SETTLEMENT AND BILLING PROTOCOL

APPENDICES A-I

APPENDIX A

GRID MANAGEMENT CHARGE COMPUTATION

A 1 Purpose of charge

The purpose of the Grid Management Charge is to allocate to Scheduling Coordinators the ISO's startup, development, operation and maintenance costs as set out in Section 8 of the ISO Tariff.

A 2 Fundamental formulae

A 2.1 Grid Management Price

The grid management price (GMP) is the figure (in $/MWh) specified in Schedule 1 of the Section 35 Cost Statement filed in accordance with Section 8.1.2 of the ISO Tariff (as amended from time to time).

A 2.2 Grid Management Charge

The Grid Management Charge for each Scheduling Coordinator j is calculated using the following formula:

$$GMC_j = GMP * QCharge_j$$

A 3 Meaning of terms of formulae

A 3.1 GMC_j -- $

The monthly Grid Management Charge for a given Scheduling Coordinator j.

A 3.2 $QCharge_j$ -- MWh

The monthly metered consumption (including Wheeling Out and Wheeling Through the ISO Control Area) for the Scheduling Coordinator j whose Grid Management Charge is being calculated.

APPENDIX B

GRID OPERATIONS CHARGE COMPUTATION

B 1 Purpose of charge

The Grid Operations Charge is a charge which recovers redispatch costs incurred due to the dispatch of Reliability Must-Run Generation pursuant to Section 2.2.8.1 of the ISO Tariff, the decrementing of Generation to accommodate the dispatch of such Reliability Must-Run Generation pursuant to Section 7.2.6.1 of the ISO Tariff and Intra-Zonal Congestion pursuant to Section 7.3.2 of the ISO Tariff. The Grid Operations Charge is paid by or charged to Scheduling Coordinators in order for the ISO to recover and properly redistribute the costs of adjusting the Balanced Schedules submitted by Scheduling Coordinators.

B 2 Fundamental formulae

B 2.1 Payments to SCs with incremented schedules

When it becomes necessary for ISO to increase the output of a Scheduling Coordinator's Generating Unit$_i$ or reduce a Curtailable Demand$_i$ in order to relieve Congestion within a Zone, the ISO will pay the Scheduling Coordinator. The amount that ISO pays the Scheduling Coordinator$_j$ is the price specified in the Scheduling Coordinator's Day-Ahead or Hour-Ahead Adjustment Bid for the Generating Unit$_i$ or Curtailable Demand$_i$ multiplied by the quantity of Energy rescheduled. The formula for calculating the payment to Scheduling Coordinator$_j$ for each block$_b$ of Energy of its Adjustment Bid curve in Trading Interval$_t$ is:

$$INC_{bijt} = adjinc_{bijt} * \Delta inc_{bijt}$$

B 2.1.1 Total Payment for Trading Interval

The formula for calculating payment to Scheduling Coordinator$_j$ whose Generating Unit$_i$ has been increased or Curtailable Demand$_i$ reduced for all the relevant blocks$_b$ of Energy in the Adjustment Bid curve of that Generating Unit or Curtailable Demand in the same Trading Interval$_t$ is:

$$PayTI_{ijt} = \sum_b INC_{bijt}$$

B 2.2 Charges to Scheduling Coordinators with decremented schedules

When it becomes necessary for the ISO to decrease the output of a Scheduling Coordinator's Generating $Unit_i$ in order to relieve Congestion within a Zone, or to accommodate Generation which the ISO requires under Reliability Must-Run Contract from Reliability Must-Run Units within the Zone, the ISO will make a charge to the Scheduling Coordinator. The amount that the ISO will charge Scheduling $Coordinator_j$ is the price specified in the Scheduling Coordinator's Day-Ahead or Hour-Ahead Adjustment Bid for the Generating $Unit_i$ multiplied by the quantity of Energy rescheduled. The formula for calculating the charge to Scheduling $Coordinator_j$ for each $block_b$ of Energy in its Adjustment Bid curve in Trading $Interval_t$ is:

$$DEC_{bijt} = adjdec_{bijt} * \Delta dec_{bijt}$$

B 2.2.1 Total Charge for Trading Interval

The formula for calculating the charge to Scheduling $Coordinator_j$ whose Generating $Unit_i$ has been decreased for all the relevant $blocks_b$ of Energy in the Adjustment Bid curve of that Generating Unit in the same Trading $Interval_t$ is:

$$ChargeTI_{ijt} = \sum_b DEC_{bijt}$$

B 2.3 Reliability Must-Run Generation

When it becomes necessary for the ISO to request an increase in the output of a Scheduling Coordinator's Reliability Must-Run Generating Unit i in a Zone under a Reliability Must-Run Contract, the ISO will pay the Scheduling Coordinator. The amount that the ISO pays the Scheduling Coordinator j is the Energy weighted average price derived from the Day-Ahead and/or Hour-Ahead Adjustment Bids for all Generating Units whose Scheduled output is decreased under B 2.2 multiplied by the quantity of Energy requested under the Reliability Must-Run Contract and adjusted for any amounts not delivered. The formula for calculating the payment to Scheduling Coordinator j for each Trading $Interval_t$ during which the Reliability Must-Run Unit i is requested to increase its output is:

$$PayRMR_{ijt} = \left(\frac{\sum_{ij} ChargeTI_{ijt}}{\sum_{bij} \Delta dec_{bij}} \right) * RMR\Delta inc_{ijt} \quad -[\ (RMR\Delta inc_{ijt} - RMRact_{ijt}) * P_{xt}\ ]$$

In this formula, the value of $RMRact_{ijt}$ shall not be greater than the value of $RMRDinc_{ijt.}$

B 2.4 Net ISO redispatch costs

Within a Zone, the Trading Interval net redispatch cost encountered by ISO to accommodate Reliability Must-Run Generating Unit and/or relieve Intra-Zonal Congestion is the sum of the amounts paid by the ISO to those Scheduling Coordinators whose Generation was increased or Curtailable Demand was decreased during the Trading Interval less the sum of the amounts received by the ISO from those Scheduling Coordinators whose Generating Units were decreased during the Trading Interval. The fundamental formula for calculating the net redispatch cost is:

$$REDISP_{CONGt} = \sum_j PayTI_{ijt} + \sum_j PayRMR_{ijt} - \sum_j ChargeTI_{ijt}$$

Note that $REDISP_{CONGt}$ can be either positive or negative. This means that it is possible for the ISO to generate either a net cost or a net income, for any given Trading Interval. Owners of Reliability Must-Run Units will give credit to the ISO for sums received from their Scheduling Coordinators in the amounts which they charge the ISO under their Reliability Must-Run Contracts.

B 2.5 Grid Operations Price

The grid operations price is the Trading Interval rate used by the ISO to apportion net Trading Interval redispatch costs within a Zone to Scheduling Coordinators within that Zone. The grid operations price is calculated using the following formula:

$$GOP_t = \frac{REDISP_{CONGt}}{\sum_j QCharge_{jt} + \sum_j Export_{jt}}$$

B 2.6 Grid Operations Charge

The Grid Operations Charge is the vehicle by which the ISO recovers the net redispatch costs within each Zone. It is allocated to each Scheduling Coordinator in a Zone in proportion to the

Scheduling Coordinator's consumption and Exports from the Zone. The formula for calculating the Grid Operations Charge for Scheduling Coordinator$_j$ in Trading Interval$_t$ is:

$$GOC_{jt} = GOP_t * \left(QCharge_{jt} + EXPORT_{jt}\right)$$

B 3 Meaning of terms of formulae

B 3.1 INC$_{bijt}$ - $

The payment from the ISO due to Scheduling Coordinator$_j$ whose Generating Unit$_i$ is increased or Curtailable Load$_i$ is reduced within a block$_b$ of Energy in its Adjustment Bid curve in Trading Interval$_t$ in order to relieve Intra-Zonal Congestion.

B 3.2 adjinc$_{bijt}$ - $/MWh

The incremental cost for the rescheduled Generating Unit$_i$ or Curtailable Load$_i$ taken from the relevant block$_b$ of Energy in the Day-Ahead or Hour-Ahead Adjustment Bid curve submitted by the Scheduling Coordinator$_j$ for the Trading Interval $_t$.

B 3.3 Δincbijt - MW

The amount by which the Generating Unit$_i$ or Curtailable Load$_i$ of Scheduling Coordinator$_j$ for Trading Interval$_t$ is increased by the ISO within the relevant block$_b$ of Energy in its Adjustment Bid curve.

B 3.4 PayTI$_{jit}$ - $

The Trading Interval payment to Scheduling Coordinator$_j$ whose Generating Unit$_i$ has been increased or Curtailable Load$_i$ reduced in Trading Interval$_t$ of the Trading Day.

B 3.5 DEC$_{bijt}$ - $

The charge to Scheduling Coordinator$_j$ whose Generating Unit$_i$ is decreased for Trading Interval$_t$ within a block$_b$ of Energy in its Adjustment Bid curve.

B 3.6 adjdec$_{bijt}$ - $/MWh

The decremental cost for the rescheduled Generating Unit$_i$ taken from the relevant block$_b$ of Energy of the Day-Ahead or Hour-Ahead Adjustment Bid curve submitted by Scheduling Coordinator$_j$ for the Trading Interval$_t$.

B 3.7 **Δdec_{bijt} - MW**

The amount by which the Generating $Unit_i$ of Scheduling $Coordinator_j$ for Trading $Interval_t$ is decreased by ISO within the relevant $block_b$ of Energy of its Adjustment Bid curve.

B 3.8 **$ChargeTI_{ijt}$ - $**

The Trading Interval charge to Scheduling $Coordinator_j$ whose Generating $Unit_i$ has been decreased in Trading $Interval_t$ of the Trading Day.

B 3.9 **$RMR\Delta inc_{ijt}$ – MW**

The amount by which the output of Reliability Must-Run Unit i of Scheduling Coordinator j is requested by the ISO to increase for Trading Interval t under its Reliability Must-Run Contract.

B 3.10 **$PayRMR_{ijt}$ - $**

The payment for Scheduling Coordinator j whose Reliability Must-Run Unit i has been increased in Trading Interval t of the Trading Day.

B 3.10.1 **$RMRact_{ijt}$ – MW**

The actual Energy Delivered by Reliability Must-Run Unit i of Scheduling Coordinator j in Trading Interval t pursuant to the ISO's request.

B 3.10.2 **P_{xt} - $/MWh**

The zonal Hourly Ex Post Price, for Uninstructed Imbalance Energy, for Trading Interval t in Zone x.

B 3.11 **$REDISP_{CONGt}$ - $**

The Trading Interval net cost to ISO to redispatch within a Zone in order to relieve Intra-Zonal Congestion or accommodate Reliability Must-Run Generation during Trading $Interval_t$.

B 3.12 **GOP_t - $/MWh**

The Trading Interval grid operations price within a Zone for Trading $Interval_t$ used by the ISO to recover the costs of redispatch for Intra-Zonal Congestion Management or for Reliability Must-Run Generation.

B 3.13 **GOC_{jt} - $**

The Trading Interval Grid Operations Charge by the ISO for Trading $Interval_t$ for Scheduling $Coordinator_j$ in the relevant Zone.

B 3.14 **$QCHARGE_{jt}$ – MWh**

The Trading Interval metered consumption within a Zone for Trading $Interval_t$ for Scheduling $Coordinator_j$ whose Grid Operations Charge is being calculated.

B 3.15 **$EXPORT_{jt}$ – MWh**

The total Energy for Trading $Interval_t$ exported from the Zone to a neighboring Control Area by Scheduling $Coordinator_j$.

