

## ATTACHMENT E

### 2.5.20 Obligations for and Self Provision of Ancillary Services.

**2.5.20.1 Ancillary Service Obligations.** Each Scheduling Coordinator shall be assigned a share of the total Regulation, Spinning Reserve, Non-Spinning and Replacement Reserve requirements by the ISO. The share assigned to each Scheduling Coordinator is described in Section 2.5.20 and in Section 2.5.28 as that Scheduling Coordinator's obligation. Each Scheduling Coordinator's Regulation obligation in each Zone shall be pro rata based upon the ~~same proportion as the ratio between the~~ Scheduling Coordinator's ~~scheduled-metered~~ hourly Demand ~~bears to and~~ the total ~~metered~~ Demand ~~-scheduled to be~~ served in each hour in that Zone. Each Scheduling Coordinator's Operating Reserve obligation in each Zone shall be pro rata based upon the same proportion as the ratio of the product of its percentage obligation based on Schedules and the sum of its metered Demand and firm exports bears to the total of such products for all Scheduling Coordinators in the Zone. The Scheduling Coordinator's percentage obligation based on Schedules shall be calculated as the sum of equal to 5% of its scheduled Demand (except the Demand covered by firm purchases from outside the ISO Control Area) scheduled to be met by Generation from hydroelectric resources plus 7% of its scheduled Demand (except the Demand covered by firm purchases from outside the ISO Control Area) scheduled to be met by Generation from non-hydroelectric resources in that Zone, plus 100% of any Interruptible Imports and on-demand obligations which it schedules. ~~Where the requirement for the ISO to maintain contingency Operating Reserve sufficient to meet the single largest contingency results in a requirement for a greater quantity of Operating Reserve than that which would result from applying the 5% and 7% criteria, each Scheduling Coordinator's share of the excess shall be calculated pro rata in the same proportion as the Scheduling Coordinator's share of contingency Operating Reserve (exclusive of such excess) calculated on the 5% and 7% basis bears to the total amount of contingency Operating Reserve (exclusive of such~~

~~excess) calculated on the same basis.~~ Each Scheduling Coordinator's Replacement Reserve obligation in each Zone shall be pro rata based upon the same proportion as the ~~metered~~ Demand ~~scheduled by~~ of the Scheduling Coordinator bears to the total ~~metered~~ ~~scheduled~~ Demand in the Zone.

#### **2.5.20.2 Right to Self Provide.**

Each Scheduling Coordinator may choose to self provide all, or a portion, of its Regulation and Reserve obligation in each Zone. The ISO shall schedule self provided Ancillary Services, Day-Ahead and Hour-Ahead, and Dispatch self provided Ancillary Services in real time. To the extent that a Scheduling Coordinator self provides, the ISO shall correspondingly reduce the quantity of the Ancillary Services concerned, which it procures as described in Sections 2.5.14 to 2.5.17. As of the ISO Operations Date, Scheduling Coordinators must self provide the Operating Reserve required to cover Interruptible Imports and on-demand obligations. ~~Where a Scheduling Coordinator's non-self-provided obligation in the Hour-Ahead Market is less than its non-self-provided obligation in the Day-Ahead Market the Scheduling Coordinator will be deemed to sell back the excess to the ISO in the Hour-Ahead Market pursuant to Section 2.5.21.~~

#### **2.5.21 Scheduling of Units to Provide Ancillary Services.**

The ISO shall prepare supplier schedules for Ancillary Services (both self provided and purchased by the ISO) for the Day-Ahead and the Hour-Ahead Markets. The ISO shall notify each Scheduling Coordinator no later than 1:00 p.m. of the day prior to the Trading Day of their Ancillary Services schedules for the Day-Ahead and no later than one hour prior to the operating hour of their Ancillary Services schedules for the Hour-Ahead. The ISO Protocols set forth the information, which will be included in these schedules. Where long-term contracts are involved, the information may be treated as standing information for the duration of the contract.

Once the ISO has given Scheduling Coordinators notice of the Day-Ahead and Hour-Ahead schedules, these schedules represent binding commitments made in the markets between the ISO and the Scheduling Coordinators concerned. Any minimum energy input and output associated with Regulation and Spinning Reserve services shall be the responsibility of the Scheduling Coordinator, as the ISO's auction does not compensate the Scheduling Coordinator for the minimum energy output of Generating Units bidding to provide these services. Accordingly the Scheduling Coordinators shall adjust their schedules to accommodate the minimum outputs required by the Generating Units included on the Schedules.

\_\_\_\_ Notwithstanding the foregoing, (a) a Scheduling Coordinator who has sold Regulation, Spinning Reserve, Non-Spinning Reserve or Replacement Reserve 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 Market Clearing Price for the Ancillary Service for the Settlement Period concerned for the Zone in which the Generating Units or other resources on behalf of which the Scheduling Coordinator buys back the capacity, are located. The ISO will purchase the Ancillary Service concerned from another Scheduling Coordinator in the Hour-Ahead Market in accordance with the provisions of the ISO Tariff.

~~(b) — a Scheduling Coordinator whose non-self-provided obligation for Regulation, Spinning Reserve, Non-Spinning Reserve or Replacement Reserve for any Zones reduces between the Day-Ahead and Hour-Ahead Market may sell back to the ISO in the Hour-Ahead Market the amount of such Ancillary Service in whole or in part which is in excess of its non-self-provided obligation in the Hour-Ahead Market. Provided that the ISO has a market for the sale of the Ancillary Service concerned to other Scheduling Coordinators, the price for such a sale back shall be the hourly user rate for the Ancillary Service for the Settlement Period for the Zone concerned in the Hour-Ahead Market. If the ISO has no market for the sale of the Ancillary Service concerned to other Scheduling Coordinators, the price for the sale back shall be zero.~~

#### **2.5.28 Settlement for User Charges for Ancillary Services.**

The ISO shall determine a separate hourly user rate for Regulation, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve for each Settlement Period purchased in the

Day-Ahead market, and in the Hour-Ahead Market. Each rate will be charged to Scheduling Coordinators on a volumetric basis applied to each Scheduling Coordinator's obligation for the Ancillary Service concerned which it has not self provided.

Each Scheduling Coordinator's obligation for Regulation, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve for each Zone shall be calculated in accordance with Section 2.5.20.1.

The cost of Voltage Support and Black Start shall be allocated to Scheduling Coordinators as described in Sections 2.5.28.

~~Except for Replacement Reserve (as to which see Section 2.5.28.4), quantities and rates for the Hour-Ahead markets shall be calculated by substituting the Hour-Ahead quantities and prices in the relevant formulae (including self provided quantities of the Ancillary Service) except that: (a) the user rates for Regulation, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve capacity shall be calculated by dividing the net payments made by the ISO for each service by the obligation for each service which has not been self-provided. The net payments are the total payments for each service net of sums payable by Scheduling Coordinators who have bought back in the Hour-Ahead Regulation, Spinning Reserve, Non-Spinning Reserve or Replacement Reserve capacity, as the case may be, which they had sold to the ISO in the Day-Ahead Market;~~ and

~~(b) the user charges for each Scheduling Coordinator for Regulation, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve capacity shall be reduced by the amount payable by the ISO to the Scheduling Coordinator for any Regulation, Spinning Reserve, Non-Spinning Reserve or Replacement Reserve obligation, as the case may be, sold back to the ISO by the Scheduling Coordinator in the Hour-Ahead Market.~~

Separate rates shall be calculated for each Service as follows:

**2.5.28.1 Regulation.** The user rate per unit of purchased Regulation service for each Settlement Period in the Day-Ahead Market for each Zone shall be calculated by dividing the

total Regulation capacity payments by the ISO's total requirement for Regulation for that Settlement Period for that Zone ~~in the Day-Ahead Market~~ which has not been self provided by Scheduling Coordinators. The ISO will calculate the user rate for Regulation in each Zone for each Settlement Period as:

$$RegRateDA (\$/MWh) = AGCPayDA / AGCObligTotalDA$$

where:

$AGCPayDA$  = Total Regulation payments for the Settlement Period in the Market for the Zone Day-Ahead.

$AGCObligTotalDA$  = the total ISO Regulation requirement for the Settlement Period ~~in the Day-Ahead Market~~ for the Zone less that which has been self provided by Scheduling Coordinators.

For each Settlement Period, each Scheduling Coordinator shall pay to the ISO a sum calculated as follows for each Zone:

$$RegRateDA * AGCObligDA$$

where  $AGCObligDA$  is the Scheduling Coordinator's obligation for Regulation in the Zone in the Settlement Period ~~in the Day-Ahead Market~~ for which it has not self provided.

**2.5.28.2 Spinning Reserve.** The user rate per unit of purchased Spinning Reserve for each Settlement Period in the Day-Ahead Market for each Zone shall be calculated by dividing the total capacity payments for Spinning Reserve by the ISO's total requirement for Spinning Reserve for that Settlement Period for that Zone ~~in the Day-Ahead Market~~, which has not been self provided by Scheduling Coordinators. The ISO will calculate the user rate for Spinning Reserve in each Zone for each Settlement Period as:

$$SpRateDA (\$/MWh) = \frac{SpinPayDA}{SpinObligTotalDA}$$

$$SpRateDA (\$/MWh) = \frac{SpinPayDA}{SpinObligTotal}$$

where:

$SpinPayDA$  = Total Spinning Reserve payments for the Settlement Period in the Market for the Zone Day-Ahead.

$SpinObligTotalDA$  = the total ISO Spinning Reserve requirement for the Settlement Period ~~in the Day-Ahead Market~~ for the Zone less that which has been self provided by Scheduling Coordinators.

For each Settlement Period, each Scheduling Coordinator shall pay to the ISO a sum calculated as follows for each Zone:

$$SPRateDA * SpinObligDA$$

where  $SpinObligDA$  is the Scheduling Coordinator's obligation for Spinning Reserve in the Zone in the Settlement Period ~~in the Day-Ahead Market~~ for which it has not self-provided.

**2.5.28.3 Non-Spinning Reserve.** The user rate per unit of purchased Non-Spinning Reserve for each Settlement Period in the Day-Ahead Market for each Zone shall be calculated by dividing the total capacity payments for Non-Spinning Reserve by the ISO's total requirements for Non-Spinning Reserve for that Settlement Period for that Zone ~~in the Day Ahead Market~~ which has not been self provided by Scheduling Coordinators. The ISO will calculate the user rate for Non-Spinning Reserve in each Zone for each Settlement Period as:

$$NonSpRateDA (\$/Mwh) = \frac{NonSpinPayDa}{NonSpinObligTotalDA}$$

$$NonSpRateDA (\$/ MWh) = \frac{NonSpinPayDA}{NonSpinObligTotal}$$

where:

$NonSpinPayDA$  = Total Non-Spinning Reserve payments for the Settlement Period in the Day-Ahead Market for the Zone.

