Settlements and Billing

Configuration Guide: Convergence Bidding Real Time Energy, Congestion and Loss Settlement

CC 6473

Version 5.4

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# Purpose of Document

The purpose of this document is to capture the business and functional requirements for the ISO Real Time Convergence Bidding Settlements, Charge Code 6473.

# Introduction

## Background

Convergence bidding tends to cause DAM and RTM prices to move closer together, or "converge," thus the term convergence bidding. The narrowing of price differences between the two markets reduces incentives for under-scheduling Load in the DAM by reducing potential financial benefits for waiting until the RTM. In addition to reducing price disparity, convergence bidding also provides greater market transparency by providing bids that are explicit rather than implicit. Additionally, the increased market liquidity from convergence bidding can help mitigate the market power of physical suppliers. Some market participants can use convergence bidding as a risk management tool to hedge the possibility of a generator outage.

A bid in convergence bidding is defined to be either a Virtual Demand Bid or Virtual Supply Bid. A Virtual Demand Bid is a Bid submitted in the CAISO Day-Ahead Market that, if cleared in the Integrated Forward Market (IFM), represents a commitment to purchase Energy at the price determined in the Day-Ahead Market, and to sell the same quantity back at the price determined in the Real-Time Market. A Virtual Supply Bid is a Bid submitted in the CAISO Day-Ahead Market that, if cleared in the Integrated Forward Market, represents a commitment to sell Energy at the price determined in the Day-Ahead Market, and to buy the same quantity back at the price determined in the Real-Time Market.

## Description

This Charge Code, “CC 6473 – Real Time Convergence Bidding Energy Congestion and Loss Settlement”, provides for the settlement of Energy that has been awarded from Virtual Bids submitted in the Integrated Forward Market (IFM) by Scheduling Coordinators (SC) on the behalf of Convergence Bidding Entities.

Convergence Bidding RT payments and charges shall be calculated as follow:

1. For a Virtual Demand Bid, the RT payment will consist of the DA Cleared MW multiplied by the Hourly FMM LMP Price at the applicable nodal location (Pnodes, Aggregated Pnodes, Pnodes/APNodes in combination with Intertie).
2. For a Virtual Supply Bid, the RT charges shall consist of the DA Cleared MW multiplied by the Hourly FMM LMP Price at the applicable nodal location.

Virtual Bids may be submitted at any Eligible PNode or Eligible Aggregated PNode. If the node is internal, the Hourly FMM LMP Price is calculated as the simple hourly average of four 15-Minute FMM LMP at the Eligible PNode or Aggregated PNodes for the relevant Trading Hour. A Virtual Supply Award in the Day-Ahead will require the seller to buy back the same quantity of supply at the same location at the Hourly FMM LMP Price. On the other hand, a Virtual Demand Award in the Day-Ahead will require the buyer to sell back the same quantity of demand at the same location at the Hourly FMM LMP Price.

For a Virtual Supply Award for an import at a tie node, the charge shall also be the product of the DA cleared MW multiplied by the Hourly FMM LMP Price on that node; while for a Virtual Demand Award for an export at a tie node, the payment shall be the product of the DA cleared MW multiplied by the Hourly FMM LMP Price on that node..