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. 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 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 Fundamental formulas

C 2.1 ISO payments to Scheduling Coordinators

C 2.1.1 Day-Ahead Market

(a) *Regulation*. When the ISO purchases Regulation capacity in the Day-Ahead Market, Scheduling Coordinators for Generating Units that provide this capacity will receive payments for each Trading Interval of the Day-Ahead Market. The payment for a given Generating Unit which provides Regulation capacity over a given Trading Interval will be the total quantity of Regulation capacity provided times the zonal Market Clearing Price for that Trading Interval in that Zone. The required Regulation capacity is defined in the Ancillary Services Requirements Protocol. This payment for Scheduling Coordinator j for providing Regulation capacity from a resource i in Zone x for Trading Interval t is calculated as follows:

$$\mathrm{AGCPayDA}_{ijxt} = \mathrm{AGCQDA}_{ijxt} * \mathrm{PAGCDA}_{xt}$$

The total Regulation payment to each Scheduling Coordinator for a given Trading Interval in the Day-Ahead Market for all the resources that it represents in a given Zone is calculated by summing all the payments for the resources of the Scheduling Coordinator in the Zone for the Trading Interval. This payment for Scheduling Coordinator j in Zone x for Trading Interval t is calculated as follows:

$$\mathrm{AGCPayTotalDA}_{jxt} = \sum_{i} \mathrm{AGCPayDA}_{ijxt}$$

(b) *Spinning Reserve*. When ISO purchases Spinning Reserve capacity in the Day-Ahead Market. Scheduling Coordinators for Generating Units that provide this capacity will receive payments for each Trading Interval of the Day-Ahead Market. The payment for a given Generating Unit which provides Spinning Reserve capacity over a given Trading Interval will be the total quantity of Spinning Reserve capacity provided times the zonal Market Clearing Price for that Trading Interval in that Zone. The required Spinning Reserve capacity is defined in the Ancillary Services Requirements Protocol. This payment for Scheduling Coordinator j for providing Spinning Reserve capacity from a resource i in Zone x for Trading Interval t is calculated as follows:

$$\mathrm{SpinPayDA}_{ijxt} = \mathrm{SpinQDA}_{ijxt} * \mathrm{PSpinDA}_{xt}$$

The total Spinning Reserve payment to each Scheduling Coordinator for a given Trading Interval in the Day-Ahead Market for all the resources that it represents in a given Zone is calculated by summing all the payments for the resources of the Scheduling Coordinator in the Zone for the Trading Interval. This payment for Scheduling Coordinator j in Zone x for Trading Interval t is calculated as follows:

$$SpinPayTotalDA_{jxt} = \sum_{i} SpinPayDA_{ixt}$$

(c) *Non-Spinning Reserve*. When the ISO purchases Non-Spinning Reserve capacity in the Day-Ahead Market, Scheduling Coordinators for Generating Units and Loads that provide this capacity will receive payments for each Trading Interval of the Day-Ahead Market. The payment for a given Generating Unit or Load which provides Non-Spinning Reserve capacity over a given Trading Interval will be the total quantity of Non-Spinning Reserve capacity provided times the zonal Market Clearing Price for that Trading Interval in that Zone. The required Non-Spinning Reserve capacity is defined in the Ancillary Services Requirements Protocol. This payment for Scheduling Coordinator j for providing Non-Spinning Reserve capacity from a resource i in Zone x for Trading Interval t is calculated as follows:

$$NonSpinPayDA_{ijxt} = NonSpinQDA_{ijxt} * PNonSpinDA_{xt}$$

The total Non-Spinning Reserve payment to each Scheduling Coordinator for a given Trading Interval in the Day-Ahead Market for all the resources that it represents in a given Zone is calculated by summing all the payments for the resources of the Scheduling Coordinator in the Zone for the Trading Interval. This payment for Scheduling Coordinator j in Zone x for Trading Interval t is calculated as follows:

$$NonSpinPayTotalDA_{jxt} = \sum_{i} NonSpinPayDA_{ijxt}$$

(d) *Replacement Reserve*. When the ISO purchases Replacement Reserve capacity in the Day-Ahead Market, Scheduling Coordinators for Generating Units and Loads that provide this capacity will receive payments for each Trading Interval of the Day-Ahead Market. The payment for a given Generating Unit or Load which provides Replacement Reserve capacity over a given Trading Interval will be the total quantity of Replacement Reserve capacity provided times the zonal Market Clearing Price for that

Trading Interval in that Zone. The required Replacement Reserve capacity is defined in the Ancillary Services Requirements Protocol. This payment for Scheduling Coordinator j for providing Replacement Reserve capacity from a resource i in Zone x for Trading Interval t is calculated as follows:

$$ReplPayDA_{ijxt} = ReplQDA_{ijxt} * PReplDA_{xt}$$

The total Replacement Reserve payment to each Scheduling Coordinator for a given Trading Interval in the Day-Ahead Market for all the resources that it represents in a given Zone is calculated by summing all the payments for the resources of the Scheduling Coordinator in the Zone for the Trading Interval. This payment for Scheduling Coordinator j in Zone x for Trading Interval t is calculated as follows:

$$ReplPayTotalDA_{jxt} = \sum_{i} ReplPayDA_{ijxt}$$

C 2.1.2 Hour-Ahead Market

(a) *Regulation*. When the ISO purchases Regulation capacity in the Hour-Ahead Market, Scheduling Coordinators for Generating Units that provide this capacity will receive payment for the Trading Interval of the Hour-Ahead Market. The payment for a given Generating Unit which provides Regulation capacity over the Trading Interval will be the total quantity of Regulation capacity provided times the zonal Market Clearing Price for that Trading Interval in that Zone. The required Regulation capacity is defined in the Ancillary Services Requirements Protocol. This payment for Scheduling Coordinator j for providing Regulation capacity from a resource i in Zone x for Trading Interval t is calculated as follows:

$$AGCPayHA_{ijxt} = AGCQIHA_{ijxt} * PAGCHA_{xt}$$

When a Scheduling Coordinator buys back, in the Hour-Ahead Market, Regulation capacity which it sold to the ISO in the Day-Ahead Market, the payment which the ISO receives will be the total quantity of Regulation capacity bought back times the zonal Hour-Ahead Market Clearing Price for that Trading Interval in that Zone.

This payment to the ISO from Scheduling Coordinator j to buy back Regulation capacity from a resource i in Zone x for Trading Interval t is calculated as follows:

$$AGCReceiveHA_{ijxt} = AGCQDHA_{ijxt} * PAGCHA_{xt}$$

The total Regulation payment for the Trading Interval of the Hour-Ahead Market to each Scheduling Coordinator for all the resources that it represents in a given Zone is calculated by summing all the payments for the resources of the Scheduling Coordinator in the Zone for the Trading Interval and then deducting therefrom any amount payable by the Scheduling Coordinator to the ISO for Regulation bought back by the Scheduling Coordinator from the ISO in the Hour-Ahead Market for the Trading Interval on behalf of resources located in the Zone. This payment for Scheduling Coordinator j in Zone x for Trading Interval t is calculated as follows:

$$AGCPayTotalHA_{jxt} = \sum_{i} AGCPayHA_{ijxt} - \sum_{i} AGCReceiveHA_{ijxt}$$

(b) *Spinning Reserve*. When the ISO purchases Spinning Reserve capacity in the Hour-Ahead Market, Scheduling Coordinators for Generating Units that provide this capacity will receive payments for the Trading Interval of the Hour-Ahead Market. The payment for a given Generating Unit which provides Spinning Reserve capacity over the Trading Interval will be the total quantity of Spinning Reserve capacity provided times the zonal Market Clearing Price for that Trading Interval in that Zone. This payment for Scheduling Coordinator j for providing Spinning Reserve capacity from a resource i in Zone x for Trading Interval t is calculated as follows:

$$SpinPayHA_{ijxt} = SpinQIHA_{ijxt} * PSpinHA_{xt}$$

When a Scheduling Coordinator buys back in the Hour-Ahead Market Spinning Reserve capacity which it sold to the ISO in the Day-Ahead Market, the payment which the ISO receives will be the total quantity of Spinning Reserve capacity bought back times the zonal Hour-Ahead Market Clearing Price for that Trading Interval in that Zone.

This payment to the ISO from Scheduling Coordinator j to buy back Spinning Reserve capacity from a resource i in Zone x for Trading Interval t is calculated as follows:

$$SpinReceiveHA_{ijxt} = SpinQDHA_{ijxt} * PSpinHA_{xt}$$

The total Spinning Reserve payment to each Scheduling Coordinator for the Trading Interval of the Hour-Ahead Market for all the resources that it represents in a given Zone is calculated by summing all the payments for the resources of the Scheduling Coordinator in the Zone for the Trading Interval and then deducting therefrom any amount

payable by the Scheduling Coordinator to the ISO for Spinning Reserve bought back by the Scheduling Coordinator from the ISO in the Hour-Ahead Market for the Trading Interval on behalf of resources located in the Zone. This payment for Scheduling Coordinator j in Zone x for Trading Interval t is calculated as follows:

$$SpinPayTotalHA_{jxt} = \sum_{i} SpinPayHA_{ijxt} - \sum_{i} SpinReceiveHA_{ijxt}$$

(c) *Non-Spinning Reserve*. When the ISO purchases Non-Spinning Reserve capacity in the Hour-Ahead Market, Scheduling Coordinators for Generating Units and Loads that provide this capacity will receive payment for the Trading Interval of the Hour-Ahead Market. The payment for a given Generating Unit or Load which provides Non-Spinning Reserve capacity over the Trading Interval will be the total quantity of Non-Spinning Reserve capacity provided times the zonal Market Clearing Price for that Trading Interval in that Zone. This payment for Scheduling Coordinator j for providing Non-Spinning Reserve capacity from a resource i in Zone x for Trading Interval t is calculated as follows:

$$NonSpinPayHA_{ijxt} = NonSpinQIHA_{ijxt} * PNonSpinHA_{xt}$$

When a Scheduling Coordinator buys back in the Hour-Ahead Market Non-Spinning Reserve capacity which it sold to the ISO in the Day-Ahead Market, the payment which the ISO receives will be the total quantity of Non-Spinning Reserve capacity bought back times the zonal Hour-Ahead Market Clearing Price for that Trading Interval in that Zone.

This payment to the ISO from Scheduling Coordinator j to buy back Non-Spinning Reserve capacity from a resource i in Zone x for Trading Interval t is calculated as follows:

$$NonSpinReceiveHA_{ijxt} = SpinQDHA_{ijxt} * PNonSpinHA_{xt}$$

The total Non-Spinning Reserve payment to each Scheduling Coordinator for the Trading Interval of the Hour-Ahead Market for all the resources that it represents in a given Zone is calculated by summing all the payments for the resources of the Scheduling Coordinator in the Zone for the Trading Interval and then deducting therefrom any amount payable by the Scheduling Coordinator to the ISO for Non-Spinning Reserve bought back by the Scheduling Coordinator from the ISO in the Hour-Ahead Market for the Trading Interval on behalf of resources located in the Zone.

This payment for Scheduling Coordinator j in Zone x for Trading Interval t is calculated as follows:

$$NonSpinPayTotalHA_{jxt} = \sum_{i} NonSpinPayHA_{ijxt} - \sum_{i} NonSpinReceiveHA_{ijxt}$$

(d) *Replacement Reserve.* When the ISO purchases Replacement Reserve capacity in the Hour-Ahead Market, Scheduling Coordinators for Generating Units and Loads that provide this capacity will receive payments for the Trading Interval of the Hour-Ahead Market. The payment for a given Generating Unit or Load which provides Replacement Reserve capacity over the Trading Interval will be the total quantity of Replacement Reserve capacity provided times the zonal Market Clearing Price for that Trading Interval in that Zone. This payment for Scheduling Coordinator j for providing Replacement Reserve capacity from a resource i in Zone x for Trading Interval t is calculated as follows:

$$ReplPayHA_{ijxt} = ReplQIHA_{ijxt} * PReplHA_{xt}$$

When a Scheduling Coordinator buys back in the Hour-Ahead Market Replacement Reserve capacity which it sold to the ISO in the Day-Ahead Market, the payment which the ISO receives will be the total quantity of Replacement Reserve capacity bought back times the zonal Hour-Ahead Market Clearing Price for that Trading Interval in that Zone.