$NonSpinObligTotalDA$  = the total ISO Non-Spinning Reserve requirement for the Settlement Period ~~in the Day-Ahead~~ for the Zone less that which has been self provided by Scheduling Coordinators.

For each Settlement Period, each Scheduling Coordinator shall pay to the ISO a sum calculated as follows for each Zone:

$$NonSpRateDA * NonSpinObligDA$$

where *NonSpinObligDA* is the Scheduling Coordinator's obligation for Non-Spinning Reserve in the Zone in the Settlement Period ~~in the Day-Ahead Market~~ for which it has not self provided.

**2.5.28.4 Replacement Reserve.** The user rate per unit of purchased Replacement Reserve for each Settlement Period in the Day-Ahead Market and Hour-Ahead Markets for each Zone shall be calculated ~~as shown below. If there is Congestion in the Day-Ahead Market the ISO will allocate the Replacement Reserve capacity Charges (both Dispatched and Un-Dispatched) on a Zonal basis. If there is no Congestion in the Day-Ahead Market the ISO will allocate the Replacement Reserve capacity Charges on a ISO Control Area-wide basis (irrespective of whether there is Congestion in the Hour Ahead Markets or not) and references in Section 2.5.28.4 of the ISO Tariff to "Zone(s)", "Zonal" and the use of subscript "x" shall be read as referring to "ISO Control Area". Dispatched Replacement Reserve capacity charges are recovered by an augmentation to the Imbalance Energy Charge to allocate costs associated with the dispatch of Replacement Reserve to those Scheduling Coordinators who contributed to the Imbalance Energy requiring such dispatch. The calculation of this augmentation is set forth in Section 11.2.4.1 of this ISO Tariff. For undispached Replacement Reserve the user rate shall be calculated by by dividing the total cost to ISO of purchasing ~~undispached~~ Replacement Reserve capacity within the Zone, for the Settlement Period by the ISO's total Replacement Reserve requirement for the Settlement Period in the Day-Ahead ~~Market and Hour-Ahead Markets~~ less that which has been self provided by Scheduling Coordinators within the Zone. The ISO will calculate the~~

user rate for Replacement Reserve in each Zone for each Settlement Period as:

$$ReplRateDA_{xt} = \frac{\sum_j ReplPayTotalDA_{jxt}}{ReplObligTotal_{xt}}$$

where:

ReplPayDA = Total Replacement Reserve payments for the Settlement Period in the Day-Ahead Market for the Zone.

ReplObligTotal = the total ISO Replacement Reserve requirement for the Settlement Period for the Zone less that which has been self provided by Scheduling Coordinators.

For each Settlement Period, each Scheduling Coordinator shall pay to the ISO a sum calculated as follows for each Zone:

$$ReplRateDA * ReplOblig$$

where ReplOblig is the Scheduling Coordinator's obligation for Replacement Reserve in the Zone in the Settlement Period for which it has not self provided.

The net cost to the ISO to purchase undispached Replacement Reserve capacity is equal to the total cost to the ISO to purchase Replacement Reserve less any amounts payable to the ISO by Scheduling Coordinators for Replacement Reserve bought back from the ISO in the Hour-Ahead Market, less the cost for the Replacement Reserve which was Dispatched.

The undispached Replacement Reserve user rate for each Settlement Period shall be calculated as follows for each Zone:

$$UnDispReplRate = \frac{(ReplPayTotal - ReplReceiveTotal) - RRC}{ReplObligTotal}$$

where

UnDispReplRate = the undispached Replacement Reserve user rate

ReplPayTotal = the total payments for Replacement Reserve capacity in the Day-Ahead and Hour-Ahead Markets

ReplReceiveTotal = the total amount payable to the ISO by Scheduling Coordinators for Replacement Reserve bought back from the ISO in the Hour-Ahead Market

RRC = the cost of Replacement Reserve capacity dispatched in real time



*ReplOblig-Total* = the ISO's total Replacement Reserve requirement in the Day-Ahead and Hour-Ahead Markets less that which has been self provided by Scheduling Coordinators.

The cost of Replacement Reserve capacity which is dispatched in real time in each Settlement Period in each Zone shall be calculated by multiplying the quantity of Replacement Reserve capacity Dispatched in the Settlement Period in the Zone by the average price paid for Replacement Reserve capacity scheduled in the Day-Ahead and Hour-Ahead Market for the same Zone and Settlement Period calculated as follows:

$$RRC = P_{avgRepl} * ReplQDisp$$

where *ReplQDisp* is the Replacement Reserve capacity Dispatched in the Zone in the Settlement Period and *PavgRepl* is calculated as follows:

$$P_{avgRepl} = \frac{ReplPayTotalDA + ( ReplPayTotalHA - ReplReceive Total )}{ReplQDA + ReplQHA}$$

where:

*ReplPayTotalDA* = the total payments for Replacement Reserve for the Day-Ahead Market.

*ReplPayTotalHA* = the total payments for Replacement Reserve for the Hour-Ahead Market.

*ReplQDA* = the total quantity of Replacement Reserve capacity provided in the Day-Ahead Market.

*ReplQHA* = the total quantity of Replacement Reserve capacity provided in the Hour-Ahead Market.

The undispached Replacement Reserve capacity charge for each Scheduling Coordinator in the Day-Ahead and Hour-Ahead Markets for each Settlement Period shall be calculated as follows in each Zone:

$$ReplOblig * UnDispReplRate$$

where *ReplOblig* is the Scheduling Coordinator's obligation for Replacement Reserve in the Settlement Period in the Day-Ahead and Hour-Ahead Markets which has not been self provided.

#### 11.2.4.1 Net Settlements for Imbalance Energy.

Imbalance Energy attributable to each Scheduling Coordinator in each Settlement Period in the relevant Zone shall be deemed to be sold or purchased, as the case may be, by the ISO and payments for Imbalance Energy shall be settled by debiting or crediting, as the case may be, the Scheduling Coordinator with an amount for each Settlement Period equal to:

*IE Charge* =

$$\left( \sum_i GenDev_i - \sum_i LoadDev_i \right) * P + \left( \sum_q ImpDev_q \right) * P - \left( \sum_q ExpDev_q \right) * P + UFEC$$

where:

The deviation between scheduled and actual Energy Generation for Generator i represented by the Scheduling Coordinator for the Settlement Period is calculated as follows:

$$GenDev_i = G_s * GMM_f - \left[ (G_a - G_{adj}) * GMM_{ah} - G_{a/s} \right]$$

The deviation between scheduled and actual Load consumption for Load i represented by the Scheduling Coordinator for the Settlement Period is calculated as follows:

$$LoadDev_i = L_s - \left[ (L_a - L_{adj}) + L_{a/s} \right]$$

The deviation between forward, scheduled and Real Time adjustments to Energy imports, adjusted for losses, for Scheduling Point q represented by the Scheduling Coordinator for the Settlement Period is calculated as follows:

$$ImpDev_q = I_s * GMM_{fq} - [(I_a - I_{adj}) * GMM_{ahq}] + I_{a/s}$$

The deviation between forward, scheduled and Real Time adjustments to Energy exports for Scheduling Point q represented by the Scheduling Coordinator for the Settlement Period is calculated as follows:

$$ExpDev_q = E_s - E_a - E_{adj}$$

and where:

**$G_s$**  = sum of effective schedules for Day-Ahead and Hour-Ahead

**$GMM_f$**  = estimated GMM for Day-Ahead

**$G_a$**  = actual metered Generation

**$G_{adj}$**  = deviations in real time ordered by the ISO for purposes such as Congestion Management

**$GMM_{ah}$**  = hour-ahead GMM (proxy for ex-post GMM)

**$G_{a/s}$**  = Energy generated from Ancillary Service resource or Supplemental Energy resource due to ISO dispatch instruction

**$L_s$**  = sum of Demand scheduled for Day-Ahead and Hour-Ahead

**$L_a$**  = actual metered Demand

**$L_{adj}$**  = Demand deviation in real time ordered by ISO for purposes such as Congestion Management

**$L_{a/s}$**  = Demand reduction from Ancillary Service resource due to ISO dispatch instruction

**$GMM_{fq}$**  = estimated GMM for an Energy import at Scheduling Point q for Day-Ahead

**$GMM_{ahq}$**  = estimated GMM for an Energy import at Scheduling Point q for Hour-Ahead (proxy for ex-post GMM)

**$I_s$**  = sum of Scheduled Energy import through Scheduling Point q for Day-Ahead and Hour-Ahead

**$I_a$**  = sum of actual Energy import through Scheduling Point q.

**$I_{adj}$**  = deviation in real time import ordered by ISO for purposes such as Congestion Management, and import curtailment.

**$I_a/s$**  = Energy generated from Ancillary Service System Resources pursuant to Existing Contracts or Supplemental Energy from interties due to dispatch instruction

**$E_S$**  = sum of scheduled Energy export scheduled through Scheduled Point q for Day-Ahead and Hour-Ahead

**$E_a$**  = sum of actual Energy export through Scheduling Point q

**$E_{adj}$**  = deviation in real time export ordered by ISO for purposes such as Congestion Management, and export curtailment

**$P$**  = Hourly Ex Post Price for Imbalance Energy for the relevant hour

**$UFEC$**  = the Unaccounted for Energy Charge for the Scheduling Coordinator calculated as follows:

**Unaccounted for Energy Charge**

The hourly Unaccounted for Energy Charge on Scheduling Coordinator j for Settlement Period t for each relevant Zone is calculated in the following manner:

The UFE for each utility service territory k is calculated as follows,

$$E_{UFE\_UDC\_k} = (I_k - E_k + G_k - (RTM_k + LPM_k) - TL_k)$$

The Transmission Loss calculation per Settlement Period t per relevant Zone for each utility service territory k is calculated as follows,

$$TL_k = \sum [G_a * (1 - GMM_{ah})] + \sum [I_a (1 - GMM_{ahq})]$$

Each metered demand point, either ISO grid connected or connected through a UDC, is allocated a portion of the UFE as follows:

$$E_{UFE\_z} = \frac{D_z}{\sum_Z D_z} E_{UFE\_UDC\_k}$$

The UFE charge for Scheduling Coordinator j per Settlement Period per relevant Zone is then,

$$UFEC_j = \left( \sum_z E_{UFE\_z} \right) * P_{xt}$$

Where the terms used in the equations have the following meaning:

**E<sub>UFE\_UDC\_k</sub> -- MWh**

The Unaccounted for Energy (UFE) for utility service territory k.

