http://caiso.com/marketops/OASIS/pubmkt2.html</a> . This information will be available for up to 90 days from the initial trading day.
Amount due SC	For each Trading Interval by zone, multiply the MCP by the generation capacity accepted and provided for each resource. The total amount due is found by adding up payments due for each generator providing AGC/Regulation capacity for the trading day. These calculations can be done for both the Day-Ahead and Hour-Ahead Markets.

The Base Parameters for Regulation Up and Regulation Down are listed at the end of this document. This template shows each of the base parameters for Up and Down Regulation, along with Section References, Data Field and Comments related to Settlements.

## Other Key Points

### Buy Back of A/S in the Hour-Ahead Market

A SC who has sold AGC/Regulation capacity to the ISO in the Day-Ahead Market may buy back that capacity, in whole or in part, from the ISO in the Hour-Ahead Market at the Zonal MCP. SCs wishing to buy back AGC/Regulation capacity in the Hour-Ahead Market must do so by submitting a revised bid in the Hour-Ahead Market for that A/S and resource concerned.

### Self Provision

The Hour-Ahead self-provided Ancillary Service schedules are used to determine both the DA and HA obligations. The SC can use this self-provision amount to offset their A/S obligation. Excess Self-Provision, amounts in excess of their obligation, can be credited to the SC with certain limitations for Unqualified Self-Provision limits. This situation occurs when the total increase of self-provision in the HA market exceeds the ISO's incremental needs in the HA market. The SCs whose increases in self-provision exceeds their own incremental needs will have a pro-rata portion of their self-provision disqualified.

# Automatic Generation Control (AGC) Regulation due ISO

**Charge # 115 AGC/Regulation Up due ISO**

**Charge # 116 AGC/Regulation Down due ISO**

## Description

AGC/Regulation is the online, synchronized, generation capacity that is available to respond to the ISO's AGC control signals on a second-by-second basis. This capacity enables a continuous balancing of resources and load within the ISO-controlled grid, and maintains frequency during normal operating conditions.

## Requirement

AGC/Regulation is a percentage of the aggregate load for each SC, which can range from 5% and higher. This percentage is an operator entered field and may vary from hour to hour depending on system conditions. Each SC's obligation for AGC/Regulation will be calculated based on the ratio of metered Demand of each SC in a particular Trading Interval by zone, to the total metered Demand for that Trading Interval in the respective zone. This obligation is reduced by a SC's ability to Self-Provided AGC/Regulation reserve.

## Purpose

These charges provide for payment from SCs to the ISO for the cost of providing AGC/Regulation capacity that was not self provided by an SC in the Day-Ahead or the Hour-Ahead Market. The charge will be by congestion zone for each Trading Interval.

## Charge Calculation and Calculation Components

The AGC/Regulation user rate for each zone and each Trading Interval is multiplied by the SC's AGC/Regulation obligation that is not self provided to produce the amount due the ISO. This calculation is done by zone for each Trading Interval.

## Equation

$$\text{RegChargeTotalDA}\$_{jxt} = \text{RegRate}\$/\text{MW} \cdot \text{hr}_{xt} * \text{NetRegObligMW}_{jxt}$$

$$\text{RegRate}\$/\text{MW} \cdot \text{hr}_{xt} = \frac{(\text{RegPayTotalDA}\$_{xt}) + (\text{RegPayTotalHA}\$_{xt})}{(\text{RegProcureDAMW}_{xt} + \text{RegProcureHAMW}_{xt})}$$

### Components of the Equation

$RegPayTotalHA\$_{xt}$  = Total payments by the ISO for Regulation procured in the Hour Ahead Market in DA Region  $x$  for Settlement Period  $t$   $[(ASM\ HA\ Qty - ASM\ DA\ Qty) * RB\$HA]$ .

$RegPayTotalDA\$_{xt}$  = Total payments by the ISO for Regulation procured in the Day Ahead Market in Region  $x$  for Settlement Period  $t$   $(ASM\ DA\ Qty * RB\$DA)$ .

$RegProcureDAMW_{xt}$  = MW of Regulation procured by the ISO in the Day Ahead Market in Region  $x$  for Settlement Period  $t$   $(ASM\ Qty)$ .

$RegProcureHAMW_{xt}$  = Total MW of Regulation procured by the ISO in the Hour Ahead Market in DA Region  $x$  for Settlement Period  $t$   $(ASM\ Qty)$ .

$$NetRegObligMW_{jxt} = AdjRegObligMW_{jxt} - EffectiveSelfProvideRegMW_{jxt}$$

$AdjRegObligMW_{jxt}$  is the SC's MW amount of Regulation reserve obligation after taking into account inter-SC trades. It should be noted that this adjusted obligation may become negative if the SC has a large inter-SC purchase.