This payment to the ISO from Scheduling Coordinator j to buy back Replacement Reserve capacity from a resource i in Zone x for Trading Interval t is calculated as follows:

$$ReplReceiveHA_{ijxt} = ReplQDHA_{ijxt} * PReplHA_{xt}$$

The total Replacement Reserve payment to each Scheduling Coordinator for the Trading Interval of the Hour-Ahead Market for all the resources that it represents in a given Zone is calculated by summing all the payments for the resources of the Scheduling Coordinator in the Zone for the Trading Interval and then deducting therefrom any amount payable by the Scheduling Coordinator to the ISO for Replacement Reserve bought back by the Scheduling Coordinator from the ISO in the Hour-Ahead Market for the Trading Interval on behalf of resources located in the Zone. This payment for Scheduling Coordinator j in Zone x for Trading Interval t is calculated as follows:

$$ReplPayTotalHA_{jxt} = \sum_{i} ReplPayHA_{ijxt} - \sum_{i} ReplReceiveHA_{ijxt}$$

C 2.1.3 Real-Time Market

Each Scheduling Coordinator will be paid for the real time instructed Energy output from Dispatched Spinning Reserve, Non-Spinning Reserve, and Replacement Reserve[1] resources which it represents at the real time Hourly Ex Post Price. Each Scheduling Coordinator will also be paid for Supplemental Energy Dispatched from resources which it represents at the same Hourly Ex Post Price. This payment for Scheduling Coordinator j for providing Energy output from a resource i in Zone x for Trading Interval t is calculated as follows:

$$EnQPay_{ijxt} = EnQ_{ijxt} * P_{xt}$$

The total payment to each Scheduling Coordinator for real time Energy output from all resources which it represents for a given Trading Interval in a given Zone is calculated by summing all the payments for the resources of the Scheduling Coordinator in the Zone for the Trading Interval. This payment for Scheduling Coordinator j in Zone x for Trading Interval t is calculated as follows:

$$EnQPayTotal_{ijxt} = \sum_{i} EnQPay_{ijxt}$$

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 Coordinators 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:

[1] For Regulation, differences between instructed and metered Energy shall be settled as Imbalance Energy in accordance with Appendix G2.1.

$$AGCRateDA_{xt} = \frac{\sum_{j} AGCPayTotalDA_{jxt}}{AGCObligTotalDA_{xt}}$$

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

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

(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 Coordinators 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:

$$SpinRateDA_{xt} = \frac{\sum_{j} SpinPayTotalDA_{jxt}}{SpinObligTotalDA_{xt}}$$

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:

$$\text{SpinChgDA}_{\text{jxt}} = \text{SpinObligDA}_{\text{jxt}} * \text{SpinRateDA}_{\text{xt}}$$

(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 Coordinators 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:

$$\text{NonSpinRateDA}_{xt} = \frac{\sum_{j} \text{NonSpinPayTotalDA}_{jxt}}{\text{NonSpinObligTotalDA}_{xt}}$$

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:

$$NonSpinChgDA_{jxt} = NonSpinObligDA_{jxt} * NonSpinRateDA_{xt}$$

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 Coordinators Spinning 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 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:

$$\text{AGCRateHA}_{xt} = \frac{\sum_{j} \text{AGCPayTotalHA}_{jxt}}{\text{AGCObligTotalHA}_{xt}}$$

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

$$AGCChgHA_{jxt} = (AGCObligHA_{jxt} * AGCRateHA_{xt}) - (AGCSellBack_{jxt} * AGCRateHA_{xt})$$

(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 Coordinators 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:

$$SpinRateHA_{xt} = \frac{\sum_{j} SpinPayTotalHA_{jxt}}{SpinObligTotalHA_{xt}}$$

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:

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

(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 Coordinators 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:

$$NonSpinRateHA_{xt} = \frac{\sum_{j} NonSpinPayTotalHA_{jxt}}{NonSpinObligTotalHA_{xt}}$$

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:

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

C 2.2.3 Replacement Reserve

Only undispatched 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 undispatched 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 undispatched 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 undispatched Replacement Reserve capacity user rate is calculated by dividing the net cost to ISO of purchasing undispatched 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 undispatched 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 undispatched Replacement Reserve capacity user rate in Zone x for Trading Interval t is calculated as follows:

$$UnDispReplRate_{xt} = \frac{(\sum_{j} ReplPayTotal_{jxt}) - RRC}{ReplObligTotal_{xt}}$$

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:

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

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

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

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 $AGCPayDA_{ijxt}$ - $

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 $AGCQDA_{ijxt}$ – 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 $PAGCDA_{xt}$ - $/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 $AGCPayTotalDA_{jxt}$ - $

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 $AGCPayHA_{ijxt}$ - $

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 $AGCReceiveHA_{ijxt}$ - $

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 **$AGCQIHA_{ijxt}$ – 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 **$AGCQDHA_{ijxt}$ – 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 **$PAGCHA_{xt}$ - $/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 **$AGCPayTotalHA_{jxt}$ - $**

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 **$AGCRateDA_{xt}$ - $/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 **$AGCObligTotalDA_{xt}$ – 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 **$AGCChgDA_{jxt}$ - $**

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

C 3.12 $AGCObligDA_{jxt}$ – 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 $AGCRateHA_{xt}$ - $/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 $ASCRateHA_{xt}$ is applied to $ASCSellBack_{jxt}$ 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 $AGCObligTotalHA_{xt}$ – 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 $AGCChgHA_{jxt}$ - $

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 $AGCObligHA_{jxt}$ – 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 $AGCSell\ Back_{jxt}$ - 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 3.17 $EnQPay_{ijxt}$ - $

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 3.18 **EnQ_{ijxt} – 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 3.19 **$EnQPayTotal_{jxt}$ - $**

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 3.20 **P_{xt} - $/MWh**

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

C 3.21 **$SpinPayDA_{ijxt}$ - $**

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 3.22 **$SpinQDA_{ijxt}$ – 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 3.23 **$PSpinDA_{xt}$ -$/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 3.24 **$SpinPayTotalDA_{jxt}$ - $**

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

C 3.25 **$SpinPayHA_{ijxt}$ - $**

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 3.25.1 **$SpinReceiveHA_{ijxt}$ - $**

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 3.26 $SpinQIHA_{ijxt}$ – 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 3.27 $SpinQDHA_{ijxt}$ – 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 3.27.1 $PSpinHA_{xt}$ -$/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 3.28 $SpinPayTotalHA_{jxt}$ - $

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 3.29 $SpinRateDA_{xt}$ - $/MW

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

C 3.30 $SpinObligTotalDA_{xt}$ – MW

The net total 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 equals the total obligation minus that self-provided.

C 3.31 $SpinChgDA_{jxt}$ - $

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

C 3.32 SpinObligDA$_{jxt}$ – 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 3.33 SpinRateHA$_{xt}$ - $/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 SpinRateHA$_{xt}$ is applied to 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 3.34 SpinObligTotalHA$_{xt}$ – 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 3.35 SpinChgHA$_{jxt}$ - $

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$_{jxt}$ – 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$_{jxt}$ - 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 3.37 NonSpinPayDA$_{ijxt}$ - $

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 3.38 NonSpinQDA$_{ijxt}$ – 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 3.39 PNonSpinDA$_{xt}$ - $/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 3.40 NonSpinPayTotalDA$_{jxt}$ - $

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 3.41 NonSpinPayHA$_{ijxt}$ - $

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 3.41.1 NonSpinReceiveHA$_{ijxt}$ - $

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 NonSpinQIHA$_{ijxt}$ – 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 NonSpinQDHA$_{ijxt}$ – 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 3.43.1 PNonSpinHA$_{xt}$ - $/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 NonSpinPayTotalHA$_{jxt}$ - $

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 NonSpinRateDA$_{xt}$ - $/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 NonSpinObligTotalDA$_{xt}$ – 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 NonSpinChgDA$_{jxt}$ - $

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 NonSpinObligDA$_{jxt}$ – MW

The net Non-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 is the obligation minus that self-provided.

C 3.49 NonSpinRateHA$_{xt}$ - $/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$_{xt}$ is applied to NonSpinSellBack$_{jxt}$ 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$_{xt}$ – 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 NonSpinChgHA$_{jxt}$ - $

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$_{jxt}$ - 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 NonSpinObligHA$_{jxt}$ – 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 ReplPayDA$_{ijxt}$ - $

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 ReplQDA$_{ijxt}$ – 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 PReplDA$_{xt}$ -$/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 **$ReplPayTotalDA_{jxt}$ - $**

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 **$ReplReceiveHA_{ijxt}$ - $**

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 **$ReplPayHA_{ijxt}$ - $**

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 **$ReplQIHA_{ijxt}$ – 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 **$ReplQDHA_{ijxt}$ – 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 **$PReplHA_{xt}$ -$/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 **$ReplPayTotalHA_{jxt}$ - $**

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 3.61 **$UnDispReplRate_{xt}$ - $/MW**

The Day-Ahead and Hour-Ahead undispatched Replacement Reserve capacity user rate charged to Scheduling Coordinators by the ISO 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 **$ReplObligTotal_{xt}$ – 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 **$ReplPayTotal_{jxt}$ - $**

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 **$PavgRepl_{xt}$ - $/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 3.65.1 **$ReplSellBack_{jxt}$ - 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 **$UnDispReplChg_{jxt}$ - $**

The undispatched 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 **$ReplOblig_{jxt}$ – 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 **$ReplQDisp_{xt}$ – MWh**

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

APPENDIX D

IMBALANCE ENERGY CHARGE COMPUTATION

D 1 Purpose of charge

The Imbalance Energy charge is the term used for allocating the cost of not only the Imbalance Energy (the differences between scheduled and actual Generation and Demand), but also any Unaccounted for Energy (UFE) and any errors in the forecasted Transmission Losses as represented by the GMMs. Any corresponding cost of Dispatched Replacement Reserve Capacity that is not allocated as an Ancillary Service is also included along with the Imbalance Energy charge.

D 2 Fundamental formulae

D 2.1 Imbalance Energy Charges on Scheduling Coordinators

The Imbalance Energy charge for Trading Interval t for Scheduling Coordinator j for Zone x is calculated using the following formula:

$$IEC_j = \left(\sum_i GenDev_i - \sum_i LoadDev_i \right) * P_{xt} + \left(\sum_q ImpDev_q \right) * P_{xt} - \left(\sum_q ExpDev_q \right) * P_{xt} + UFEC_j$$

The deviation between scheduled and actual Energy Generation for Generator i represented by Scheduling Coordinator j in Zone x during Trading Interval t is calculated as follows:

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

The deviation between scheduled and actual Load consumption for Load i represented by Scheduling Coordinator j in Zone x during Trading Interval t is calculated as follows:

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

The deviation between forward scheduled and Real Time adjustments to Energy imports[1], adjusted for losses, for Scheduling Point q represented by Scheduling Coordinator j into zone x during Trading Interval t is calculated as follows:

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

[1] Note that this deviation is a difference between a forward Market value and a Real Time value. It is not inadvertent energy.