**E<sub>UFE\_z</sub> -- MWh**

The portion of Unaccounted for Energy (UFE) allocated to metering point z.

**I<sub>k</sub> -- MWh**

The total metered imports into utility service territory k in Settlement Period t.

**E<sub>k</sub> -- MWh**

The total metered exports from utility service territory k in Settlement Period t.

**G<sub>k</sub> -- MWh**

The total metered Generation in Settlement Period t in utility service territory k.

**RTM<sub>k</sub> -- MWh**

The Settlement Period t total of the real-time metering in utility service territory k in Settlement Period t.

**LPM<sub>k</sub> -- MWh**

The calculated total of the Load Profile metering in utility service territory k per Settlement Period t.

**TL<sub>k</sub> -- MWh**

The Transmission Losses per Settlement Period t in utility service territory k.

**D<sub>z</sub> -- MWh**

The Demand including Exports in Settlement Period t at metered point z.

**Replacement Reserve Dispatch Charge**

For each Scheduling Coordinator whose Generators falls below its Schedule, or whose Demand exceeds its Schedule, such that the net Schedule is unbalanced, the following additional charge will apply:

$$RepResDispChrg_{jt} = D_{jt} * RRDispCost_t$$

where:

$$D_{jt} = \frac{\text{Max} \left( 0, \left\{ \sum_i GenDev_i - \sum_i LoadDev_i + \sum_q ImpDev_q + \sum_q ExpDev_q + E_{UFE\_jk} \right\} \right)}{\sum \text{Max} \left( 0, \left\{ \sum_i GenDev_i - \sum_i LoadDev_i + \sum_q ImpDev_q + \sum_q ExpDev_q + E_{UFE\_jk} \right\} \right)}$$

where:

*RRDispCost* is defined in Section 2.5.28.4 of this ISO Tariff.

If there is Congestion in the Day-Ahead Market the ISO will allocate the Replacement Reserve Dispatch Charges on a Zonal basis. If there is no Congestion in the Day-Ahead Market the ISO will allocate the Replacement Reserve Dispatch Charges on a ISO Control Area-wide basis (irrespective of whether there is Congestion in the Hour-Ahead Markets or not).

This additional charge (*RepResDispChrg*) allocates the cost of dispatched Replacement Reserve to Scheduling Coordinators in proportion to their contribution to the need for the dispatch of that Replacement Reserve, as measured by the magnitude of the Energy insufficiency served through the Imbalance Energy market. The ISO shall develop protocols and procedures for the monitoring of persistent intentional excessive imbalances by Scheduling Coordinators and for the imposition of appropriate sanctions and/or penalties to deter such behavior. The net balance of the charges attributable to all Scheduling Coordinators represents the Transmission Losses imbalance total for each hourly Settlement Period.

## 23. Temporary Changes to the Real-Time Market for Imbalance Energy

**NOTE: MATERIAL SHOWN AS DELETED IN THE TARIFF SHEETS FOR SECTIONS 23.2.1 AND 23.5 HAS BEEN OMITTED**

### 23.2.1 Amendments to the Body of the ISO Tariff

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#### 11.2.4.1 Net Settlements for Uninstructed Imbalance Energy.

Uninstructed Imbalance Energy attributable to each Scheduling Coordinator in each Settlement Period in the relevant Zone shall be deemed to be sold or purchased, as the case may be, by the ISO and payments for Uninstructed Imbalance Energy shall be settled by debiting or crediting, as the case may be, the Scheduling Coordinator with an amount for each Settlement Period equal to:

*IE Charge* =

$$\left( \sum_i GenDev_i - \sum_i LoadDev_i \right) * P + \left( \sum_q ImpDev_q \right) * P - \left( \sum_q ExpDev_q \right) * P + UFEC$$

where:

The deviation between scheduled and actual Energy Generation for Generator i represented by the Scheduling Coordinator for the Settlement Period is calculated as follows:

$$GenDev_i = G_s * GMM_f - \left[ (G_a - G_{adj}) * GMM_{ah} - G_{a/s} \right]$$

The deviation between scheduled and actual Load consumption for Load i represented by the Scheduling Coordinator for the Settlement Period is calculated as follows:

$$LoadDev_i = L_s - \left[ (L_a - L_{adj}) + L_{a/s} \right]$$

The deviation between forward, scheduled and Real Time adjustments to Energy imports, adjusted for losses, for Scheduling Point q represented by the Scheduling Coordinator for the Settlement Period is calculated as follows:

$$ImpDev_q = I_s * GMM_{fq} - \left[ (I_a - I_{adj}) * GMM_{ahq} \right] + I_{a/s}$$

The deviation between forward, scheduled and Real Time adjustments

to Energy exports for Scheduling Point q represented by the Scheduling Coordinator for the Settlement Period is calculated as follows:

$$ExpDev_q = E_s - E_a - E_{adj}$$

and where:

**$G_s$**  = sum of effective schedules for Day-Ahead and Hour-Ahead

**$GMM_f$**  = estimated GMM for Day-Ahead

**$G_a$**  = actual metered Generation

**$G_{adj}$**  = deviations in real time ordered by the ISO for purposes such as Congestion Management

**$GMM_{ah}$**  = hour-ahead GMM (proxy for ex-post GMM)

**$G_{a/s}$**  = Energy generated from Ancillary Service resource or Supplemental Energy resource due to ISO dispatch instruction

**$L_s$**  = sum of Demand scheduled for Day-Ahead and Hour-Ahead

**$L_a$**  = actual metered Demand

**$L_{adj}$**  = Demand deviation in real time ordered by ISO for purposes such as Congestion Management

**$L_{a/s}$**  = Demand reduction from Ancillary Service resource due to ISO dispatch instruction

**$GMM_{fq}$**  = estimated GMM for an Energy import at Scheduling Point q for Day-Ahead

**$GMM_{ahq}$**  = estimated GMM for an Energy import at Scheduling Point q for Hour-Ahead (proxy for ex-post GMM)

**$I_s$**  = sum of Scheduled Energy import scheduled through Scheduling Point q for Day-Ahead and Hour-Ahead

**$I_a$**  = sum of actual Energy import scheduled through Scheduling Point q.



***I<sub>adj</sub>*** = deviation in real time import ordered by ISO for purposes such as Congestion Management, and import curtailment.

***I<sub>a/s</sub>*** = Energy generated from Ancillary Service System Resources pursuant to Existing Contracts or Supplemental Energy from interties due to dispatch instruction

***E<sub>S</sub>*** = sum of scheduled Energy export scheduled through Scheduled Point q for Day-Ahead and Hour-Ahead

***E<sub>a</sub>*** = sum of actual Energy export scheduled through Scheduling Point q for Day-Ahead and Hour-Ahead

***E<sub>adj</sub>*** = deviation in real time export ordered by ISO for purposes such as Congestion Management, and export curtailment

***P*** = Hourly Ex Post Price for Uninstructed Imbalance Energy for the relevant hour, as defined in Section 2.5.23.2.2

***UFEC*** = the Unaccounted for Energy Charge for the Scheduling Coordinator calculated as follows:

#### **Unaccounted for Energy Charge**

The hourly Unaccounted for Energy Charge on Scheduling Coordinator j for Settlement Period t for each relevant Zone is calculated in the following manner:

The UFE for each utility service territory k is calculated as follows,

$$E_{UFE\_UDC\_k} = (I_k - E_k + G_k - (RTM_k + LPM_k) - TL_k)$$

The Transmission Loss calculation per Settlement Period t per relevant Zone for each utility service territory k is calculated as follows,

$$TL_k = \sum [G_a * (1 - GMM_{ah})] + \sum [I_a (1 - GMM_{ahq})]$$

Each metered demand point, either ISO grid connected or connected through a UDC, is allocated a portion of the UFE as follows:

$$E_{UFE\_z} = \frac{D_z}{\sum_Z D_z} E_{UFE\_UDC\_k}$$

The UFE charge for Scheduling Coordinator j per Settlement Period per relevant Zone is then,

$$UFEC_j = \left( \sum_z E_{UFE\_z} \right) * P_{xt}$$

Where the terms used in the equations have the following meaning:

**EUFE\_UDC\_k -- MWh**

The Unaccounted for Energy (UFE) for utility service territory k.

**EUFE\_z -- MWh**

The portion of Unaccounted for Energy (UFE) allocated to metering point z.

**I\_k -- MWh**

The total metered imports into utility service territory k in Settlement Period t.

**E\_k -- MWh**

The total metered exports from utility service territory k in Settlement Period t.

**G\_k -- MWh**

The total metered Generation in Settlement Period t in utility service territory k.

**RTM\_k -- MWh**

The Settlement Period t total of the real-time metering in utility service territory k in Settlement Period t.

**LPM\_k -- MWh**

The calculated total of the Load Profile metering in utility service territory k per Settlement Period t.

**TL\_k -- MWh**

The Transmission Losses per Settlement Period t in utility service territory k.

**D\_z -- MWh**

The Demand including Exports in Settlement Period t at metered point z.

**Replacement Reserve Dispatch Charge**

For each Scheduling Coordinator whose Generators falls below its Schedule, or whose Demand exceeds its Schedule, such that the net Schedule is unbalanced, the following additional charge will apply:

$$RepResDispChrg_{jt} = D_{jt} * RRDispCost_t$$

where:

$$D_{jt} = \frac{\text{Max}\left(0, \left\{ \sum_i \text{GenDev}_i - \sum_i \text{LoadDev}_i + \sum_q \text{ImpDev}_q + \sum_q \text{ExpDev}_q + E_{\text{UFE}_{-jk}} \right\}\right)}{\sum \text{Max}\left(0, \left\{ \sum_i \text{GenDev}_i - \sum_i \text{LoadDev}_i + \sum_q \text{ImpDev}_q + \sum_q \text{ExpDev}_q + E_{\text{UFE}_{-jk}} \right\}\right)}$$

$$D_{jt} = \frac{\text{Max}\left(0, \left\{ \sum_i \text{GenDev}_i - \sum_i \text{LoadDev}_i + \sum_q \text{ImpDev}_q + \sum_q \text{ExpDev}_q + E_{\text{UFE}_{-jk}} \right\}\right) * \text{ReplObligRatio}_{jxt}}{\sum \left( \text{Max}\left(0, \left\{ \sum_i \text{GenDev}_i - \sum_i \text{LoadDev}_i + \sum_q \text{ImpDev}_q + \sum_q \text{ExpDev}_q + E_{\text{UFE}_{-jk}} \right\}\right) * \text{ReplObligRatio}_{jxt} \right)}$$

where:

$$\text{ReplObligRatio}_{jxt} = \frac{\text{ReplOblig}_{jxt}}{\sum_j \text{ReplOblig}_{jxt}}$$

**ReplOblig<sub>jxt</sub> is the replacement reserve capacity obligation as defined in Section 2.5.28.4; and**

where:

*RRDispCost* is defined in Section 2.5.28.4 of this ISO Tariff.