# Charge Code Requirements

## Business Rules

| Bus Req ID | Business Rule |
| --- | --- |
| 1 | The Settlement Amount per Trading Hour per SC for all its Virtual Bid Energy associated with a Convergence Bidding Entity is the net of the payments and charges for the Energy associated with all of the SC’s awarded Virtual Supply and Virtual Demand Bids segments over all Eligible PNodes/Aggregated PNodes for the Trading Hour. |
| 2 | Virtual Supply Bids and Virtual Demand Bids, as their names imply, are virtual in the sense that they are not backed-up by a physical supply resource or physical demand. *(Fact)* |
| 3 | A Virtual Demand Bid is defined to be a Bid submitted in the CAISO Day-Ahead Market that, if cleared in the Integrated Forward Market (IFM), represents a commitment to purchase Energy at the price determined in the Day-Ahead Market, and to sell the same quantity back at the price determined in the Real-Time Market. |
| 4 | A Virtual Supply Bid is defined to be a Bid submitted in the CAISO Day-Ahead Market that, if cleared in the Integrated Forward Market, represents a commitment to sell Energy at the price determined in the Day-Ahead Market, and to buy the same quantity back at the price determined in the Real-Time Market. |
| 5 | This Charge Code shall be calculated daily on an hourly basis. |
| 6 | The total settlement amount for Virtual Awards per Trading Hour of the Real-Time market for a particular SC representing a Convergence Bidding Entity (CBE) shall be determined as the sum of the Virtual Supply Award settlement amount and the Virtual Demand Award settlement amount for the SC over the Trading Hour. |
| 7 | The CAISO will charge each Scheduling Coordinator with Virtual Supply Awards at an Eligible PNode or Eligible Aggregated PNode an amount equal to the simple hourly average of the four 15-minute FMM LMP at the Eligible PNode or Eligible Aggregated PNode of the relevant Trading Hour, multiplied by the MWhs of Virtual Supply Awards |
| 8 | The CAISO will pay each Scheduling Coordinator with Virtual Demand Awards at an Eligible PNode or Eligible Aggregated PNode an amount equal to the simple hourly average of the four 15-minute FMM LMP at the Eligible PNode or Eligible Aggregated PNode of the relevant Trading Hour, multiplied by the MWhs of Virtual Demand Awards |
| 9 | For adjustments to the Charge Code that cannot be accomplished by correction of upstream data inputs, recalculation or operator override, Pass Through Bill Charge adjustment shall be applied. |
| 10 | The currently specified Charge Code configuration shall calculate the CAISO totals for the overall Virtual Award Energy, Congestion and Loss Settlement Amount by Scheduling Coordinator (SC) in the Trading Hour. |
| 11 | For each BAA, the total Real Time congestion contribution from virtual awards is computed as the total virtual award (the RT liquidation of DA virtual awards) at each nodal location multiplied by the MCC of the nodal location. |

## Predecessor Charge Codes

| Charge Code/ Pre-calc Name |
| --- |
| Real Time Price Pre-calculation |

## Successor Charge Codes

| Charge Code/ Pre-calc Name |
| --- |
| CC 6477 – Real Time Imbalance Energy Offset |
| CC 6774 – Real Time Congestion Offset |
| CC 6700 - CRR Hourly Settlement |
| CC 7076 - Flexible Ramp Forecasted Movement Allocation |

## Inputs – External Systems

| Input Req ID | Variable Name | Description |
| --- | --- | --- |
| 1 | FMMIntervalPNodeLMP AA’Qpmdhc | Pnode, APnode, or Pnode/APnode and Intertie combination LMP prices for Energy in the Fifteen Minute Market.  This does not include APnode prices where the APNode Type A’ is in (‘DEFAULT’, ‘CUSTOM’). ($/MWh) |
| 2 | BAHourlyDAVirtualAwardNodalQuantity BQ’AA’Qpay’mdh | The input provides the DA Virtual Award cleared Energy quantity in association with Business Associate B (MW) |
| 3 | PTBChargeAdjustmentBANetHourlyRTVirtualAwardAmount BJmdh | PTB adjustment variable for the currently configured Charge Code, amount per Business Associate B and PTB ID J. ($) |
| 4 | FMMIntervalBAAMCCPrice Q’M’AA’Qpmdhc | FMM Interval Marginal Cost Of Congestion Price  These are mapped from Pnode, APnode, or Pnode/APnode and Intertie combination MCC prices for Energy in the Fifteen Minute Market, where the APnode is not of type “DEFAULT” or “CUSTOM”. |
| 5 | BAHourlyDAVirtualAwardFlexRampForecastedMovementMWQty BAA’QQ’pay’mdh | The DA hourly virtual award quantity for flexible ramp forecasted movement. |

## Inputs - Predecessor Charge Codes or Pre-calculations

| Input Req ID | Variable Name | Predecessor Charge Code/ Pre-calc Configuration |
| --- | --- | --- |
|  | HourlyAverageBAAFMMMCCPrice Q’AA’mdh | RT Price Pre-calculation |
|  | HourlyAverageFMMLMPPrice AA’mdh | RT Price Pre-calculation |

## CAISO Formula

BAHourlyRTVirtualSupplyOrDemandAwardEnergySettlementAmount BAQpmdh ***=***

BAHourlyRTVirtualSupplyAwardEnergySettlementAmount BAQpmdh+ BAHourlyRTVirtualDemandAwardEnergySettlementAmount BAQpmdh