$EffectiveSelfProvideRegMW_{jxt}$  is the SC's effective self provision for regulation. This quantity is equal to the SC's final HA self provision, which includes any self provision buy back amount, less the unqualified excess provision.

### Amount due the ISO:

This is the amount the ISO will be paid by SCs for procuring the needed AGC/Regulation capacity.

At the back of this document there is also an equation map which lays out each of the components of the settlement equation and goes through an example to better explain the validation process.

To view the AGC/Regulation due ISO equation in the Settlements and Billing Protocol, See SABP Appendix C-7 section 2.2.1.

## Verifying the Charge

Charge component	How to verify
Zonal AGC/Regulation User Rate	<ul style="list-style-type: none"> <li>Obtain ASM quantities and Rational Buyer MCP on website and put into equation to derive the Reg Rate. Recognizing that Rational Buyer could produce true-up charges through CT101 trading day.</li> </ul>
NSP AGC/Regulation Obligation	<ul style="list-style-type: none"> <li>Obtain your metered load as a % of the system metered load, self-provision amounts and SC to SC trades for each hour to come up with the Billable Quantity.</li> </ul>
Amount due the ISO	<ul style="list-style-type: none"> <li>Multiply the NSP AGC/Regulation Obligation for each zone and given Trading Interval by the Zonal AGC/Regulation capacity user rate to find the amount due the ISO.</li> <li>Sum up all of the individual zone totals to calculate the total amount due the ISO.</li> </ul>

## Other Key Points

### Buy Back of A/S in the Hour-Ahead Market

A SC who has sold AGC/Regulation capacity to the ISO in the Day-Ahead Market may buy back that capacity, in whole or in part, from the ISO in the Hour-Ahead Market at the Zonal MCP. SCs wishing to buy back AGC/Regulation capacity in the Hour-Ahead Market must do so by submitting a revised bid in the Hour-Ahead Market for the A/S and resource concerned.

**AGC REGULATION EXAMPLE**(Use ASM MW's  
& RB \$MCP)**Requirement Information (ASM):**

	<u>MW's</u>	<u>\$ MCP</u>	<u>Charges</u>
Reg Up - DA	800	10.00	12,000.00
Reg Down - DA	150	25.00	3,750.00
Reg Up - HA	200	20.00	5,000.00
Reg Down - HA	50	50.00	2,500.00
			23,250.00
			23,250.00

**Procurement Information (Rational Buyer):**

	<u>MW's</u>	<u>\$ MCP</u>	<u>Payments</u>
Reg Up - DA	900	15.00	13,500.00
Reg Down - DA	150	25.00	3,750.00
Reg Up - HA	250	25.00	6,250.00
Reg Down - HA	50	50.00	2,500.00
			26,000.00
			26,000.00

Total System Load - As Submitted through Metering @ T+47	25,000
SC System Load - As Submitted through Metering @ T+47	1,000
SC's Pro Rata Share of AGC	0.04

No Self Provision of Regulation Up

No Self Provision of Regulation Down

**SC Generation Information**

GEN_1_UNIT		<u>Capacity MW's</u>
Units Pmax		500
 <u>HE08 Schedules</u>		
Final Accepted DA Capacity of Reg Up		100
Final Accepted HA Capacity of Reg Down		50
Preferred Operating Point		100
Units Meter Read for HE08	Scenario #1	107
	Scenario #2	95

**Payment Settlement Information:**

Regulation Up is settled at 100MWs times the DA RB MCP of \$15 for a total of \$\$1500.

Regulation Down is settled at 50MWs times the HA RB MCP of \$50 for a total of \$2500.