If there is Congestion in the Day-Ahead Market the ISO will allocate the Replacement Reserve Dispatch Charges on a Zonal basis. If there is no Congestion in the Day-Ahead Market the ISO will allocate the Replacement Reserve Dispatch Charges on a ISO Control Area-wide basis (irrespective of whether there is Congestion in the Hour-Ahead Markets or not).

This additional charge (*RepResDispChrg*) allocates the cost of dispatched Replacement Reserve to Scheduling Coordinators in proportion to their contribution to the need for the dispatch of that Replacement Reserve, as measured by the magnitude of the Energy insufficiency served through the Imbalance Energy market. The ISO shall develop protocols and procedures for the monitoring of persistent intentional excessive imbalances by Scheduling Coordinators and for the imposition of appropriate sanctions and/or penalties to deter such behavior. The net balance of the charges attributable to all Scheduling Coordinators represents the Transmission Losses imbalance total for each hourly Settlement Period.

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## 23.5 Amendments to the Settlement and Billing Protocol

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### D2.3—Replacement Reserve Capacity Dispatch Charge

The Replacement Reserve Capacity Dispatch Charge (RRDC) for Scheduling Coordinator  $j$  in Trading Interval  $t$  is calculated using the following formula:

$$RRDC_j = \frac{\left[ \text{Max} \left( 0, \left\{ \sum_i \text{GenDev}_i - \sum_i \text{LoadDev}_i + \sum_q \text{ImpDev}_q + \sum_q \text{ExpDev}_q + E_{UFE\_jk} \right\} \right) \right]}{\left[ \sum_j \text{Max} \left( 0, \left\{ \sum_i \text{GenDev}_i - \sum_i \text{LoadDev}_i + \sum_q \text{ImpDev}_q + \sum_q \text{ExpDev}_q + E_{UFE\_jk} \right\} \right) \right]} * RRC$$

$$RRDC_j = \frac{\left[ \text{Max} \left( 0, \left\{ \sum_i \text{GenDev}_i - \sum_i \text{LoadDev}_i + \sum_q \text{ImpDev}_q + \sum_q \text{ExpDev}_q + E_{UFE\_jk} \right\} \right) * \text{ReplObligRatio}_{jxt} \right]}{\left[ \sum_j \left( \text{Max} \left( 0, \left\{ \sum_i \text{GenDev}_i - \sum_i \text{LoadDev}_i + \sum_q \text{ImpDev}_q + \sum_q \text{ExpDev}_q + E_{UFE\_jk} \right\} \right) * \text{ReplObligRatio}_{jxt} \right) \right]} * RRC$$

If there is Congestion in the Day Day-Ahead Market the ISO will allocate the Replacement Reserve Capacity Dispatch Charges on a Zonal basis. If there is no Congestion in the Day Day-Ahead Market the ISO will allocate the Replacement Reserve Capacity Dispatch Charges on a ISO Control Area-wide basis (irrespective of whether there is Congestion in the Hour Hour-Ahead Markets or not).

### **ASRP 4.3 SC's Obligation for Regulation**

Each Scheduling Coordinator's Obligation for Regulation for each Settlement Period of the Day-Ahead Market and for each Hour-Ahead Market in each Zone shall be calculated based upon the ratio of metered Demand ~~scheduled~~ by each Scheduling Coordinator in each identified Zone for that Settlement Period to the total metered ~~Scheduled-DD~~ Demand for that Settlement Period in that Zone.

### **ASRP 5.5.1 Obligation for Spinning and Non-Spinning Reserve**

Except for the requirement for Non-Spinning Reserve referred to in paragraph ASRP 5.5.2, ~~the Spinning and Non-Spinning Reserve allocation for each Settlement Period of the Day-Ahead Market and for each Hour-Ahead Market shall be determined for each Scheduling Coordinator equal to 5% of its pro rata share of the total system Demand (except the Demand covered by firm purchases from outside the ISO Control Area) scheduled to be met by total system Generation from hydroelectric resources plus 7% of its pro rata share of the total system Demand (except the Demand covered by firm purchases from outside the ISO Control Area) to be met by total system Generation from non-hydroelectric resources. This obligation will originally be determined without the consideration of Congestion, however the final allocation may be made by the ISO to each Scheduling Coordinator in such a manner as to minimize Congestion. each Scheduling Coordinator's Operating Reserve obligation in each Zone shall be pro rata based upon the same proportion as the product of its percentage obligation based on Schedules and the sum of its metered Demand and firm exports bears to the total of such products for all Scheduling Coordinators in the Zone. The Scheduling Coordinator's percentage obligation based on Schedules shall be calculated as the sum of 5% of its scheduled Demand (except the Demand covered by firm purchases from outside the ISO Control Area) scheduled to be met by Generation from hydroelectric resources plus 7% of its scheduled Demand (except the Demand covered by firm purchases~~

from outside the ISO Control Area) scheduled to be met by Generation from non-hydroelectric resources in that Zone.

**ASRP 6.3 Scheduling Coordinator's Obligation for Replacement Reserve**

Scheduling Coordinator's Obligation for Replacement Reserve for each Settlement Period of the Day-Ahead Market and for each Hour-Ahead Market in each zone shall be based upon the ratio of the metered Demand ~~scheduled~~ by each Scheduling Coordinator in each identified Zone for that Settlement Period to the total metered ~~scheduled~~ Demand for that Settlement Period in that Zone.

## **SABP Appendix C**

### **ANCILLARY SERVICES CHARGES COMPUTATION**

#### **C 1 Purpose of charges**

The Ancillary Services Charges reimburse the ISO for the costs of purchasing Ancillary Services in the Day-Ahead and Hour-Ahead Markets. Each Scheduling Coordinator that does not self provide Ancillary Services must purchase these services from the ISO. The ISO will in turn purchase these Ancillary Services from Scheduling Coordinators in the markets. Ancillary Services purchased and resold by the ISO includes Regulation, Spinning Reserve, Non-Spinning Reserve, and Replacement Reserve.

This Appendix C also addresses the payments by ISO to Scheduling Coordinators for the Dispatch of energy from Dispatched Ancillary Services Units and for the Dispatch of Supplemental Energy in the Real Time Market. The ISO recovers the costs of Real Time Dispatch of such energy through the Imbalance Energy charges described in Appendix D of this Protocol.

The reference to a Scheduling Coordinator by Zone refers to the Demand of that Scheduling Coordinator which is located in the Zone. A Generation Unit, Load, or System Resource located in another Control Area is considered to be located in the Zone in which its contract path enters the ISO Controlled Grid.

The ISO will purchase Ancillary Services for each Trading Interval in both the Day-Ahead and Hour-Ahead Markets. Separate payments will be calculated for each service for each Trading Interval and in each market for each Generating Unit, ~~and Load~~ and System Resource. The ISO will then calculate a total payment for each Scheduling Coordinator for each Trading Interval for each service for each Zone in each market for all the Generating Units, ~~and Loads~~ and System Resources that the Scheduling Coordinator represents. The ISO will charge Scheduling Coordinators for Ancillary Services, other than for energy, which they purchase from the ISO by calculating and applying charges to each Scheduling Coordinator for each Trading Interval for each service in each Zone in each market.

#### **C 2.2 ISO allocation of charges to Scheduling Coordinators**

##### **C 2.2.1 Day-Ahead Market**

- (a) *Regulation*. The ISO will charge the zonal cost of providing Regulation capacity that is not self provided by Scheduling Coordinators, in the Day-Ahead Market, through the application of a charge to each Scheduling Coordinator for each Trading Interval. This charge will be computed by multiplying the Regulation user rate for the Trading Interval by the Scheduling Coordinator's Regulation obligation, for which it has not self provided, for the same period.

The zonal Regulation user rate for the Day-Ahead Market is calculated by dividing the total cost to ISO of purchasing Regulation Capacity within the Zone, for the Trading Interval, by the total ISO Regulation obligation for the Trading Interval within the Zone. The Day-Ahead Regulation user rate in Zone x for Trading Interval t is calculated as follows:

$$\overline{AGCRateDA}_{xt} = \frac{\sum_j \overline{AGCPayTotalDA}_{jxt}}{\overline{AGCObligTotalDA}_{xt}}$$

$$AGCRateDA_{xt} = \frac{\sum_j AGCPayTotalDA_{jxt}}{AGCObligTotal_{xt}}$$

The Regulation capacity charge for Scheduling Coordinator j in the Day-Ahead Market in Zone x for Trading Interval t is calculated as follows:

$$\overline{AGCChgDA}_{jxt} = \overline{AGCObligDA}_{jxt} * \overline{AGCRateDA}_{xt}$$

$$AGCChgDA_{jxt} = AGCOblig_{jxt} * AGCRateDA_{xt}$$

- (b) Spinning Reserve. The ISO will charge the zonal cost of providing Spinning Reserve capacity that is not self provided by Scheduling Coordinators, in the Day-Ahead Market, through the application of a charge to each Scheduling Coordinator for each Trading Interval. This charge will be computed by multiplying the Spinning Reserve capacity user rate for the Trading Interval by the Scheduling Coordinator's Spinning Reserve obligation, for which it has not self provided, for the same period.

The zonal Spinning Reserve capacity user rate for the Day-Ahead Market is calculated by dividing the total cost to ISO of purchasing Spinning Reserve capacity within the Zone, for the Trading Interval, by the total ISO Spinning Reserve obligation for the Trading Interval within the Zone. The Day-Ahead Spinning Reserve capacity user rate in Zone x for Trading Interval t is calculated as follows:



$$\cancel{SpinRateDA_{xt}} = \frac{\sum_j SpinPayTotalDA_{jxt}}{SpinObligTotalDA_{xt}}$$


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$$SpinRateDA_{xt} = \frac{\sum_j SpinPayTotalDA_{jxt}}{SpinObligTotal_{xt}}$$

The Spinning Reserve capacity charge for Scheduling Coordinator j in the Day-Ahead Market in Zone x for Trading Interval t is calculated as follows:

$$\cancel{SpinChgDA_{jxt}} = \cancel{SpinObligDA_{jxt}} * \cancel{SpinRateDA_{xt}}$$


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$$SpinChgDA_{jxt} = SpinOblig_{jxt} * SpinRateDA_{xt}$$

- (c) Non-Spinning Reserve. The ISO will charge the zonal cost of providing Non-Spinning Reserve capacity that is not self provided by Scheduling Coordinators, in the Day-Ahead Market, through the application of a charge to each Scheduling Coordinator for each Trading Interval. This charge will be computed by multiplying the Non-Spinning Reserve capacity user rate for the Trading Interval by the Scheduling Coordinator's Non-Spinning Reserve obligation, for which it has not self provided, for the same period.