BAHourlyRTVirtualSupplyAwardEnergySettlementAmount BAQpmdh =

Where a = ‘SUP’

(IF

APNODE\_TYPE (A’) is in (‘DEFAULT’, ‘CUSTOM’)

THEN

BAHourlyRTVirtualSupplyAwardEnergySettlementAmount BAQpmdh =

Sum over (Q’, A’, y’, a) (BAHourlyDAVirtualAwardNodalQuantity BQ’AA’Qpay’mdh \*

HourlyAverageFMMLMPPrice AA’mdh)

ELSE

BAHourlyRTVirtualSupplyAwardEnergySettlementAmount BAQpmdh =

Sum over (Q’, A’, y’, a) (BAHourlyDAVirtualAwardNodalQuantity BQ’AA’Qpay’mdh \*

HourlyFMMNodalLMP AA’Qpmdh)

END IF)

BAHourlyRTVirtualDemandAwardEnergySettlementAmount BAQpmdh=

Where a = ‘DMND’

(IF

APNODE\_TYPE (A’) is in (‘DEFAULT’, ‘CUSTOM’)

THEN

BAHourlyRTVirtualDemandAwardEnergySettlementAmount BAQpmdh=

Sum over (Q’, A’, y’, a) (BAHourlyDAVirtualAwardNodalQuantity BQ’AA’Qpay’mdh \*

HourlyAverageFMMLMPPrice AA’mdh )

ELSE

BAHourlyRTVirtualDemandAwardEnergySettlementAmount BAQpmdh=

Sum over (Q’, A’, y’, a) ( BAHourlyDAVirtualAwardNodalQuantity BQ’AA’Qpay’mdh \*

HourlyFMMNodalLMP AA’Qpmdh)

END IF

### BAAVirtualAwardFlexRampUpForecastedMovementMWAmount Q’mdh = sum (B, A, A’, Q, p, a, y’) Max (0, BAHourlyDAVirtualAwardFlexRampForecastedMovementMWQty BAA’QQ’pay’mdh) \* HourlyIntervalPnodeFlexRampUpPrice AA’Qpmdh

### BAAVirtualAwardFlexRampDownForecastedMovementMWAmount Q’mdh = sum (B, A, A’, Q, p, a, y’) Min (0, BAHourlyDAVirtualAwardFlexRampForecastedMovementMWQty BAA’QQ’pay’mdh) \* HourlyIntervalPnodeFlexRampDownPrice AA’Qpmdh

### HourlyIntervalPnodeFlexRampUpPrice AA’Qpmdh = Average (c) (FMMIntervalPnodeFlexRampUpPrice AA’Qpmdhc)

### HourlyIntervalPnodeFlexRampDownPrice AA’Qpmdh = Average (c) (FMMIntervalPnodeFlexRampDownPrice AA’Qpmdhc)

HourlyFMMNodalLMP AA’Qpmdh =

Average(FMMIntervalPNodeLMP AA’Qpmdhc)

CAISOHourlyRTVirtualSupplyOrDemandAwardEnergySettlementAmount mdh =

BAHourlyRTVirtualSupplyOrDemandAwardEnergySettlementAmount BAQpmdh

TotalVirtualAwardNodalQuantity AA’Qpmdh =

Sum over (Q’, B, a, y’) (BAHourlyDAVirtualAwardNodalQuantity BQ’AA’Qpay’mdh)

Where APnode Type (A’) is NOT in (‘DEFAULT’, ‘CUSTOM’)

TotalVirtualAwardLAPQuantity AA’mdh =

Sum over (B, Q’, a, y’, Q, p) (BAHourlyDAVirtualAwardNodalQuantity BQ’AA’Qpay’mdh)

Where APnode Type (A’) in (‘DEFAULT’, ‘CUSTOM’)

RTVirtualSupplyOrDemandAwardLAPCongestionAmount Q’mdh =

( TotalVirtualAwardLAPQuantity AA’mdh **\*** HourlyAverageBAAFMMMCCPrice Q’AA’mdh)

RTVirtualSupplyOrDemandAwardNodalCongestionAmount Q’mdh =

( TotalVirtualAwardNodalQuantity AA’Qpmdh **\*** HourlyFMMNodalMCC Q’AA’Qpmdh)