**Charge Settlement Information**

By following through the equation map the key data elements are as follows:

**Regulation Up Charge Allocation**

$$\text{RegOblig\%} = 1000/25,000 = .04 \text{ or } 4\%$$

$$\text{AdjRegTotalMW} = 800 + 200 = 1000\text{MWs of Regulation Up}$$

$$\text{BaseRegObligMW} = .04 * 1000 = 40\text{MWs}$$

$$\text{RegRate\$/MW} = \$17,000/1000\text{MW} = \text{Total Paid for Reg Up/Total MWs Procured} = \$17/\text{MW}$$

$$\text{RegChargeTotal\$} = 40\text{MW} * \$17 = \$680.00$$

**Regulation Down Charge Allocation**

$$\text{RegOblig\%} = 1000/25,000 = .04 \text{ or } 4\%$$

$$\text{AdjRegTotalMW} = 150 + 50 = 200\text{MWs of Regulation Down}$$

$$\text{BaseRegObligMW} = .04 * 200 = 8\text{MWs}$$

$$\text{RegRate\$/MW} = \$6,250/200\text{MW} = \text{Total Paid for Reg Down/Total MW Procured} = \$31.25/\text{MW}$$

$$\text{RegChargeTotal\$} = 8\text{MW} * \$31.25 = \$250.00$$

<b>BASE PARAMETER VALIDATION GUIDE FOR AS COST ALLOCATION</b>				
<b>Charge Type</b>	<b>Base Parameter</b>	<b>Cross Reference to Statement File Specification</b>		<b>Comments from Settlements</b>
		<b>Section Ref</b>	<b>Data Field</b>	
<b>Regulation Up</b>				
	RegUPProcureDAMWxt	7.4	Total Day Ahead Ancillary Service Procured Amount	Total ancillary service amount (in MW) procured day ahead market
	RegUPProcureHAMWxt	7.4	Total Hour Ahead Ancillary Service Procured Amount	Total additional ancillary service amount (in MW) in the hour ahead market
	TotalOnDemandRegUpObligxt	7.4	Total On Demand Obligation	Total on demand obligation for the region
	TotalEffectiveSelfProvideRegUpMWxt	7.4	Total Effective Self Provision	The portion of the Total Self Provision that is effective.
	RegUpPayTotal \$DAxt	7.4	Total Day Ahead Ancillary Service Procured Amount * Day Ahead MCP	DA MCP is provided on Ancillary Detail file.
	RegUpPayTotal \$HAxt	7.4	Total Hour Ahead Ancillary Service Procured Amount * Hour Ahead MCP	HA MCP is provided on Ancillary Detail file.
	MeteredLoadMWjxt	7.4	Measured quantity	Reg Up/Reg Down: SC's metered load in region
	OnDemandRegUpObligjxt	7.4	On demand obligation	SC's on demand obligation for a region

	InterSCRegUpSoldjxt	7.4	Inter SC sold quantity	Amount of capacity SC sold through inter SC
	InterSCRegUpBoughtjxt	7.4	Inter SC bought quantity	Amount of capacity SC bought through inter S
	EffectiveSelfProivdeRegUpObligMWjxt	7.4	Effective self provision	The amount of self provision the SC will recei
	TotalMeteredLoadxt	7.4	Total measured quantity	Total metered load in the region.
	RegOblig%jxt	7.4	Percent Obligation	SC's measured quantity divided by the total m quantity
<b>Regulation Down</b>				
	RegDownProcureDAMWxt	7.4	Total Day Ahead Ancillary Service Procured Amount	Total ancillary service amount (in MW) procur region in the day ahead market
	RegDownProcureHAMWxt	7.4	Total Hour Ahead Ancillary Service Procured Amount	Total additional ancillary service amount (in M in the region in the hour ahead market
	TotalOnDemandRegDownObligxt	7.4	Total On Demand Obligation	Total on demand obligation for the region
	TotalEffectiveSelfProvideRegDownMWxt	7.4	Total Effective Self Provision	The portion of the Total Self Provision that IS effective.
	RegDownPayTotal \$DAxt	7.4	Total Day Ahead Ancillary Service Procured Amount * Day Ahead MCP	DA MCP is provided on Ancillary Detail file.
	RegDownPayTotal \$HAxt	7.4	Total Hour Ahead Ancillary Service Procured Amount * Hour Ahead MCP	HA MCP is provided on Ancillary Detail file.

	MeteredLoadMWjxt	7.4	Measured quantity	Reg Up/Reg Down: SC's metered load in regi
	OnDemandRegDownObligjxt	7.4	On demand obligation	SC's on demand obligation for a region
	InterSCRegDownSoldjxt	7.4	Inter SC sold quantity	Amount of capacity SC sold through inter SC
	InterSCRegDownBoughtjxt	7.4	Inter SC bought quantity	Amount of capacity SC bought through inter S
	EffectiveSelfProivdeRegDownObligMWjxt	7.4	Effective self provision	The amount of self provision the SC will recei
	TotalMeteredLoadxt	7.4	Total measured quantity	Total metered load in the region.
	RegOblig%jxt	7.4	Percent Obligation	SC's measured quantity divided by the total m quantity