The zonal Non-Spinning Reserve capacity user rate for the Day-Ahead Market is calculated by dividing the total cost to ISO of purchasing Non-Spinning Reserve capacity within the Zone, for the Trading Interval, by the total ISO Non-Spinning Reserve obligation for the Trading Interval within the Zone. The Day-Ahead Non-Spinning Reserve capacity user rate in Zone x for Trading Interval t is calculated as follows:

$$\cancel{NonSpinRateDA_{xt}} = \frac{\sum_j NonSpinPayTotalDA_{jxt}}{NonSpinObligTotalDA_{xt}}$$


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$$NonSpinRateDA_{xt} = \frac{\sum_j NonSpinPayTotalDA_{jxt}}{NonSpinObligTotal_{xt}}$$

The Non-Spinning Reserve capacity charge for Scheduling Coordinator j in the Day-Ahead Market in Zone x for Trading Interval t is calculated as follows:

$$\frac{\text{NonSpinChgDA}_{jxt} = \text{NonSpinObligDA}_{jxt} * \text{NonSpinRateDA}_{xt}}{\text{NonSpinChgDA}_{jxt} = \text{NonSpinOblig}_{jxt} * \text{NonSpinRateDA}_{xt}}$$

- (d) Replacement Reserve. The ISO will charge the zonal cost of providing Replacement Reserve capacity that is not self provided by Scheduling Coordinators, in the Day-Ahead Market, through the application of a charge to each Scheduling Coordinator for each Trading Interval. This charge will be computed by multiplying the Replacement Reserve user rate for the Trading Interval by the Scheduling Coordinator's Replacement Reserve obligation, for which it has not self provided, for the same period.

The zonal Replacement Reserve user rate for the Day-Ahead Market is calculated by dividing the total cost to ISO of purchasing Replacement Reserve Capacity within the Zone, for the Trading Interval, by the total ISO Replacement Reserve obligation for the Trading Interval within the Zone. The Day-Ahead Replacement Reserve user rate in Zone x for Trading Interval t is calculated as follows:

$$\text{ReplRateDA}_{xt} = \frac{\sum_j \text{ReplPayTotalDA}_{jxt}}{\text{ReplObligTotal}_{xt}}$$

The Replacement Reserve capacity charge for Scheduling Coordinator j in the Day-Ahead Market in Zone x for Trading Interval t is calculated as follows:

$$\text{ReplChgDA}_{jxt} = \text{ReplOblig}_{jxt} * \text{ReplRateDA}_{xt}$$

### C 2.2.2 Hour-Ahead Market

- (a) Regulation. The ISO will charge the zonal net cost of providing Regulation capacity that is not self provided by Scheduling Coordinators, in the Hour-Ahead Market through the application of a charge to each Scheduling Coordinator for the Trading Interval concerned. This charge will be computed by multiplying the Regulation user rate for the Trading Interval by the Scheduling Coordinator's RegulationSpinning Reserve obligation, for which it has not self provided, for the same period.

The zonal Regulation capacity user rate for the Hour-Ahead Market is calculated by dividing the total cost to the ISO of purchasing Regulation capacity within the Zone less any amounts payable to the ISO by Scheduling Coordinators for Regulation bought back from the ISO in the Hour-Ahead Market on behalf of resources located in the Zone, for

the Trading Interval, by the total ISO Regulation capacity obligation for the Trading Interval within the Zone. The Hour-Ahead Regulation capacity user rate in Zone x for Trading Interval t is calculated as follows:

$$\underline{AGCRateHA_{xt} = \frac{\sum_j AGCPayTotalHA_{jxt}}{AGCObligTotalHA_{xt}}}$$

$$\underline{AGCRateHA_{xt} = \frac{\sum_j AGCPayTotalHA_{jxt}}{AGCObligTotal_{xt}}}$$

The Regulation capacity charge for Scheduling Coordinator j in the Hour-Ahead Market in Zone x for Trading Interval t is calculated as follows:

$$\underline{AGCChgHA_{jxt} = \frac{(AGCObligHA_{jxt} * AGCRateHA_{xt})}{(AGCSellBack_{jxt} * AGCRateHA_{xt})}}$$

$$\underline{AGCChgHA_{jxt} = (AGCOblig_{jxt} * AGCRateHA_{xt})}$$

**(b) Spinning Reserve.** The ISO will charge the zonal net cost of providing Spinning Reserve capacity that is not self provided by Scheduling Coordinators, in the Hour-Ahead Market, through the application of a charge to each Scheduling Coordinator for the Trading Interval. This charge will be computed by multiplying the Spinning Reserve capacity user rate for the Trading Interval by the Scheduling Coordinator's Spinning Reserve obligation, for which it has not self provided, for the same period.

The zonal Spinning Reserve capacity user rate for the Hour-Ahead Market is calculated by dividing the total cost to ISO of purchasing Spinning Reserve capacity within the Zone less any amounts payable to the ISO by Scheduling Coordinators for Spinning Reserve bought back from the ISO in the Hour-Ahead Market on behalf of resources located in the Zone, for the Trading Interval, by the total ISO Spinning Reserve obligation for the Trading Interval within the Zone. The Hour-Ahead Spinning Reserve capacity user rate in Zone x for Trading Interval t is calculated as follows:

$$\underline{\underline{SpinRateHA_{xt} = \frac{\sum_j SpinPayTotalHA_{jxt}}{SpinObligTotalHA_{xt}}}}$$

$$\underline{\underline{SpinRateHA_{xt} = \frac{\sum_j SpinPayTotalHA_{jxt}}{SpinObligTotal_{xt}}}}$$

The Spinning Reserve capacity charge for Scheduling Coordinator j in the Hour-Ahead Market in Zone x for Trading Interval t is calculated as follows:

$$\underline{\underline{SpinChgHA_{jxt} = (SpinObligHA_{jxt} * SpinRateHA_{xt}) - (SpinSellBack_{jxt} * SpinRateHA_{xt})}}$$

$$\underline{\underline{SpinChgHA_{jxt} = (SpinOblig_{jxt} * SpinRateHA_{xt})}}$$

- (c) Non-Spinning Reserve. The ISO will charge the zonal net cost of providing Non-Spinning Reserve capacity that is not self provided by Scheduling Coordinators, in the Hour-Ahead Market, through the application of a charge to each Scheduling Coordinator for the Trading Interval. This charge will be computed by multiplying the Non-Spinning Reserve capacity user rate for the concerned Trading Interval by the Scheduling Coordinator's Non-Spinning Reserve obligation, for which it has not self provided, for the same period.

The zonal Non-Spinning Reserve capacity user rate for the Hour-Ahead Market is calculated by dividing the total cost to ISO of purchasing Non-Spinning Reserve capacity within the Zone less any amounts payable to the ISO by Scheduling Coordinators for Non-Spinning Reserve bought back from the ISO in the Hour-Ahead Market on behalf of resources in the Zone, for the Trading Interval, by the total ISO Non-Spinning Reserve obligation for the Trading Interval within the Zone. The Hour-Ahead Non-Spinning Reserve capacity user rate in Zone x for Trading Interval t is calculated as follows:

$$\underline{\underline{NonSpinRateHA_{xt} = \frac{\sum_j NonSpinPayTotalHA_{jxt}}{NonSpinObligTotalHA_{xt}}}}$$

$$\underline{\underline{NonSpinRateHA_{xt} = \frac{\sum_j NonSpinPayTotalHA_{jxt}}{NonSpinObligTotal_{xt}}}}$$

The Non-Spinning Reserve capacity charge for Scheduling Coordinator j in the Hour-Ahead Market in Zone x for Trading Interval t is calculated as follows:

$$NonSpinChgHA_{jxt} = (NonSpinObligHA_{jxt} * NonSpinRateHA_{xt})$$

$$- (NonSpinSellBack_{jxt} * NonSpinRateHA_{xt})$$

$$NonSpinChgHA_{jxt} = (NonSpinOblig_{jxt} * NonSpinRateHA_{xt})$$

- (d) Replacement Reserve. The ISO will charge the zonal cost of providing Replacement Reserve capacity that is not self provided by Scheduling Coordinators, in the Hour-Ahead Market, through the application of a charge to each Scheduling Coordinator for each Trading Interval. This charge will be computed by multiplying the Replacement Reserve user rate for the Trading Interval by the Scheduling Coordinator's Replacement Reserve obligation, for which it has not self provided, for the same period.

The zonal Replacement Reserve user rate for the Hour-Ahead Market is calculated by dividing the total cost to ISO of purchasing Replacement Reserve Capacity within the Zone less any amounts payable to the ISO by Scheduling Coordinators for Non-Spinning Reserve bought back from the ISO in the Hour-Ahead Market on behalf of resources in the Zone, for the Trading Interval, by the total ISO Replacement Reserve obligation for the Trading Interval within the Zone. The Hour-Ahead Replacement Reserve user rate in Zone x for Trading Interval t is calculated as follows:

$$ReplRateHA_{xt} = \frac{\sum_j ReplPayTotalHA_{jxt}}{ReplObligTotal_{xt}}$$

The Replacement Reserve capacity charge for Scheduling Coordinator j in the Hour-Ahead Market in Zone x for Trading Interval t is calculated as follows:

$$ReplChgHA_{jxt} = ReplOblig_{jxt} * ReplRateHA_{xt}$$

### C-2.2.3 Replacement Reserve

Only undispached Replacement Reserve capacity charges are covered within the Ancillary Services calculations. Dispatched Replacement Reserve capacity charges are covered within the Imbalance Energy calculations in Appendix D. This enables the ISO to allocate the cost of Dispatched Replacement Reserve capacity to those Scheduling Coordinators who contributed to the Imbalance Energy requiring such Dispatch.

If there is Congestion in the Day-Ahead Market the ISO will allocate the Replacement Reserve capacity Charges (both Dispatched and Un-Dispatched) on a Zonal basis. If there is no Congestion in the Day Ahead Market the ISO will allocate the Replacement Reserve capacity Charges on a ISO Control Area-wide basis (irrespective of whether there is Congestion in the Hour Ahead Markets or not) and references in C 2.2.3 of this Appendix C to Settlements and Billing Protocol to “Zone(s)”, “Zonal” and the use of subscript “x” shall be read as referring to “ISO Control Area”.

The ISO will charge the zonal net cost of providing undispached Replacement Reserve capacity that is not self provided by Scheduling Coordinators, in the Day-Ahead and Hour-Ahead Markets, through the application of a charge to each Scheduling Coordinator for each Trading Interval. This charge will be computed by multiplying the undispached Replacement Reserve capacity user rate for the Trading Interval by the Scheduling Coordinators Replacement Reserve obligation, for which it has not self provided, for the same Trading Interval.