The deviation between forward scheduled and Real Time adjustments to Energy exports[2] for Scheduling Point q represented by Scheduling Coordinator j from Zone x during Trading Interval t is calculated as follows:

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

D 2.2 Unaccounted for Energy Charge

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

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

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

The Transmission Loss calculation per Trading Interval 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 Trading Interval per relevant Zone is then,

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

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:

[2] Note that this deviation is a difference between a forward Market value and a Real Time value. It is not inadvertent energy.

$$RRDC_j = \left[\frac{Max\left(0, \left\{ \sum_i GenDev_i - \sum_i LoadDev_i + \sum_q ImpDev_q + \sum_q ExpDev_q + E_{UFE\_jk} \right\}\right)}{\sum Max\left(0, \left\{ \sum_j GenDev_i - \sum_i LoadDev_i + \sum_q ImpDev_q + \sum_q ExpDev_q + E_{UFE\_jk} \right\}\right)} \right] * RRC$$

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).

D 3 Meaning of terms of formulae

D 3.1 IEC_j – $

The Imbalance Energy charge on Scheduling Coordinator j in Trading Interval t for each relevant Zone.

D 3.2 $GenDev_i$ – MWh

The deviation between scheduled and actual Energy Generation for Generator i represented by Scheduling Coordinator j in Zone x during Trading Interval t.

D 3.3 $LoadDev_i$ – MWh

The deviation between scheduled and actual Load consumption for Generator i represented by Scheduling Coordinator j in Zone x during Trading Interval t.

D 3.4 $ImpDev_q$ – MWh

The deviation between forward scheduled and Real Time adjustments to Energy imports, as adjusted for losses, for Scheduling Point q represented by Scheduling Coordinator j into Zone x during Trading Interval t.

D 3.5 $ExpDev_q$ – MWh

The deviation between forward scheduled and Real Time adjustments to Energy exports for Scheduling Point q represented by Scheduling Coordinator j from Zone x during Trading Interval t.

D 3.6 **G_s – MWh**

The total scheduled Generation of Scheduling Coordinator j for Generator i in Trading Interval t as a result of both the Day-Ahead Final Schedule and the Hour-Ahead Final Schedule.

D 3.7 **G_a – MWh**

The total actual metered Generation of Scheduling Coordinator j for Generator i in Trading Interval t.

D 3.8 **G_{adj} – MWh**

The deviation in Real Time Generation ordered by the ISO for Congestion Management, Overgeneration, etc.]. This value will be calculated based on the projected impact of the Dispatch instruction(s) over the time period within the Trading Interval for which such Dispatch instruction(s) applies.

D 3.9 **$G_{a/s}$ – MWh**

The Energy generated from Ancillary Service resource i or Supplemental Energy resource i due to ISO Dispatch of instructions. This value will be calculated based on the projected impact of the Ancillary Services or Supplemental Energy Dispatch instruction(s) over the time period within the Trading Interval for which such Ancillary Services or Supplemental Energy Dispatch instruction(s) applies.

D 3.10 **GMM_f – fraction**

The forecasted Generation Meter Multiplier (GMM) for Generator i as provided to the Scheduling Coordinator by the ISO in advance of the operation of the Day-Ahead Market.

D 3.11 **GMM_{fq} – fraction**

The forecasted Generation Meter Multiplier for an Energy import at Scheduling Point q as provided to the Scheduling Coordinator by the ISO in advance of the Day-Ahead Market.

D 3.12 **GMM_{ah} – fraction**

The final forecasted Generation Meter Multiplier (GMM) for a Generator i as calculated by the ISO at the hour-ahead stage (but after close of the Hour-Ahead Market).

D 3.13 **GMM_{ahq} – fraction**

The forecasted Generation Meter Multiplier for an Energy import at Scheduling Point q as provided to the Scheduling Coordinator by the ISO after close of the Hour-Ahead Market.

D 3.14 **L_s – MWh**

The total scheduled Demand of Scheduling Coordinator j for Demand i in Trading Interval t as a result of both the Day-Ahead Final Schedule and the Hour-Ahead Final Schedule.

D 3.15 **L_a – MWh**

The total actual metered Demand of Scheduling Coordinator j for Demand i in Trading Interval t.

D 3.16 **L_{adj} – MWh**

The deviation in realtime Demand (i.e., Load bidding into the market) ordered by the ISO for Congestion Management, Overgeneration, etc.]. This value will be calculated based on the projected impact of the Dispatch instruction(s) over the time period within the Trading Interval for which such Dispatch instruction(s) applies.

D 3.17 **$L_{a/s}$ – MWh**

The Energy reduction by curtailable Load due to ISO dispatch of Ancillary Services from such curtailable Load (i.e., Load bidding into the Ancillary Services markets). This value will be calculated based on the projected impact of the Ancillary Services Dispatch instruction(s) over the time period within the Trading Interval for which such Ancillary Services Dispatch instruction(s) applies.

D 3.18 **I_s – MWh**

The total scheduled Energy import of Scheduling Coordinator j through Scheduling Point q in Trading Interval t as a result of both the Day-Ahead Final Schedule and the Hour-Ahead Final Schedule.

D 3.19 **I_a – MWh**

The total actual Energy import of Scheduling Coordinator j through Scheduling Point q in Trading Interval t. This is deemed to be equal to the total scheduled Energy import I_s.

D 3.20 **I_{adj} – MWh**

The deviation in real time import ordered by the ISO for congestion management, overgeneration, etc. or a result of an import curtailment. This value will be calculated based on the projected impact of the Dispatch instruction(s) (or curtailment event) between the close of the Hour-Ahead Market and the end of the Trading Interval for which such Dispatch Instructions(s) (or curtailment event) applies.

D 3.21 **$I_{a/s}$ – MWh**

The Energy generated from Ancillary Service System Resources pursuant to Existing Contracts or Supplemental Energy from interties due to ISO's Dispatch instruction.

D 3.22 **E_s – MWh**

The total scheduled Energy export of Scheduling Coordinator j through Scheduling Point q in Trading Interval t as a result of both the Day-Ahead Final Schedule and the Hour-Ahead Final Schedule.

D 3.23 **E_a – MWh**

The total actual Energy export of Scheduling Coordinator j through Scheduling Point q in Trading Interval t. This is deemed to be equal to the total scheduled Energy export E_s.

D 3.24 **E_{adj} – MWh**

The deviation in Real Time export ordered by the ISO for Congestion Management, Overgeneration, etc. or as a result of an export curtailment. This value will be calculated based on the projected impact of the Dispatch Instruction(s) (or curtailment event between the close of the Hour-Ahead Market and the end of the Trading Interval for which such Dispatch Instruction (or curtailment event) applies.

D 3.25 **P_{xt} – $/MWh**

The Hourly Ex Post Price for Imbalance Energy for the relevant Trading Interval. This value is calculated as the weighted average of the 12 Five Minute Ex Post Prices in each Zone during each hour. The Five Minute Ex Post Price is equal to the bid price of the marginal resource accepted by the ISO for dispatch and deemed eligible to set the price during a five minute period.

D 3.26 **$UFEC_j$ – $**

The Unaccounted for Energy Charge for Scheduling Coordinator j is the cost representing the difference in Energy, for each UDC Service Area and Trading Interval, between the net Energy delivered into the UDC Service Area, adjusted for UDC Service Area Transmission Losses (calculated in accordance with ISO Tariff Section 7.4.3), and the total metered Demand within the UDC Service Area adjusted for distribution losses using Distribution System loss factors approved by the Local Regulatory Authority. This difference (UFE) which is attributable to meter measurement errors, power flow modeling errors, energy theft, statistical Load profile errors, and distribution loss deviations is multiplied by the Hourly Ex-Post Price.

D 3.27 **$E_{UFE\_UDC\_k}$ – MWh**

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

D 3.28 **E_{UFE_z} – MWh**

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

D 3.29 **$RRDC_j$**

The Replacement Reserve Capacity Dispatch Charge for Scheduling Coordinator j for Trading Interval t.

D 3.30 **RRC – $**

The Dispatched Replacement Reserve Capacity Cost which is to be allocated to Scheduling Coordinators in proportion to their contributions to Imbalance Energy requirements. The RRC is, in turn, calculated as the total cost of Replacement Reserve capacity in Trading Interval t (as determined in the Hour-Ahead and Day-Ahead Markets) less the Undispatched Replacement Reserve Capacity Cost. [Note: Both these costs are dealt with in the Ancillary Services payments in Appendix C]

D 3.31 **G_k – MWh**

The total metered Generation in Trading Interval t in utility service territory k.

D 3.32 **D_z – MWh**

The Demand including Exports in Trading Interval t at metered point z.

D 3.33 **I_k – MWh**

The total metered imports into utility service territory k in Trading Interval t.

D 3.34 **E_k – MWh**

The total metered exports from utility service territory k in Trading Interval t.

D 3.35 **RTM_k – MWh**

The Trading Interval t total of the real-time metering in utility service territory k in Trading Interval t.

D 3.36 **LPM_k – MWh**

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

D 3.37 **TL_k – MWh**

The Transmission Losses per Trading Interval t in utility service territory k.

APPENDIX E

USAGE CHARGE COMPUTATION

E 1 Purpose of Charge

The Usage Charge is payable by Scheduling Coordinators who schedule Energy across Congested Inter-Zonal Interfaces pursuant to Section 7.2.5 of the ISO Tariff. Scheduling Coordinators who counter-schedule across Congested Inter-Zonal Interfaces are entitled to Usage Charge Payments. The right to schedule across a Congested Inter-Zonal Interface is determined through the ISO's Congestion Management procedures.

The following categories of Payments and Charges are covered in this Appendix E:

(a) Usage Charges payable by Scheduling Coordinators for Energy transfers scheduled across Congested Inter-Zonal Interfaces and which contribute to Congestion.

(b) Usage Charge rebates payable to Scheduling Coordinators for Energy transfers scheduled across Congested Inter-Zonal Interfaces and which contribute to relieving Congestion.

(c) Credits of net Usage Charge revenues to Participating TOs.

(d) Debits of net Usage Charge revenues to Participating TOs.

(e) Rebates of Usage Charge to Scheduling Coordinators as set out in E 2.3.3.

E 2 Fundamental Formulae

E 2.1 ISO Usage Charges on Scheduling Coordinators

Each Scheduling Coordinator j whose Final Schedule includes the transfer of Energy scheduled across one or more Congested Inter-Zonal Interfaces shall (save to the extent that the transfer involves the use of transmission capacity represented by Existing Rights and/or Non-Converted Rights) pay, or be paid, Usage Charges in Trading Interval t calculated in accordance with the following formulae:

In the Day-Ahead Market:

$$UC_{jtd} = \sum_{x} NetZoneImp_{jtxd} * l_{dxt}$$

In the Hour-Ahead Market:

$$UC_{jth} = \sum_{x} (NetZoneImp_{jtxh} - NetZoneImp_{jtxd}) * \mathbf{l}_{hxt}$$

E 2.2 Payments of Usage Charges to Scheduling Coordinators

Each Scheduling Coordinator j whose Final Schedule includes the transfer of Energy from one Zone to another in a direction opposite that of Congestion shall (save to the extent that the transfer involves the use of transmission capacity represented by Existing Rights and/or Non-Converted Rights) receive a Usage Charge payment from the ISO calculated in accordance with the formulae described in section E2.1.