RTVirtualSupplyOrDemandAwardCongestionAmount Q’mdh =

RTVirtualSupplyOrDemandAwardLAPCongestionAmount Q’mdh + RTVirtualSupplyOrDemandAwardNodalCongestionAmount Q’mdh

HourlyFMMNodalMCC Q’AA’Qpmdh =

Average(FMMIntervalBAAMCCPrice Q’M’AA’Qpmdhc)

## Outputs

| Output ID | Name | Description |
| --- | --- | --- |
|  | In addition to the outputs below, all inputs are required to be accessible for review by analysts and report on Settlement statements. |  |
|  | BAHourlyRTVirtualDemandAwardEnergySettlementAmount BAQpmdh | The hourly settlement amount for DA Virtual Demand Award cleared Energy quantity for Business Associate B. |
|  | BAHourlyRTVirtualSupplyAwardEnergySettlementAmount BAQpmdh | The hourly settlement amount for DA Virtual Supply Award cleared Energy quantity for Business Associate B. |
|  | BAHourlyRTVirtualSupplyOrDemandAwardEnergySettlementAmount BAQpmdh | The Total hourly settlement amount for DA Virtual Supply and Demand Award cleared Energy quantity for Business Associate B. |
|  | CAISOHourlyRTVirtualSupplyOrDemandAwardEnergySettlementAmount mdh | The CAISO hourly settlement amount for DA Virtual Supply and Demand Award cleared Energy quantity |
|  | BAAVirtualAwardFlexRampUpForecastedMovementMWAmount Q’mdh | The hourly BAA-level virtual award for flexible ramp up product forecasted movement. |
|  | BAAVirtualAwardFlexRampDownForecastedMovementMWAmount Q’mdh | The hourly BAA-level virtual award for flexible ramp down product forecasted movement. |
|  | HourlyFMMNodalLMP AA’Qpmdh | Average Hourly FMM Interval LMP for Eligible PNode or Aggregated PNode, or in combination with an Intertie. Excludes APnodes that are DEFAULT or CUSTOM LAPs. |
|  | TotalVirtualAwardNodalQuantity AA’Qpmdh | Total DA virtual awards liquidated in real time at nodal locations excluding APnodes that are DEFAULT or CUSTOM LAPs. |
|  | TotalVirtualAwardLAPQuantity AA’mdh | Total DA virtual awards liquidated in real time at nodal locations which are DEFAULT or CUSTOM LAPs. |
|  | RTVirtualSupplyOrDemandAwardCongestionAmount Q’mdh | BAA level net total congestion revenues from cleared DA virtual Supply and Demand Awards assessed at FMM MCC Prices **($)** |
|  | RTVirtualSupplyOrDemandAwardLAPCongestionAmount Q’mdh | BAA level net total LAP congestion revenues from cleared DA virtual Supply and Demand Awards assessed at FMM MCC Prices **($)** |
|  | RTVirtualSupplyOrDemandAwardNodalCongestionAmount Q’mdh | BAA level net total Nodal congestion revenues from cleared DA virtual Supply and Demand Awards assessed at FMM MCC Prices **($)** |
|  | RTVirtualSupplyOrDemandAwardCongestionAmount Q’mdh | BAA level net total congestion revenues from cleared DA virtual Supply and Demand Awards assessed at FMM MCC Prices **($)** |
|  | HourlyFMMNodalMCC Q’AA’Qpmdh | Average Hourly FMM Interval MCC for Eligible PNode or Aggregated PNode, or in combination with an Intertie.  Excludes APnodes that are DEFAULT or CUSTOM LAPs. |

# Charge Code Effective Dates

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| Charge Code/  Pre-calc Name | Document  Version | Effective Start Date | Effective End Date | Version Update Type |
| --- | --- | --- | --- | --- |
| (CC 6473) | 5.0 | 2/01/11 | 4/30/14 | Configuration Impacted |
| (CC 6473) | 5.1 | 5/1/14 | 9/30/14 | Configuration Impacted |
| (CC 6473) | 5.2 | 10/1/14 | 3/31/17 | Configuration Impacted |
| (CC 6473) | 5.2a | 4/1/17 | 10/31/18 | Documentation Only |
| (CC 6473) | 5.3 | 11/1/18 | 4/30/26 | Configuration Impacted |
| Convergence Bidding Real Time Energy, Congestion and Loss Settlement (CC 6473) | 5.4 | 5/1/26 | Open | Configuration Impacted |