The zonal undispached Replacement Reserve capacity user rate is calculated by dividing the net cost to ISO of purchasing undispached Replacement Reserve capacity within the Zone, for the Trading Interval, by the total ISO Replacement Reserve obligation for the Trading Interval within the Zone. The net cost to ISO to purchase undispached Replacement Reserve capacity is equal to the total cost to ISO to purchase Replacement Reserve capacity less any amounts payable to the ISO by Scheduling Coordinators for Replacement Reserve bought back from the ISO in the Hour-Ahead Market on behalf of resources located in the Zone less the cost for Replacement Reserve capacity which was Dispatched. The undispached Replacement Reserve capacity user rate in Zone x for Trading Interval t is calculated as follows:

$$\underline{\underline{UnDispReplRate_{xt} = \frac{(\sum_j ReplPayTotal_{jxt}) - RRC}{ReplObligTotal_{xt}}}}$$

The zonal cost of Replacement Reserve capacity which is dispatched in the Real Time Market in a Trading Interval is calculated by multiplying the quantity of Replacement Reserve capacity Dispatched in the Trading Interval in the Zone by the average price paid for Replacement Reserve capacity scheduled in the Day-Ahead Market and the Hour-Ahead Market for the same Zone and Trading Interval. The cost of Replacement Reserve capacity dispatched in the Real Time Market in Zone x for Trading Interval t is calculated as follows:

$$\underline{\underline{RRC = PavgRepl_{xt} * ReplQDisp_{xt}}}$$

The average price paid for Replacement Reserve capacity in the Day-Ahead Market in Zone x in Trading Interval t is calculated as follows:

$$\underline{\underline{PavgRepl_{xt} = \frac{\sum_j ReplPayTotalDA_{jxt} + \sum_j ReplPayTotalHA_{jxt}}{\sum_{ij} ReplQDA_{ijxt} + \sum_{ij} ReplQIHA_{ijxt} - \sum_{ij} ReplQDHA_{ijxt}}}}$$

The undispatched Replacement Reserve capacity charge for Scheduling Coordinator  $j$  in the Day-Ahead and Hour-Ahead Market in Zone  $x$  for Trading Interval  $t$  is calculated as follows:

$$UnDispReplChg_{jxt} = (ReplOblig_{jxt} * UnDispReplRate_{xt}) - (ReplSellBack_{jxt} * UnDispReplRate_{xt})$$

#### **C 2.2.4 Real-Time Market**

(a) — The ISO will charge the costs of purchasing real time instructed Energy output from Dispatched Regulation, Spinning Reserve, Non-Spinning Reserve, Replacement Reserve and Supplemental Energy resources through the Imbalance Energy settlement process.

### **C 3 Meaning of terms of formulae**

#### **C 3.1 AGCPayDA<sub>ijxt</sub> - \$**

The payment for Scheduling Coordinator j for providing Regulation capacity in the Day-Ahead Market from a resource i in Zone x for Trading Interval t.

#### **C 3.2 AGCQDA<sub>ijxt</sub> – MW**

The total quantity of Regulation capacity provided in the ISO Day-Ahead Market from resource i by Scheduling Coordinator j in Zone x for Trading Interval t.

#### **C 3.3 PAGCDA<sub>xt</sub> - \$/MW**

The Market Clearing Price for units exempt from FERC Ancillary Service rate caps or the bid price for those Units subject to the cap for Regulation capacity in the Day-Ahead Market for Trading Interval t in Zone x.

#### **C 3.4 AGCPayTotalDA<sub>ijxt</sub> - \$**

The total payment for Regulation capacity to Scheduling Coordinator j in the Day-Ahead Market in Zone x for Trading Interval t.

#### **C 3.5 AGCPayHA<sub>ijxt</sub> - \$**

The payment for Scheduling Coordinator j for providing incremental (additional to Day-Ahead) Regulation capacity in the Hour-Ahead Market from a resource i in Zone x for Trading Interval t.

#### **C 3.5.1 AGCReceiveHA<sub>ijxt</sub> - \$**

The payment from Scheduling Coordinator j for buying back from the ISO in the Hour-Ahead Regulation capacity which the ISO had purchased from Scheduling Coordinator j in the Day-Ahead Market from a resource i in Zone x for Trading Interval t.

#### **C 3.6 AGCQIHA<sub>ijxt</sub> – MW**

The total quantity of incremental (additional to Day-Ahead) Regulation capacity provided in the ISO Hour-Ahead Market from resource i by Scheduling Coordinator j in Zone x for Trading Interval t.

#### **C 3.7 AGCQDHA<sub>ijxt</sub> – MW**

The total quantity of decremental (less than Day-Ahead) Regulation capacity provided in the ISO Hour-Ahead Market from resource i by Scheduling Coordinator j in Zone x for Trading Interval t.



### **C 3.7.1 PAGCHA<sub>xt</sub> - \$/MW**

The Market Clearing Price for units exempt from FERC Ancillary Service rate caps or the bid price for those units subject to the cap for incremental (additional to Day-Ahead) Regulation capacity in the Hour-Ahead Market for Trading Interval t in Zone x. On buyback condition, MCP applies.

### **C 3.8 AGCPayTotalHA<sub>jxt</sub> - \$**

The total payment for incremental (additional to Day-Ahead) Regulation capacity to Scheduling Coordinator j in the Hour-Ahead Market in Zone x for Trading Interval t, after deduction of payments from Scheduling Coordinator j for buying back from the ISO in the Hour-Ahead, Regulation capacity which the ISO had purchased from Scheduling Coordinator j in the Day-Ahead Market in Zone x for Trading Interval t.

### **C 3.9 AGCRateDA<sub>xt</sub> - \$/MW**

The Day-Ahead Regulation capacity user rate charged to Scheduling Coordinators by the ISO in Zone x for Trading Interval t.

### **C 3.10 AGCObligTotalDA<sub>xt</sub> – MW**

The net total Regulation obligation in ~~the Day-Ahead Market in~~ Zone x for Trading Interval t as defined in the Ancillary Services Requirements Protocol. This net total equals the total obligation minus that self-provided.

### **C 3.11 AGCChgDA<sub>jxt</sub> - \$**

The Regulation charge for Scheduling Coordinator j in the Day-Ahead Market in Zone x for Trading Interval t.

### **C 3.12 AGCObligDA<sub>jxt</sub> – MW**

The net Regulation obligation ~~in the Day-Ahead Market~~ for Scheduling Coordinator j in Zone x for Trading Interval t as defined in the Ancillary Services Requirements Protocol. This net obligation equals the obligation minus that self-provided.

### **C 3.13 AGCRateHA<sub>xt</sub> - \$/MW**

The Hour-Ahead incremental (additional to Day-Ahead) Regulation capacity user rate charged to Scheduling Coordinators by the ISO in Zone x for Trading Interval t. ~~Where ASCRateHA<sub>xt</sub> is applied to ASCSellBack<sub>jxt</sub> it shall be set at zero if there is no market for the sale by the ISO of the Regulation capacity concerned to other Scheduling Coordinators.~~

### ~~C 3.14 AGCObligTotalHA<sub>xt</sub> – MW~~

~~The net total incremental (additional to Day-Ahead) Regulation obligation in the Hour-Ahead Market in Zone x for Trading Interval t as defined in the Ancillary Services Requirements Protocol. This net total obligation equals the total obligation minus that self-provided.~~

### ~~C 3.15~~ **C 3.14 AGCChgHA<sub>jxt</sub> - \$**

The incremental (additional to Day-Ahead) Regulation charge for Scheduling Coordinator j in the Hour-Ahead Market in Zone x for Trading Interval t.

**C 3.16 AGCObligHA<sub>jxt</sub> – MW**

The net incremental (additional to Day-Ahead) Regulation obligation in the Hour-Ahead Market for Scheduling Coordinator j in Zone x for Trading Interval t as defined in the Ancillary Services Requirements Protocol. This net obligation equals the obligation minus that self-provided.

**C 3.16.1 AGCSell Back<sub>jxt</sub> – MW**

The decremental (less than Day-Ahead) Regulation obligation in Zone x which the Scheduling Coordinator j sells back to the ISO for Trading Interval t in the Hour-Ahead Market.

**C 3.17C 3.15 EnQPay<sub>ijxt</sub> - \$**

The payment for Scheduling Coordinator j for Dispatched and supplemental Energy output from a resource i in the Real Time Market in Zone x for Trading Interval t.

**C 3.18C 3.16 EnQ<sub>ijxt</sub> – MWh**

The Dispatched and Supplemental Energy output in the Real Time Market from resource i represented by Scheduling Coordinator j in Zone x for Trading Interval t.

**C 3.19C 3.17 EnQPayTotal<sub>jxt</sub> - \$**

The total payment to each Scheduling Coordinator j for Dispatched and Supplemental Energy output in the Real Time Market from all resources which it represents for Trading Interval t in Zone x.

**C 3.20C 3.18 P<sub>xt</sub> - \$/MWh**

The Hourly Ex Post Price of Imbalance Energy in the Real Time Market in Zone x for Trading Interval t.

**C 3.21C 3.19 SpinPayDA<sub>ijxt</sub> - \$**

The payment for Scheduling Coordinator j for providing Spinning Reserve capacity in the Day-Ahead Market from a resource i in Zone x for Trading Interval t.

**C 3.22C 3.20 SpinQDA<sub>ijxt</sub> – MW**

The total quantity of Spinning Reserve capacity provided in the Day-Ahead Market by resource i represented by Scheduling Coordinator j in Zone x for Trading Interval t.

**C 3.23C 3.21 PSpinDA<sub>xt</sub> -\$/MW**

The Day-Ahead Market Clearing Price for units exempt from FERC Ancillary Service rate caps or the bid price for those units subject to the cap for Spinning Reserve capacity in Zone x for Trading Interval t.

**C 3.24C 3.22 SpinPayTotalDA<sub>jxt</sub> - \$**

The total payment to Scheduling Coordinator j for Spinning Reserve capacity in the Day-Ahead Market in Zone x for Trading Interval t.

**C 3.25C 3.23 SpinPayHA<sub>ijxt</sub> - \$**

The payment for Scheduling Coordinator j for providing incremental (additional to Day-Ahead) Spinning Reserve capacity in the Hour-Ahead Market from a resource i in Zone x for Trading Interval t.

**C 3.25-1C 3.23.1 SpinReceiveHA<sub>ijxt</sub> - \$**

The payment from Scheduling Coordinator j for buying back from the ISO in the Hour-Ahead, Spinning Reserve capacity which the ISO had purchased from Scheduling Coordinator j in the Day-Ahead Market from a resource i in Zone x for Trading Interval t.