E 2.3 ISO Credits and Debits to Transmission Owners of Net Usage Charge Revenues

E 2.3.1 Day-Ahead Market

The ISO will pay to the Participating TO_n in respect of the Transmission Revenue Balancing Account (being the owner, or part-owner, of a Congested Inter-Zonal Interface) its share of the total net Usage Charge revenue for Trading Interval t in the Day-Ahead Market in accordance with the following formula:

$$PayUCTO_{ntd} = \sum_{y} \mathbf{m}_{ytd} * K_{yn} * L_{ytd}$$

E 2.3.2 Hour-Ahead Market

The ISO will pay to the Participating TO_n (being the owner, or part owner, of a Congested Inter-Zonal Interface) in respect of its Transmission Revenue Balancing Account, for Trading Interval $_t$ its share of the total net Usage Charge revenue in accordance with the following formula:

$$PayUCTO_{nth} = \sum_{y} \mathbf{m}_{yth} * K_{yn} * (L_{yth} - L_{ytd})$$

Under normal operating conditions, (L_{yth} - L_{ytd}) is positive and Participating TOs will receive a refund on the net Usage Charge for the relevant Trading Interval t in the Hour-Ahead Market.

E 2.3.3 Debits to Participating TOs and Rebates to Scheduling Coordinators

If, after the close of the Day-Ahead Market, Participating TOs instruct the ISO to reduce interface limits based on operating conditions or an unscheduled transmission outage occurs and as a result of either of those events, Congestion is increased and Available Transfer Capacity is decreased in the Inter-Zonal Interface

in the Hour-Ahead Market, the (L_{yth} - L_{ytd}) will be negative. In this case Participating TOs will be charged for the relevant Trading Interval t in the Hour-Ahead Market and such charge will be apportioned to those Scheduling Coordinators whose Final Day-Ahead Schedules were reduced.

E 3 Meaning of terms of formulae

E 3.1 UC_{jtd} ($)

The Usage Charge payable by or to Scheduling Coordinator j for the relevant Trading Interval t in the Day-Ahead Market.

E 3.2 UC_{jth} - $

The Usage Charge payable by or to Scheduling Coordinator j for Trading Interval t in the Hour-Ahead Market.

E 3.3 $NetZoneImp_{jtxd}$ (MWh)

The net Zonal import scheduled by Scheduling Coordinator j in Zone x for the relevant Trading Interval t in the Day-Ahead Market. For Zones internal to the ISO Control Area, net Zonal import equals scheduled Demand minus scheduled Generation plus transfers. For zones external to the ISO Control Area (i.e., for Scheduling Points), net zonal import equals scheduled imports (i.e., out of the ISO Control Area) minus scheduled exports (i.e., into the ISO Control Area).

E 3.4 $NetZoneImp_{jtxh}$ (MWh)

The net Zonal import scheduled by the Scheduling Coordinator j in Zone x for the relevant Trading Interval t in the Hour-Ahead Market. For Zones internal to the ISO Control Area, net Zonal import equals scheduled Demand minus scheduled Generation plus transfers. For zones external to the ISO Control Area (i.e., for Scheduling Points), net zonal import equals scheduled imports (i.e., out of the ISO Control Area) minus scheduled exports (i.e., into the ISO Control Area).

E 3.5 λ_{dxt} ($/MWh)

The reference Zonal marginal price for Zone x for the relevant Trading Interval t in the Day-Ahead Market, as calculated by the ISO's Congestion Management computer optimization algorithm.

E 3.6 λ_{hxt} ($/MWh)

The reference Zonal marginal price for Zone x for the relevant Trading Interval t in the Hour-Ahead Market, as calculated by the ISO's Congestion Management computer optimization algorithm.

E 3.7 **$PayUCTO_{ntd}$ ($)**

The amount calculated by the ISO to be paid to or by the Participating TO_n (in respect of its Transmission Revenue Balancing Account) for the relevant Trading Interval t in the Day-Ahead Market.

E 3.7.1 **$PayUCTO_{nth}$ ($)**

The amount calculated by the ISO to be paid to the Participating TO_n (in respect of its Transmission Revenue Balancing Account) for the relevant Trading Interval t in the Hour-Ahead Market.

E 3.8 **μ_{ytd} ($/MW)**

The Day-Ahead Congestion price (shadow price) at Inter-Zonal interface y for Trading Interval t. This price is calculated by the ISO's Congestion Management computer optimization algorithm.

E 3.8.1 **μ_{yth} ($/MW)**

The Hour-Ahead Congestion price (shadow price) at Inter-Zonal Interface y for Trading Interval t. This price is calculated by the ISO's Congestion Management computer optimization algorithm.

E 3.9 **K_{yn} (%)**

The percentage ownership by Participating TO n of the Congested Inter-Zonal interface y.

E 3.10 **L_{ytd} (MW)**

The total loading of Inter-Zonal Interface y for Trading Interval t in the Day-Ahead as calculated by the ISO's Congestion Management optimization algorithm.

E 3.11 **L_{yth} (MW)**

The total loading of Inter-Zonal Interface y for Trading Interval t in the Hour-Ahead as calculated by the ISO's Congestion Management optimization algorithm.

APPENDIX F

WHEELING ACCESS CHARGES COMPUTATION

F 1 Purpose of Charge

The Wheeling Access Charge is paid by Scheduling Coordinators for Wheeling as set forth in Section 7.1.4 of the ISO Tariff. The ISO will collect the Wheeling revenues from Scheduling Coordinators on a Trading Interval basis and repay these to the Participating TOs based on the ratio of each Participating TO's Transmission Revenue Requirement to the sum of all Participating TOs' Revenue requirements.

F 2 Fundamental Formulae

F 2.1 ISO Charges on Scheduling Coordinators for Wheeling

The ISO will charge Scheduling Coordinators scheduling a Wheeling Out or a Wheeling Through, the product of the Wheeling Access Charge and the total of the hourly schedules of Wheeling in MWh for each Trading Interval at each Scheduling Point associated with that transaction pursuant to Section 7.1.4 of the ISO Tariff.

F 2.1.1 Wheeling Access Charge

The Wheeling Access Charge for each Participating TO is its base Transmission Revenue Requirement (TRR) divided by the annual kWh deliveries by the Participating TO or End-Use Customers connected to its transmission and distribution facilities plus the Participating TO's Transmission Revenue Balancing Account (TRBA) adjustment as set forth in Section 5 of the TO Tariff. The Wheeling Access Charge for transmission service will be the TO-specific Wheeling Access Charge at the point in the ISO Controlled Grid where the Energy is scheduled to exit the ISO Controlled Grid.

To the extent that more than one Participating TO owns, or has firm entitlement to, transmission capacity exiting the ISO Controlled Grid at a Scheduling Point, the ISO will charge Scheduling Coordinators for each Trading Interval a rate for Wheeling at that Scheduling Point which reflects an average of the Wheeling Access Charge of those Participating TOs, weighted by the relative share of such ownership or firm entitlements to transmission capacity. The Weighted Average Rate for Wheeling for Scheduling Point q is calculated using the following formula; note if there is only one

Participating TO owning, or having firm entitlement to, transmission capacity at Scheduling Point q then this formula gives the TO-specific Wheeling Access Charge:

$WABC_q = \Sigma (P_n * Q_n / \Sigma Q_n)$

F 2.1.2 Wheeling Charge

The Wheeling Charge by the ISO on Scheduling Coordinator j for Scheduling Point q for each Trading Interval is calculated by the product of (i) the weighted average rate for Wheeling at Scheduling Point q, and (ii) the summation of kWh wheeled over that Scheduling Point in Trading Interval t using the following formula:

$WChg_{jq} = WABC_q * QChargeW_{jqt}$

The total Wheeling Charges by the ISO on Scheduling Coordinator j for all Scheduling Points in Trading Interval t is calculated using the following formula:

$TotalWChg_j = S_q \, WChg_{jq}$

F 2.2 ISO Payments to Transmission Owners for Wheeling

The ISO will pay all Wheeling revenues to Participating TOs on the basis of the ratio of each Participating TO's Transmission Revenue Requirement ("TRR") (less the TRR associated with Non-Converted Rights and Existing Rights) to the sum of all Participating TOs' TRRs (less the TRRs associated with Non-Converted Rights and Existing Rights) as specified in Section 7.1.4.3 of the ISO Tariff. The sum to be paid to Participating TO_n for a Trading Interval is calculated as follows:

$$PayTO_n = \frac{TRR_n}{\sum_n TRR_n} * \sum_j totalWChrg_j$$

F 3 Meaning of terms in formulae

F 3.1 $WABC_q$ ($/kWh)

The Weighted Average Rate for Wheeling Service for Scheduling Point q.

F 3.2 P_n ($/kWh)

The Wheeling Access Charge rate for Participating TO n as set forth in Section 5 of the TO Tariff.

F 3.3 **Q_n (MW)**

The Available Transfer Capacity, whether from transmission ownership or contractual entitlements, of each Participating TO n for each ISO Scheduling Point which has been placed within the ISO Controlled Grid. Available Transfer Capacity does not include capacity associated with Non-Converted Rights and Existing Rights of a Participating TO as defined in Section 2.4.4 of the ISO Tariff.

F 3.4 **$WChg_{jq}$ ($)**

The Wheeling Charges by the ISO on Scheduling Coordinator j for Scheduling Point q in Trading Interval t. Both Wheeling Out and Wheeling Through transactions are included in this term.

F 3.5 **$QChargeW_{jqt}$ (kWh)**

The summation of kWh wheeled over Scheduling Point q by Scheduling Coordinator j in Trading Interval t. Both Wheeling Out and Wheeling Through transactions are included in this term.

F 3.6 **$TotalWChg_j$ ($)**

The total Wheeling Charges payable by Scheduling Coordinator j to the ISO for all Scheduling Points over which it has Wheeling transactions in Trading Interval t. Both Wheeling Out and Wheeling Through transactions are included in this term.

F 3.7 **$PayTo_n$ ($)**

The Trading Interval payment of Wheeling Out and Through Revenues from the ISO to Participating TO n.

F 3.8 **TRR_n**

The Transmission Revenue Requirement of Participating TO_n.

APPENDIX G

VOLTAGE SUPPORT and BLACK START CHARGES COMPUTATION

G 1 **Purpose of charge**

G 1.1 Voltage Support (VS) and Black Start (BS) charges are the charges made by the ISO to recover costs it incurs under contracts entered into between the ISO and those entities offering to provide VS or BS. Each Scheduling Coordinator pays an allocated proportion of the VS&BS charge to the ISO so that the ISO recovers the total costs incurred.

G 1.2 All Generating Units are required by the ISO Tariff to provide reactive power by operating within a power factor range of 0.90 lag and 0.95 lead. Additional short term Voltage Support required by the ISO is referred to as supplemental reactive power. If the ISO requires the delivery of this supplemental reactive power by instructing a Generating Unit to operate outside its mandatory MVar range, the Scheduling Coordinator representing this Generating Unit will only receive compensation if it is necessary to reduce the MW output to achieve the MVar instructed output. Supplemental reactive power charges to Scheduling Coordinators are made on a Trading Interval basis. As of the ISO Operations Date the ISO will contract for long term Voltage Support Service with the Owner of Reliability Must-Run Units under Reliability Must-Run contracts.

G 1.3 The ISO will procure Black Start capability through contracts let on an annual basis. The quantities and locations of the Black Start capability will be determined by the ISO based on system analysis studies. Charges to Scheduling Coordinators for instructed Energy output from Black Start units are made on a Trading Interval basis.