**C 3.26C 3.24 SpinQIHA<sub>ijxt</sub> – MW**

The total quantity of incremental (additional to Day-Ahead) Spinning Reserve capacity provided in the Hour-Ahead Market by resource i represented by Scheduling Coordinator j in Zone x for Trading Interval t.

**C 3.27C 3.25 SpinQDHA<sub>ijxt</sub> – MW**

The total quantity of decremental (less than Day-Ahead) Spinning Reserve capacity provided in the ISO Hour-Ahead Market from resource i by Scheduling Coordinator j in Zone x for Trading Interval t.

**C 3.27-1C 3.25.1 PSpinHA<sub>xt</sub> -\$/MW**

The Hour-Ahead Market Clearing Price for units exempt from FERC Ancillary Service rate caps or the bid price for those units subject to the cap for incremental (additional to Day-Ahead) Spinning Reserve capacity in Zone x for Trading Interval t. On Buyback condition, MCP applies charge for HA.

**C 3.28C 3.26 SpinPayTotalHA<sub>jxt</sub> - \$**

The total payment to Scheduling Coordinator j for incremental (additional to Day-Ahead) Spinning Reserve capacity in the Hour-Ahead Market in Zone x for Trading Interval t, after deduction of payments from Scheduling Coordinator j for buying back from the ISO in the Hour-Ahead, Spinning Reserve capacity which the ISO had purchased from Scheduling Coordinator j in the Day-Ahead market in Zone x for Trading Interval t.

**C 3.29C 3.27 SpinRateDA<sub>xt</sub> - \$/MW**

The Day-Ahead Spinning Reserve capacity user rate charged to Scheduling Coordinators by the ISO in Zone x for Trading Interval t.

**C 3.30C 3.28 SpinObligTotalDA<sub>xt</sub> – MW**

The net total Spinning Reserve capacity obligation ~~in the Day-Ahead Market in in~~ Zone x for Trading Interval t as defined in the Ancillary Services Requirements Protocol. This net total equals the total obligation minus that self-provided.

**C 3.31C 3.29 SpinChgDA<sub>jxt</sub> - \$**

The Spinning Reserve capacity charge for Scheduling Coordinator j in the Day-Ahead Market in Zone x for Trading Interval t.

**C 3.32C 3.30 SpinObligDA<sub>jxt</sub> – MW**

The net Spinning Reserve capacity obligation ~~in the Day-Ahead Market~~ for Scheduling Coordinator j in Zone x for Trading Interval t as defined in the Ancillary Services Requirements Protocol. This net obligation equals the obligation minus that self-provided.

**C 3.33C 3.31 SpinRateHA<sub>xt</sub> - \$/MW**

The Hour-Ahead incremental (additional to Day-Ahead) Spinning Reserve capacity user rate charged to Scheduling Coordinators by the ISO in Zone x for Trading Interval t.

Where  $\text{SpinRateHA}_{xt}$  is applied to  $\text{SpinSellBack}_{jxt}$  it shall be set at zero if there is no market for the sale by the ISO of the Spinning Reserve capacity concerned to other Scheduling Coordinators.

**C 3.35C 3.32 SpinObligTotalHA<sub>xt</sub> – MW**

The net total incremental (additional to Day-Ahead) Spinning Reserve capacity obligation in the Hour-Ahead Market in Zone x for Trading Interval t as defined in the Ancillary Services Requirements Protocol. This net total obligation equals the total obligation minus that self-provided.

**C 3.35C 3.32 SpinChgHA<sub>jxt</sub> - \$**

The incremental (additional to Day-Ahead) Spinning Reserve capacity charge for Scheduling Coordinator j in the Hour-Ahead Market in Zone x for Trading Interval t.

**C 3.36 SpinObligHA<sub>jxt</sub> – MW**

The net incremental (additional to Day-Ahead) Spinning Reserve capacity obligation in the Hour-Ahead Market for Scheduling Coordinator j in Zone x for Trading Interval t as defined in the Ancillary Services Requirements Protocol. This net obligation equals the obligation less that self-provided.

**C 3.36.1 SpinSellBack<sub>jxt</sub> – MW**

The decremental (less than Day-Ahead) Spinning Reserve capacity obligation in Zone x which the Scheduling Coordinator j sells back to the ISO for Trading Interval t in the Hour-Ahead Market.

**C 3.37C 3.33 NonSpinPayDA<sub>ijxt</sub> - \$**

The payment for Scheduling Coordinator j for providing Non-Spinning Reserve capacity in the Day-Ahead Market from a resource i in Zone x for Trading Interval t.

**C 3.38C 3.34 NonSpinQDA<sub>ijxt</sub> – MW**

The total quantity of Non-Spinning Reserve capacity provided from resource i in the Day-Ahead Market by Scheduling Coordinator j in Zone x for Trading Interval t.

**C 3.39C 3.35 PNonSpinDA<sub>xt</sub> - \$/MW**

The Day-Ahead Market Clearing Price for units exempt from FERC Ancillary Service rate caps or the bid price for those units subject to the cap for Non-Spinning Reserve capacity for Trading Interval t in Zone x.

**C 3.40C 3.36 NonSpinPayTotalDA<sub>jxt</sub> - \$**

The total payment to Scheduling Coordinator j for providing Non-Spinning Reserve capacity in the Day-Ahead Market in Zone x for Trading Interval t.

**C 3.41C 3.37 NonSpinPayHA<sub>ijxt</sub> - \$**

The payment for Scheduling Coordinator j for providing incremental (additional to Day-Ahead) Non-Spinning Reserve capacity in the Hour-Ahead Market from a resource i in Zone x for Trading Interval t.

**C 3.41.1C 3.37.1 NonSpinReceiveHA<sub>ijxt</sub> - \$**

The payment from Scheduling Coordinator j for buying back from the ISO in the Hour-Ahead, Non-Spinning Reserve capacity which the ISO had purchased from Scheduling Coordinator j in the Day-Ahead Market from a resource i in Zone x for Trading Interval t.

**~~C 3.42~~ ~~C 3.38~~ NonSpinQIHA<sub>ijxt</sub> – MW**

The total quantity of incremental (additional to Day-Ahead) Non-Spinning Reserve capacity provided from resource i in the Hour-Ahead Market by Scheduling Coordinator j in Zone x for Trading Interval t.

**~~C 3.43~~ ~~C 3.39~~ NonSpinQDHA<sub>ijxt</sub> – MW**

The total quantity of decremental (less than Day-Ahead) Non-Spinning Reserve capacity provided in the ISO Hour-Ahead Market from resource i by Scheduling Coordinator j in Zone x for Trading Interval t.

**~~C 3.43.1C 3.39.1~~ PNonSpinHA<sub>xt</sub> - \$/MW**

The Hour-Ahead zonal Market Clearing Price for units exempt from FERC Ancillary Service rate caps or the bid price for those units subject to the cap for incremental (additional to Day-Ahead) Non-Spinning Reserve capacity for Trading Interval t in Zone x. On Buyback condition, MCP applies.

**~~C 3.44~~ ~~C 3.40~~ NonSpinPayTotalHA<sub>jxt</sub> - \$**

The total payment to Scheduling Coordinator j for providing incremental (additional to Day-Ahead) Non-Spinning Reserve capacity in the Hour-Ahead Market in Zone x for Trading Interval t, after deduction of payments from Scheduling Coordinator j for buying back from the ISO in the Hour-Ahead, Non-Spinning Reserve capacity which the ISO had purchased from Scheduling Coordinator j in the Day-Ahead market in Zone x for Trading Interval t.

**~~C 3.45~~ ~~C 3.41~~ NonSpinRateDA<sub>xt</sub> - \$/MW**

The Day-Ahead Non-Spinning Reserve capacity user rate charged to Scheduling Coordinators by the ISO in Zone x for Trading Interval t.

**~~C 3.46~~ ~~C 3.42~~ NonSpinObligTotalDA<sub>xt</sub> – MW**

The net total Non-Spinning Reserve capacity obligation ~~in the Day-Ahead Market~~ in Zone x for Trading Interval t as defined in the Ancillary Services Requirements Protocol. This net total obligation equals the total minus that self-provided.

**~~C 3.47~~ ~~C 3.43~~ NonSpinChgDA<sub>jxt</sub> - \$**

The Non-Spinning Reserve Capacity charge for Scheduling Coordinator j in the Day-Ahead Market in Zone x for Trading Interval t.

**~~C 3.48~~ ~~C 3.44~~ NonSpinObligDA<sub>jxt</sub> – MW**

The net Non-Spinning Reserve capacity obligation ~~in the Day-Ahead Market for for~~ Scheduling Coordinator j in Zone x for Trading Interval t as defined in the Ancillary Services Requirements Protocol. This net obligation is the obligation minus that self-provided.

**~~C 3.49~~ ~~C 3.45~~ NonSpinRateHA<sub>xt</sub> - \$/MW**

The Hour-Ahead incremental (additional to Day-Ahead) Non-Spinning Reserve capacity user rate charged to Scheduling Coordinators by the ISO in Zone x for Trading Interval t. ~~Where NonSpinRate HA<sub>xt</sub> is applied to NonSpinSellBack<sub>jxt</sub> it shall be set at zero if there is no market for the sale by the ISO of the Non-Spinning Reserve capacity concerned to other Scheduling Coordinators.~~

**~~C 3.50~~ ~~NonSpinObligTotalHA<sub>xt</sub>~~ – MW**

~~The net total incremental (additional to Day-Ahead) Non-Spinning Reserve capacity obligation in the Hour-Ahead Market in Zone x for Trading Interval t as defined in the Ancillary Services Requirements Protocol. The net total obligation is the total minus that self-provided.~~

**~~C 3.51~~ ~~C 3.46~~ ~~NonSpinChgHA<sub>jxt</sub>~~ - \$**

~~The incremental (additional to Day-Ahead) Non-Spinning Reserve Capacity charge for Scheduling Coordinator j in the Hour-Ahead Market in Zone x for Trading Interval t.~~

**~~C 3.51.1~~ ~~NonSpinSellBack<sub>jxt</sub>~~ – MW**

~~The decremental (less than Day-Ahead) Non-Spinning Reserve capacity obligation in Zone x which the Scheduling Coordinator j sells back to the ISO for Trading Interval t in the Hour-Ahead Market.~~

**~~C 3.52~~ ~~C 3.47~~ ~~NonSpinObligHA<sub>jxt</sub>~~ – MW**

~~The net incremental (additional to Day-Ahead) Non-Spinning Reserve capacity obligation in the Hour-Ahead Market for Scheduling Coordinator j in Zone x for Trading Interval t as defined in the Ancillary Services Requirements Protocol. This net obligation is the obligation minus that self-provided.~~