G 2 **Fundamental formulae**

G 2.1 **Payments to Scheduling Coordinators for providing Voltage Support**

Payments to Scheduling Coordinators for additional Voltage Support service comprise:

G 2.1.1 Lost Opportunity Cost Payments (supplemental reactive power) to Scheduling Coordinators for Generating Units

When the ISO obtains additional Voltage Support by instructing a Generating Unit to operate outside its mandatory MVar range by reducing its MW output the ISO will select Generating Units based on their Supplemental Energy Bids ($/MWh). Subject to any locational requirements the ISO will select the Generating Unit with the highest decremental Supplemental Energy Bid to reduce MW output by such amount as is necessary to achieve the instructed MVar reactive energy production. Each Trading Interval the ISO will pay Scheduling Coordinator j for that Generating Unit i in Zone x, the lost opportunity cost ($) resulting from the reduction of MW output in Trading Interval t in accordance with the following formula:

$$VSST_{xijt} = Max\ \{0, P_{xt} - Sup_{xdecit}\} * DEC_{xit}$$

G 2.1.2 Long term contract payments to Scheduling Coordinators for Reliability Must-Run Units for Generating Units and other Voltage Support Equipment

The ISO will pay Scheduling Coordinator j for the provision of Voltage Support from its Reliability Must-Run Units located in Zone x in month m a sum ($VSLT_{xjm}$) consisting of:

(a) the total of the Ancillary Service Pre-empted Dispatch Payments if the ISO has decreased the output of the Reliability Must-Run Units for the provision of Voltage Support outside the power factor range of the Reliability Must-Run Unit in any Trading Interval in month m and/or

(b) (if applicable) the total payments for the provision of Voltage Support in month m requested by the ISO from the synchronous condensers of the Reliability Must-Run Units,

calculated in each case in accordance with the terms of the relevant Reliability Must-Run Contract. Data on these payments will not be generated by the ISO. Such data will be based on the invoices issued by the Owners of Reliability Must-Run Generating Units pursuant to their Reliability Must-Run Contracts and will be verified by the ISO.

G 2.2 Charges to Scheduling Coordinators for Voltage Support

G 2.2.1 User Rate

The user rate ($/MWh) for the lost opportunity cost for voltage support referred to in G2.1.1 in Zone x for Trading Interval t will be calculated using the following formula:

$$VSSTRate_{xt} = \frac{\sum_{ij} VSST_{xijt}}{\sum_{j} QChargeVS_{xjt}}$$

The user rate ($/MWh) for month m for long term voltage support referred to in G2.1.2 in Zone x will be calculated using the following formula:

$$VSSTRate_{xm} = \frac{\sum_{j} VSLT_{xjm}}{\sum_{jm} QChargeVS_{xjt}}$$

G 2.2.2 Voltage Support Charges

The lost opportunity cost Voltage Support charge ($)payable to recover the sums under G2.1.1 for Zone x for Trading Interval t for Scheduling Coordinator j will be calculated using the following formula:

$$VSSTCharge_{xjt} = VSSTRate_{xt} * QChargeVS_{xjt}$$

The monthly long term voltage support charge ($) payable to recover sums under G2.1.2 for Zone x for month m for Scheduling Coordinator j will be calculated using the following formula:

$$VSLTCharge_{xjm} = VSLTRate_{xm} * \sum_{m} QChargeVS_{xjt}$$

G 2.3 Payments to Participating Generators for Black Start

Payments to Participating Generators that provide Black Start Energy or capability shall be made

in accordance with the agreements they have entered into with the ISO for the provision of Black Start services and shall be calculated as follows:

G 2.3.1 Black Start Energy Payments

Whenever a Black Start Generating Unit provides a Black Start in accordance with the ISO's instructions, the ISO will pay the Black Start Generator for that Unit for the Generating Unit's energy output and start-up costs. The ISO will pay Black Start Generator for Generating Unit i, the Black Start energy and start-up costs ($) in Trading Interval t in accordance with the following formula:

$$BSEn_{ijt} = (EnQBS_{ijt} * EnBid_{ijt}) + BSSUP_{ijt}$$

G 2.3.2 Black Start Energy Payments to Owners of Reliability Must-Run Units

Whenever a Reliability Must-Run Unit provides a Black Start in accordance with the ISO's instructions, the ISO will pay the Scheduling Coordinator of the Reliability Must-Run Unit the Generating Unit's Energy and start-up costs. The ISO will pay Scheduling Coordinator j for Reliability Must-Run Unit i the Black Start Energy and start-up costs ($) in Trading Interval t in accordance with the following formula:

$BSEn_{ijt} = (EnQBS_{ijt} * EnBid_{ijt}) + (BSSUP_{ijt})$

G 2.4 Charges to Scheduling Coordinators for Black Start

G 2.4.1 User Rate

The user rate ($/MWh) for Black Start Energy payments referred to in G2.3.1 and G2.3.2 for Trading Interval t will be calculated using the following formula:

$$BSRate_t = \frac{\sum_{ij} BSEn_{ijt}}{\sum_j QChargeBlackStart_{jt}}$$

G 2.4.2 Black Start Charges

The user charge ($/MWh) for Black Start Energy to recover the costs of payments under G2.3.1 and G2.3.2 for Trading Interval t for Scheduling Coordinator j will be calculated using the following formula:

$$BSCharge_{jt} = BSRate_t * QChargeBlackStart_{jt}$$

G 3 Meaning of Terms in the Formulae

G 3.1 $VSST_{xijt}$ ($)

The lost opportunity cost paid by the ISO to Scheduling Coordinator j for Generating Unit i in Zone x, resulting from the reduction of MW output in Trading Interval t.

G 3.2 P_{xt} ($/MWh)

The Hourly Ex Post price for Imbalance Energy in Trading Interval t in Zone x.

G 3.3 Sup_{xdecit} ($/MWh)

The Supplemental Energy Bid submitted by Scheduling Coordinator j for Generating Unit i in Zone x in Trading Interval t, whose output is

reduced by the ISO to provide additional short term Voltage Support.

G 3.4 **Dec_{xit}** **(MW)**

The reduction in MW by Scheduling Coordinator j for Generating Unit i in Zone x in Trading Interval t, in order to provide short term additional Voltage Support.

G 3.5 **$VSLT_{xjm}$** **($)**

The payment from the ISO to Scheduling Coordinator j for its Reliability Must-Run Units in Zone x for Voltage Support in month m calculated in accordance with the relevant Reliability Must-Run Contract.

G 3.6 **$VSSTRate_{xt}$** **($/MWh)**

The Trading Interval lost opportunity cost Voltage Support user rate charged by the ISO to Scheduling Coordinators for Trading Interval t for Zone x.

G 3.7 **$VSLTRate_{xm}$** **($/MWh)**

The monthly long term voltage support user rate charged by the ISO to Scheduling Coordinators for month m for Zone x.

G 3.8 **$QChargeVS_{xjt}$** **(MWh)**

The charging quantity for Voltage Support for Scheduling Coordinator j for Trading Interval t in Zone x equal to the total metered Demand (including exports to neighboring Control Areas) for Scheduling Coordinator j in Zone x for Trading Interval t.

G 3.9 **$VSSTCharge_{xjt}$** **($)**

The lost opportunity cost Voltage Support user charge for Zone x for Trading Interval t for Scheduling Coordinator j.

G 3.10 **$VSLTCharge_{xjm}$** **($)**

The long term charge for voltage support for month m for Zone x for Scheduling Coordinator j.

G 3.11 **$BSEn_{ijt}$** **($)**

The ISO payment to Scheduling Coordinator j (or Black Start Generator j) for that Generating Unit i providing Black Start Energy in Trading Interval t.

G 3.12 **$EnQBS_{ijt}$** **(MWh)**

The energy output, instructed by the ISO, from the Black Start capability of Generating Unit i from Scheduling Coordinator j (or Participating Generator j) for Trading Interval t.

G 3.13 **$EnBid_{ijt}$** **($/MWh)**

The price for Energy output from the Black Start capability of Generating Unit i of Scheduling Coordinator j or (Black Start Generator j) for Trading Interval t calculated in accordance with the applicable Reliability Must-Run Contract or Interim Black Start Agreement.

G 3.14 **$BSSUP_{ijt}$** **($)**

The start-up payment for a Black Start successfully made by Generating Unit i of Scheduling Coordinator j (or Black Start Generator j) in Trading Interval t calculated in accordance with the applicable Reliability Must-Run Contract or Interim Black Start Agreement.

G 3.15 **$BSRate_{t}$** **($/MWh)**

The Black Start Energy Payment user rate charged by the ISO to Scheduling Coordinators for Trading Interval t.

G 3.16 **$QChargeBlackstart_{jt}$** **(MW)**

The charging quantity for Black Start for Scheduling Coordinator j for Trading Interval t equal to the total metered Demand (excluding exports to neighboring Control Areas) of Scheduling Coordinator j for Trading Interval t.

APPENDIX H

RELIABILITY MUST-RUN PAYMENTS AND CHARGES COMPUTATION

H 1 Purpose of the Payments and Charges

The Reliability Must-Run Payments are the amounts which the ISO is obligated to pay to the owners of Reliability Must-Run Units under or arising out of Reliability Must-Run Contracts. The Reliability Must-Run Charges enable the ISO to recover those amounts from relevant Participating TOs.

H 2 Calculation of Payments and Charges

H 2.1 Reliability Must-Run Payments.

Invoices submitted by Reliability Must-Run Owners to the ISO must be calculated as follows:

(a) *Agreement A*:

The Reliability Must-Run Payment under Agreement A for each month for each Owner shall be the total of the payments for that month for each Reliability Must-Run Unit owned by the Owner to which the Conditions of Must-Run Agreement A apply calculated in accordance with those Conditions. The Agreement A payment for Reliability Must-Run Owner o for Reliability Must-Run Unit u for month m shall be calculated as follows:

$$\begin{aligned} RMR\ Pay\ A_{uom} = & \sum_{m} \left[\left(E_{uot} * RPR_{uot}\right) + \left(EM_{uot} * ER_{uot}\right) + \left(E_{uot} * HVO\&M_{uot}\right) + \left(SCAC_{uot}\right) \right] \\ & + HOF_{uom} + SUFC_{uom} + SUPC_{uom} + OSUC_{uom} \\ & + \sum_{m} \left[AGC_{uot} + SR_{uot} + NSR_{uot} + RR_{uot} + VS_{uot} + ASPDP_{uot} \right] \\ & - \sum_{m} \left[EA_{uot} * SCP_{uot} \right] - \sum_{m} \left[SCASCP_{uot} \right] - \sum_{m} \left[SCASEP_{uot} \right] - \sum_{m} \left[ER_{uot} * P_{xuot} \right] \\ & + \sum_{m} \left[\left(ER_{uot} - E_{uot}\right) * P_{xuot} \right] \end{aligned}$$

The total payment to each Owner for Reliability Must-Run services under Agreement A for a given month shall be calculated by summing all the payments for the month for the Reliability Must-

Run Units owned by the Owner to which Agreement A applies. The payment for Owner o for month m shall be calculated as follows:

$$RMR\ Pay\ Total\ A_{om} = \sum_{u}\ RMRPayA_{uom} + OPA_{om} + IAA_{om} + IDA_{om}$$

(b) *Agreement B*

The Reliability Must-Run Payment under Agreement B for each month for each Owner shall be the total of the payments for that month for each Reliability Must-Run Unit owned by the Owner to which the Conditions of Must-Run Agreement B apply calculated in accordance with those Conditions. The Agreement B payment for Reliability Must-Run Owner o for Reliability Must-Run Unit u for month m shall be calculated as follows:

$$\begin{aligned} RMR\ Pay\ B_{uom} = \sum_{m}\ & [AP_{uot} + (EM_{uot} * ER_{uot}) + (E_{uot} * HVO\&M_{uot}) + (SCAC_{uot})] \\ & + HOF_{uom} + SUFC_{uom} + SUPC_{uom} + OSUC_{uom} + \\ & \sum_{m}\ [ASPDP_{uot} + VS_{uot}] \\ & - 0.9 * \sum_{m}\ [EMT_{uot} * PXM_{t}] - \sum_{m}\ [EA_{uot} * SCP_{uot}] \\ & - \sum_{m} [SCASCP_{uot}] - \sum_{m} [SCASEP_{uot}] - \sum_{m}\ [ER_{uot} * P_{xuot}] \\ & + \sum_{m} [(ER_{uot} - E_{uot}) * P_{xuot}] \end{aligned}$$

The total payment to each Owner for Reliability Must-Run services under Agreement B for a given month shall be calculated by summing all the payments for the month for the Reliability Must-Run Units owned by the Owner to which Agreement B applies. The payment for Owner o for month m shall be calculated as follows:

$$RMR\ Pay\ Total\ B_{om} = \sum_{u}\ RMRPayB_{uom} + OPB_{om} + IAB_{om} + IDB_{om}$$

(c) *Agreement C*

The Reliability Must-Run Payment under Agreement C for each month for each Owner shall be the total of the payments for that month for each Reliability Must-Run Unit owned by the Owner to which the Conditions of Must-Run Agreement C apply calculated in accordance with those Conditions. The Agreement C payment for Reliability Must-Run Owner o for Reliability Must-Run Unit u for month m shall be calculated as follows:

$$RMR\ Pay\ C_{uom} = \sum_{m} \left[AP_{uot} + (EM_{uot} * ER_{uot}) + (E_{uot} * HVO\&M_{uot}) + (SCAC_{uot})\right] + HOF_{uom} + SUFC_{uom} + SUPC_{uom} + OSUC_{uom} + \sum_{m} \left[VS_{uot}\right] - \sum_{m} \left[EA_{uot} * SCP_{uot}\right] - \sum_{m} \left[SCASCP_{uot}\right] - \sum_{m} \left[SCASEP_{uot}\right] - \sum_{m} \left[ER_{uot} * P_{xuot}\right] + \sum_{m} \left[(ER_{uot} - E_{uot}) * P_{xuot}\right]$$

The total payment to each Owner for Reliability Must-Run services under Agreement C for a given month shall be calculated by summing all the payments for the month for the Reliability Must-Run Units owned by the Owner to which Agreement C applies. The payment for Owner o for month m shall be calculated as follows:

$$RMR\ Pay\ Total\ C_{om} = \sum_{u} RMRPayC_{uom} + OPC_{om} + IAC_{om} + IDC_{om}$$

(d) *Total Payment*

The total amount payable to each Owner for each month for Reliability Must-Run services shall be the total of the amounts due to the Owner under Agreements A, B and C for that month. The total payment for Reliability Must-Run Owner o for month m shall be calculated as follows:

$$RMR\ Total\ Pay_{om} = \sum_{u} RMRTotalPayA_{om} + RMRTotalPayB_{om} + RMRTotalPayC_{om}$$

H 2.2 Reliability Must-Run Charges

Each Participating TO shall pay to the ISO the total amount payable by the ISO for each month under the Reliability Must-Run Contracts for the Reliability Must-Run Units located in the Participating TO's Service Area.

The charge to Participating TO n for month m for Reliability Must-Run Unit u located in the Service Area of Participating TO n shall be calculated as follows:

$RMRC_{nmu} = RMRPay_{nmu}$

The total charge to each Participating TO for Reliability Must-Run services for a given month shall be calculated by summing all the charges for the month for the Reliability Must-Run Units located in

the Service Area of the Participating TO. The charge for Participating TO n for month m shall be calculated as follows:

$$Total\ RMRC_{nm} = \sum_{u} RMRC_{nmu}$$

H 3 Meaning of terms of formulae

H 3.1 $RMRPayA_{uom}$ ($)

The amount payable to Reliability Must-Run Owner o under Conditions of Must-Run Agreement A for Reliability Must-Run Unit u for month m.

H 3.2 RPR_{uot} ($/MWh)

The Hourly Reliability Payment Rate for Reliability Must-Run Unit u owned by Reliability Must-Run Owner o under the Conditions of Must-Run Agreement A applicable to Reliability Must-Run Unit u.

H 3.3 E_{uot} (MWh)

The Energy Delivered by Reliability Must-Run Unit u owned by Reliability Must-Run Owner o in Settlement Period t pursuant to a Dispatch Notice or an ISO's Request under the Conditions of Must-Run Agreement applicable to Reliability Must-Run Unit u. Energy Delivered can never exceed Energy requested by the ISO in Dispatch Notices or ISO's Requests.

H 3.4 EM_{uot} (lb.)

The emissions produced by Reliability Must-Run Unit u owned by Reliability Must-Run Owner o in Settlement Period t calculated in accordance with Schedule C to the Conditions of Must-Run Agreement applicable to the Reliability Must-Run Unit when the Reliability Must-Run Unit Delivers Energy pursuant to a Dispatch Notice or an ISO's Request under the Conditions of Must-Run Agreement. Note: only applicable where Owner is required to pay volumetric fee for emissions.

H 3.5 ER_{uot} ($/lb.)

The emissions rate for Reliability Must-Run Unit u owned by Reliability Must-Run Owner o under the Conditions of Reliability Must-Run Agreement applicable to Reliability Must-Run Unit u. Note: only applicable where Owner is required to pay volumetric fee for emissions.

H 3.6 **$HVO\&M_{uot}$** **($/MWh)**

The Hourly Variable O&M Costs for Reliability Must-Run Unit u owned by Reliability Must-Run Owner o for Settlement Period t under the Conditions of Must-Run Agreement applicable to Reliability Must-Run Unit u.

H 3.6.1 **$SCAC_{uot}$** **($)**

The Scheduling Coordinator administration charge payable by Reliability Must-Run Owner o for Reliability Must-Run Unit u for Settlement Period t under the Conditions of Must-Run Agreement applicable to Reliability Must-Run Unit u.

H 3.7 **HOF_{uom}** **($)**

The Hourly Operating Fuel Costs for Reliability Must-Run Unit u owned by Reliability Must-Run Owner o for Energy Delivered pursuant to a Dispatch Notice or an ISO's Request under the Conditions of Must-Run Agreement applicable to Reliability Must-Run Unit u in month m calculated in accordance with Schedule C to the Conditions of Must-Run Agreement. This figure must be broken down to show that the calculation accords with Schedule C.

H 3.8 **$SUFC_{uom}$** **($)**

The Start-up Fuel Costs for Reliability Must-Run Unit u owned by Reliability Must-Run Owner o for Start-ups made in month m pursuant to a Dispatch Notice or an ISO's Request under the Conditions of Must-Run Agreement applicable to Reliability Must-Run Unit u, calculated in accordance with Schedule D to the Conditions of Must-Run Agreement. The figure must be broken down to show that the calculation accords with Schedule D.

H 3.9 **$SUPC_{uot}$** **($)**

The Start-up and Shutdown Power Costs for Reliability Must-Run Unit u owned by Reliability Must-Run Owner o for Start-ups made in month m pursuant to a Dispatch Notice or an ISO's Request under the Conditions of Must-Run Agreement applicable to Reliability Must-Run Unit u, calculated in accordance with Schedule D to the Conditions of Must-Run Agreement. This figure must be broken down to show that the calculation accords with Schedule D.

H 3.10 **$OSUC_{uom}$** **($)**

The other Start-up costs for Reliability Must-Run Unit u owned by Reliability Must-Run Owner o for Start-ups made in month m pursuant to a Dispatch Notice or an ISO's Request under the Conditions of Must-Run Agreement applicable to Reliability Must-Run Unit u, calculated in accordance with Schedule D to the

Conditions of Must-Run Agreement. This figure must be broken down to show that the calculation accords with Schedule D.

H 3.11 **AGC_{uot}** **($)**

The amount payable under the Conditions of Must-Run Agreement A applicable to Reliability Must-Run Unit u owned by Reliability Must-Run Owner o for Regulation capacity Delivered by Reliability Must-Run Unit u in Settlement Period t pursuant to a Dispatch Notice or ISO's Request issued by the ISO under the Conditions of Must-Run Agreement.

H 3.12 **SR_{uot}** **($)**

The amount payable under the Conditions of Must-Run Agreement A applicable to Reliability Must-Run Unit u owned by Reliability Must-Run Owner o for Spinning Reserve Capacity Delivered by Reliability Must-Run Unit u in Settlement Period t pursuant to a Dispatch Notice or ISO's Request issued by the ISO under the Conditions of Must-Run Agreement.

H 3.13 **NSR_{uot}** **($)**

The amount payable under the Conditions of Must-Run Agreement A applicable to Reliability Must-Run Unit u owned by Reliability Must-Run Owner o for Non-Spinning Reserve Capacity Delivered by Reliability Must-Run Unit u in Settlement Period t pursuant to a Dispatch Notice or ISO's Request issued by the ISO under the Conditions of Must-Run Agreement.

H 3.14 **RR_{uot}** **($)**

The charge under the Conditions of Must-Run Agreement A applicable to Reliability Must-Run Unit u owned by Reliability Must-Run Owner o for Replacement Reserve Capacity Delivered by Reliability Must-Run Unit u in Settlement Period t pursuant to a Dispatch Notice or ISO's Request issued by the ISO under the Conditions of Must-Run Agreement.

H 3.15 **VS_{uot}** **($)**

The amount payable under the Conditions of Must-Run Agreement applicable to Reliability Must-Run Unit u owned by Reliability Must-Run Owner o for additional Voltage Support Delivered by Reliability Must-Run Unit u in Settlement Period t pursuant to a Dispatch Notice or ISO's Request issued by the ISO under the Conditions of Must-Run Agreement. This will be either the Ancillary Service Pre-empted Dispatch Payment or the payment for Voltage Support from synchronous condensers, calculated in each case in accordance

with the terms of the applicable Conditions of Must-Run Agreement.

H 3.16 **$ASPDP_{uot}$** **($/MWh)**

The amount payable under the Conditions of Must-Run Agreement applicable to Reliability Must-Run Unit u owned by Reliability Must-Run Owner o for reducing its Scheduled output in order to Deliver Regulation, Spinning Reserve, Non-Spinning Reserve or Replacement Reserve capacity in Settlement Period t pursuant to a Dispatch Notice or ISO's Request issued by the ISO under the Conditions of Must-Run Agreement.

H 3.16.1 **EA_{uot}** **(MWh)**

The Energy requested to be Delivered by Reliability Must-Run Unit u owned by Reliability Must-Run Owner o in Settlement Period t in a Dispatch Notice or an ISO's Request issued in the Day-Ahead or the Hour-Ahead under the Conditions of Must-Run Agreement applicable to Reliability Must-Run Unit u.

H 3.17 **SCP_{uot}** **($/MWh)**

The price payable to Reliability Must-Run Unit Owner o from its Scheduling Coordinator for Energy scheduled to be delivered in Settlement Period t by Reliability Must-Run Unit u pursuant to a Dispatch Notice or ISO's Request issued by the ISO under the Conditions of Must-Run Agreement applicable to Reliability Must-Run Unit u. This is the Energy weighted average of the decremental Adjustment Bids accepted by the ISO to accommodate Reliability Must-Run Generation and to relieve Intra-Zonal Congestion as described in Appendix B to SABP.

H 3.18 **$SCASCP_{uot}$** **($/MWh)**

The price payable to Reliability Must-Run Unit Owner o from its Scheduling Coordinator for Regulation, and/or Spinning Reserve, and/or Non-Spinning Reserve, and/or Replacement Reserve capacity Delivered in Settlement Period t by Reliability Must-Run Unit u pursuant to a Dispatch Notice or ISO's Request issued by the ISO under the Conditions of Must-Run Agreement applicable to Reliability Must-Run Unit u.