**~~C 3.53~~ ~~C 3.48~~ ~~ReplPayDA<sub>ijxt</sub>~~ - \$**

~~The payment for Scheduling Coordinator j for providing Replacement Reserve capacity in the Day-Ahead Market from a resource i in Zone x for Trading Interval t.~~

**~~C 3.54~~ ~~C 3.49~~ ~~ReplQDA<sub>ijxt</sub>~~ – MW**

~~The total quantity of Replacement Reserve capacity provided in the Day-Ahead Market from resource i by Scheduling Coordinator j in Zone x for Trading Interval t.~~

**~~C 3.55~~ ~~C 3.50~~ ~~PReplDA<sub>xt</sub>~~ - \$/MW**

~~The Day-Ahead Market Clearing Price for units exempt from FERC Ancillary Service rate caps or the bid price for those units not subject to the cap for Replacement Reserve capacity in Zone x for Trading Interval t.~~

**~~C 3.56~~ ~~C 3.51~~ ~~ReplPayTotalDA<sub>jxt</sub>~~ - \$**

~~The total payment to Scheduling Coordinator j for providing Replacement Reserve capacity in the Day-Ahead Market in Zone x for Trading Interval t.~~

**~~C 3.56.1~~ ~~C 3.51.1~~ ~~ReplReceiveHA<sub>ijxt</sub>~~ - \$**

~~The payment from Scheduling Coordinator j for buying back from the ISO in the Hour-Ahead, Replacement Reserve capacity which the ISO had purchased from Scheduling Coordinator j in the Day-Ahead Market from a resource i in the Zone x for Trading Interval t.~~

**~~C 3.57~~ ~~C 3.52~~ ~~ReplPayHA<sub>ijxt</sub>~~ - \$**

~~The payment for Scheduling Coordinator j for providing of incremental (additional to Day-Ahead) Replacement Reserve capacity in the Hour-Ahead Market from a resource i in Zone x for Trading Interval t.~~

**~~C 3.58~~ C 3.53 RepIQIHA<sub>ijxt</sub> – MW**

The total quantity of incremental (additional to Day-Ahead) Replacement Reserve capacity provided in the Hour-Ahead Market from resource i by Scheduling Coordinator j in Zone x for Trading Interval t.

**~~C 3.59~~ C 3.54 RepIQDHA<sub>ijxt</sub> – MW**

The total quantity of decremental (less than Day-Ahead) Replacement Reserve capacity provided in the ISO Hour-Ahead Market from resource i by Scheduling Coordinator j in Zone x for Trading Interval t.

**~~C 3.59.1~~ C 3.54.1 PRepIHA<sub>xt</sub> -\$/MW**

The Hour-Ahead Market Clearing Price for Non-FERC jurisdictional units or the bid price for FERC jurisdictional units for incremental (additional to Day-Ahead) Replacement Reserve capacity in Zone x for Trading Interval t. On Buyback condition, MCP applies.

**~~C 3.60~~ C 3.55 RepIPayTotalHA<sub>ijxt</sub> - \$**

The total payment to Scheduling Coordinator j for providing of incremental (additional to Day-Ahead) Replacement Reserve capacity in the Hour-Ahead Market in Zone x for Trading Interval t, after deduction of payments from Scheduling Coordinator j for buying back from the ISO in the Hour-Ahead, Replacement Reserve capacity which the ISO had purchased from Scheduling Coordinator j in the Day-Ahead Market in Zone x from Trading Interval t.

**C 3.56 RepIRateDA<sub>xt</sub> - \$/MW**

The Day-Ahead Replacement Reserve capacity user rate charged to Scheduling Coordinators by the ISO in Zone x for Trading Interval t.

**C 3.57 ReplChgDA<sub>jxt</sub> - \$**

The Replacement Reserve capacity charge for Scheduling Coordinator j in the Day-Ahead Market in Zone x for Trading Interval t.

**C 3.58 ReplRateHA<sub>xt</sub> - \$/MW**

The Hour-Ahead incremental (additional to Day-Ahead) Spinning Reserve capacity user rate charged to Scheduling Coordinators by the ISO in Zone x for Trading Interval t.

**~~C 3.61~~ UnDispReplRate<sub>xt</sub> - \$/MW**

~~The Day-Ahead and Hour-Ahead undispached Replacement Reserve capacity user rate charged to Scheduling Coordinators by the ISO in Zone x for Trading Interval t.~~

**C 3.59 ReplChgHA<sub>jxt</sub> - \$**

The incremental (additional to Day-Ahead) Replacement Reserve capacity charge for Scheduling Coordinator j in the Hour-Ahead Market in Zone x for Trading Interval t.

**~~C 3.62~~RRC - \$**

~~The cost of Replacement Reserve capacity dispatched in the Real Time Market in Zone x for Trading Interval t.~~

**~~C 3.63~~C 3.60 ReplObligTotal<sub>xt</sub> - MW**

The net total Replacement Reserve capacity obligation in the Day-Ahead and Hour-Ahead Markets in Zone x for Trading Interval t as defined in the Ancillary Services Requirements Protocol. This net total obligation is the total obligation minus that self-provided.

**~~C 3.64~~C 3.61 ReplPayTotal<sub>jxt</sub> - \$**

The total payment to Scheduling Coordinator j for providing Replacement Reserve capacity in the Day-Ahead and Hour-Ahead Markets in zone x for Trading Interval t.

**~~C 3.65~~C 3.62 PavgRepl<sub>xt</sub> - \$/MW**

The average price paid for Replacement Reserve capacity in the Day-Ahead Market and the Hour-Ahead Market in Zone x in Trading Interval t.

**C 3.65.1ReplSellBack<sub>jxt</sub> - MW**

The decremental (less than Day-Ahead) Replacement Reserve capacity obligation in Zone x which the Scheduling Coordinator j sells back to the ISO for Trading Interval t in the Hour-Ahead Market.

**~~C 3.66~~C 3.63 UnDispReplChg<sub>jxt</sub> - \$**

The undispached Replacement Reserve Capacity charge for Scheduling Coordinator j in the Day-Ahead and Hour-Ahead Markets in Zone x for Trading Interval t.



**~~C 3.67~~ C 3.64 ReplOblig<sub>jxt</sub> – MW**

The Replacement Reserve capacity obligation in the Day-Ahead and Hour-Ahead Markets for Scheduling Coordinator j in Zone x for Trading Interval t as defined in the Ancillary Services Requirements Protocol.

**~~C 3.68~~ C 3.65 ReplQDisp<sub>xt</sub> – MWh**

The Dispatched Replacement Reserve capacity in the Day-Ahead Market in Zone x in Trading Interval t.

## SABP Appendix D

### IMBALANCE ENERGY CHARGE COMPUTATION

#### **D-2.3 Replacement Reserve Capacity Dispatch Charge**

The Replacement Reserve Capacity Dispatch Charge (RRDC) for Scheduling Coordinator  $j$  in Trading Interval  $t$  is calculated using the following formula:

If there is Congestion in the Day-Ahead Market the ISO will allocate the Replacement Reserve Capacity Dispatch Charges on a Zonal basis. If there is no Congestion in the Day-Ahead Market the ISO will allocate the Replacement Reserve Capacity Dispatch Charges on a ISO Control Area-wide basis (irrespective of whether there is Congestion in the Hour-Ahead Markets or not).

## SCHEDULING PROTOCOL

### SP 9.3 Scheduling Ancillary Services Resources

- (a) SCs are allowed to self-provide all or a portion of the following Ancillary Services to satisfy their obligations to the ISO:
  - i. Regulation;
  - ii. Spinning Reserve;
  - iii. Non-Spinning Reserve; and
  - iv. Replacement Reserve.
- (b) The ISO will reduce the quantity of Ancillary Services it competitively procures by the corresponding amount of the Ancillary Services that SCs self-provide.
- (c) The ISO shall prepare supplier schedules for Ancillary Services (both self-provided and purchased by the ISO) for the Day-Ahead Market and the Hour-Ahead Market.
- (d) The Ancillary Services schedules shall contain the information set out in the SBP for each Settlement Period of the following Trading Day in the case of the Day-Ahead schedules or for a specific Settlement Period in the case of Hour-Ahead schedules.
- (e) Once the ISO has given SCs notice of the Day-Ahead and Hour-Ahead schedules, these schedules represent binding commitments made in the reserve markets between the ISO and the SCs concerned. However, ~~(f)~~ a Scheduling Coordinator who has sold Regulation, Spinning Reserve, Non-Spinning Reserve or Replacement Reserve 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 Market Clearing Price for the Ancillary Service for the Settlement Period concerned for the Zone in which the Generating Unit or other resources on behalf of which the Scheduling Coordinator buys back the capacity, are located. The ISO will purchase the Ancillary Service concerned from another Scheduling Coordinator in the Hour-Ahead Market in accordance with the provisions of the ISO Tariff.
  - (ii) ~~a Scheduling Coordinator whose non-self-provided obligation for Regulation, Spinning Reserve, Non-Spinning Reserve or Replacement Reserve for any Zone reduces between the Day-Ahead and Hour-Ahead Market may sell back to the ISO in the Hour-Ahead Market the amount of such Ancillary Service in whole or in part which is in excess of its non-self-provided obligation in the Hour-Ahead Market. Provided that the ISO has a market for the sale of the Ancillary Service concerned to other Scheduling Coordinators, the price for such a sale back shall be the hourly user rate for the Ancillary Service for the Settlement Period for the Zone concerned in the Hour-Ahead Market. If the ISO has no market for the sale of the Ancillary Service concerned to other Scheduling Coordinators, the price for the sale back shall be zero.~~

- (f) Any minimum Energy output associated with Regulation and Spinning Reserve services shall be the responsibility of the SC, as the ISO's auction does not compensate the SC for the minimum Energy output of its Generating Units or System Unit, if any, bidding to provide these services. Accordingly, the SCs shall adjust their Balanced Schedules to accommodate the minimum Energy outputs required by the Generating Units or System Units, if any, included in the Ancillary Services schedules.
  
- (g) SCs providing one or more of the Ancillary Services cannot change the identification of the Generating Units System Units or external imports of System Resources, if any, or Curtailable Demands offered in the Day-Ahead Market, in the Hour-Ahead Market, or in the Real-Time Market (except with respect to System Units, if any, in which case SCs are required to identify and disclose the resource specific information for all Generating Units and Curtailable Demands constituting the System Unit scheduled or bid into the ISO's Day-Ahead Market and Hour-Ahead Market as required in SP 3.3.2(e)).