H 3.19 **$SCASEP_{uot}$** **($/MWh)**

The price payable to Reliability Must-Run Unit Owner o from its Scheduling Coordinator for Energy delivered from Regulation, and/or Spinning Reserve, and/or Non-Spinning Reserve, and/or Replacement Reserve capacity in Settlement Period t in compliance with a Dispatch Notice or ISO's Request issued by the ISO under

the Conditions of Must-Run Agreement applicable to Reliability Must-Run Unit u.

H 3.19.1 **ER_{uot}** **(MWh)**

The Energy requested to be Delivered by Reliability Must-Run Unit u owned by Reliability Must-Run Owner o in Settlement Period t in a Dispatch Notice or an ISO's Request issued in Real Time under the Conditions of Must-Run Agreement applicable to Reliability Must-Run Unit u.

H 3.19.2 **P_{xuot}** **($/MWh)**

The Hourly Ex Post Price for Settlement Period t for the Zone in which Reliability Must-Run Unit u owned by Reliability Must-Run Owner o is located.

H 3.20 **$RMRPayTotalA_{om}$** **($)**

The total amount payable by the ISO to Reliability Must-Run Owner o for month m for Reliability Must-Run services from Reliability Must-Run Units to which Conditions of Must-Run Agreement A apply.

H 3.21 **OPA_{om}** **($)**

Any amount payable for month m from the ISO to Reliability Must-Run Owner o or from the Owner to the ISO (in which case this figure shall have a negative value) under Article 8.4 of Conditions of Must-Run Agreement A.

H 3.22 **IAA_{om}** **($)**

Any interest payable for month m from the ISO to Reliability Must-Run Owner o or from the Owner to the ISO (in which case this figure shall have a negative value) under Article 4.5(f) of Conditions of Must-Run Agreement A.

H 3.23 **IDA_{om}** **($)**

Any interest payable from the ISO to Reliability Must-Run Owner o or from the Owner to the ISO (in which case this figure shall have a negative value) under Article 4.5(e) of Conditions of Must-Run Agreement A in respect of unpaid or disputed amounts, provided that such interest has not previously been included in any invoice.

H 3.24 **$RMRPayB_{uom}$** **($)**

The amount payable to Reliability Must-Run Owner o under Conditions of Must-Run Agreement B for Reliability Must-Run Unit u for month m.

H 3.25 **AP_{uot}** **($)**

The Availability Payment for Settlement Period t for Reliability Must-Run Unit u owned by Reliability Must-Run Owner o calculated in accordance with the Conditions of Must-Run Agreement applicable to Reliability Must-Run Unit u.

H 3.26 **PXM_{t}** **($/MWh)**

The Power Exchange Market Clearing Price for Settlement Period t.

H 3.27 **EMT_{uot}** **(MWh)**

The Energy delivered from Reliability Must-Run Unit u owned by Reliability Must-Run Owner o in Settlement Period t pursuant to a Market Transaction.

H 3.28 **$RMRPayTotalB_{om}$** **($)**

The total amount payable by the ISO to Reliability Must-Run Owner o for month m for Reliability Must-Run services from Reliability Must-Run Units to which Conditions of Must-Run Agreement B apply.

H 3.29 **OPB_{om}** **($)**

Any amount payable for month m from ISO to Reliability Must-Run Owner o under Article 2.2(g) or 8.6(b) of Conditions of Must-Run Agreement B or from the Owner to the ISO (in which case this figure shall have a negative value) under Article 2.2(b) or 8.6(b).

H 3.30 **IAB_{om}** **($)**

Any interest payable for month m from the ISO to Reliability Must-Run Owner o or from the Owner to the ISO (in which case this figure shall have a negative value) under Article 4.6(f) of Conditions of Must-Run Agreement B.

H 3.31 **IDB_{om}** **($)**

Any interest payable from the ISO to Reliability Must-Run Owner o or from the Owner to the ISO (in which case this figure shall have a negative value) under Article 4.6(e) of Conditions of Must-Run Agreement B in respect of unpaid or disputed amounts, provided that such interest has not previously been included in any invoice.

H 3.32 **$RMRPayC_{uom}$** **($)**

The amount payable to Reliability Must-Run Owner o under Conditions of Must-Run Agreement C for Reliability Must-Run Unit u for month m.

H 3.33 **$RMRPayTotalC_{om}$** **($)**

The total amount payable by the ISO to Reliability Must-Run Owner o for month m for Reliability Must-Run services from Reliability Must-Run Units to which Conditions of Must-Run Agreement C apply.

H 3.34 **OPC_{om}** **($)**

Any amount payable for month m from the ISO to Reliability Must-Run Owner O under Article 2.2(f) or 8.6(b) or from the Owner to the ISO (in which case this figure shall have a negative value) under Article 2.2 (b) or 8.6(b) of Conditions of Must-Run Agreement C.

H 3.35 **IAC_{om}** **($)**

Any interest payable for month m from the ISO to Reliability Must-Run Owner o or from the Owner to the ISO (in which case this figure shall have a negative value) under Article 4.6(f) of Conditions of Must-Run Agreement C.

H 3.36 **IDC_{om}** **($)**

Any interest payable from the ISO to Reliability Must-Run Owner o or from the Owner to the ISO (in which case this figure shall have a negative value) under Article 4.6(e) of Conditions of Must-Run Agreement C in respect of unpaid or disputed amounts, provided that such interest has not previously been included in any invoice.

H 3.37 **$RMRC_{nmu}$** **($)**

The Reliability Must-Run Charge payable by Participating TO n for month m for Reliability Must-Run Unit u located in the Participating TO n's Service Area.

H 3.38 **$RMRPay_{nmu}$** **($)**

The total amount payable by the ISO for month m under the Conditions of Must-Run Agreement applicable to Reliability Must-Run Unit u located in the Service Area of Participating TO n.

H 3.39 **AGC_{nmu}** **($)**

The amount received in month m by the ISO from Scheduling Coordinators for Regulation capacity held on Reliability Must-Run Unit u located in the Service Area of Participating TO n pursuant to a Dispatch Notice or ISO's Request issued by the ISO under the Conditions of Must-Run Agreement.

H 3.40 **SR_{nmu}** **($)**

The amount received by the ISO from Scheduling Coordinators in month m for Spinning Reserve capacity held on Reliability Must-Run Unit u located in the Service Area of Participating TO n pursuant to a Dispatch Notice or ISO's Request issued by the ISO under the Conditions of Must-Run Agreement.

H 3.41 **NSR_{nmu}** **($)**

The amount received by the ISO from Scheduling Coordinators in month m for Non-Spinning Reserve capacity held on Reliability Must-Run Unit u located in the Service Area of Participating TO n pursuant to a Dispatch Notice or ISO's Request issued by the ISO under the Conditions of Must-Run Agreement.

H 3.42 **RR_{nmu}** **($)**

The amount received by the ISO from Scheduling Coordinators in month m for Replacement Reserve capacity held on Reliability Must-Run Unit u located in the Service Area of Participating TO n pursuant to a Dispatch Notice or ISO's Request issued by the ISO under the Conditions of Must-Run Agreement.

H 3.43 **VS_{ntu}** **($)**

The amount received by the ISO from Scheduling Coordinators in month m for additional Voltage Support provided by Reliability Must-Run Unit u located in the Service Area of Participating TO n pursuant to a Dispatch Notice or ISO's Request issued by the ISO under the Conditions of Must-Run Agreement.

H 3.44 **Total $RMRC_{nm}$** **($)**

The total Reliability Must-Run charge payable by Participating TO n for month m for Reliability Must-Run services from Reliability Must-Run Units located in the Participating TO n Service Area.

H 4 **Data Input/Output**

Term	Units	Variable Name	Input or Output	Detail Required
$RMRPayA_{uom}$	$	RMR Unit Payment under A	Output	By Unit
RPR_{uot}	$/MWh	Reliability Payment Rate	Input	By Unit By Settlement Period

Term	Units	Variable Name	Input or Output	Detail Required
E_{uot}	MWh	Non-Market Transaction Energy Delivered	Input	By Unit By Settlement Period
EM_{uot}	lb.	Emissions Produced	Input	By Unit By Settlement Period
ER_{uot}	$/lb.	Emissions rate	Input	By Unit By Settlement Period
$HVO\&M_{uot}$	$/MWh	Variable O&M Rate	Input	By Unit By Settlement Period
$SCAC_{uot}$	$	SC Admin. Charge	Input	By Unit
HOF_{uom}	$	Hourly Operating Fuel Costs	Input	By Unit
$SUFC_{uom}$	$	Startup Fuel Costs	Input	By Unit
$SUPC_{uom}$	$	Startup and Shutdown Power Costs	Input	By Unit
$OSUC_{uom}$	$	Shutdown Power Costs	Input	By Unit
AGC_{uot}	$	Regulation Payment due	Input	By Unit By Settlement Period
SR_{uot}	$	Spinning Reserve Payment due	Input	By Unit By Settlement Period
NSR_{uot}	$	Non-Spinning Reserve Payment due	Input	By Unit By Settlement Period

Term	Units	Variable Name	Input or Output	Detail Required
RR_{uot}	$	Replacement Reserve Payment due	Input	By Unit By Settlement Period
VS_{uot}	$	Voltage Support Payment due	Input	By Unit By Settlement Period
ASPDP	$/MWh	Ancillary Service Pre-empted Dispatch Payment	Input	By Unit By Settlement Period
EA_{uot}	MWh	Energy Requested DA and HA	Input	By Unit By Settlement Period
SCP_{uot}	$	Scheduling Coordinator's Energy Price	Input	By Unit By Settlement Period
SCASCP	$/MW	Scheduling Coordinator's Ancillary Service Capacity Price	Input	By Unit By Settlement Period
SCASEP	$/MWh	Scheduling Coordinator's Ancillary Service Energy Price	Input	By Unit By Settlement Period
ER_{uot}	MWh	Energy Requested in Real Time	Input	By Unit By Settlement Period
P_{xuot}	$/MWh	Zonal Hourly Ex Post Price for Uninstructed Imbalance Energy	Input	By Unit By Settlement Period
$RMRPayTotalA_{om}$	$	Total RMR Payment under A	Output	
OPA_{om}	$	Other A Payment	Input	
IAA	$	Interest on adjustments	Input	

Term	Units	Variable Name	Input or Output	Detail Required
IDA	$	Interest on unpaid and disputed amounts	Input	
$RMRPayB_{uom}$	$	RMR Unit Payment under B	Output	By Unit
AP_{uot}	MWh	Availability Payment	Input	By Unit By Settlement Period
PXM_t	$/MWh	PX Market Clearing Price	Input	
EMT_{uot}	MWh	Market Transaction Energy	Input	By Unit By Settlement Period
$RMRPayTotalB_{om}$	$	Total RMR Payment under B	Output	
OPB_{om}	$	Other B Payment	Input	
IAB	$	Interest on adjustments	Input	
IDB	$	Interest on unpaid and disputed amounts	Input	
$RMRPayC_{uom}$	$	RMR Unit Payment under C	Output	By Unit
$RMRPayTotalC_{om}$	$	Total RMR Payment under C	Output	
OPC_{om}	$	Other C Payment	Input	
IAC	$	Interest on adjustments	Input	
IDC	$	Interest on unpaid or disputed amounts	Input	
$RMRC_{nmu}$	$	RMR Charge per Unit	Output	By Unit
$RMRPay_{nmu}$	$	RMR Unit Payments	Input	By Unit

Term	Units	Variable Name	Input or Output	Detail Required
Total $RMRC_{nm}$	$	Total RMR Charge	Output	

APPENDIX I

DRAFT SAMPLE OF INVOICE

Independent System Operator

MARKET INVOICE

CUSTOMER 1
101 N. Harbor Blvd.
Anaheim CA 92808

Invoice: 181
Date: 20-JUN-97
Customer Number: 1000

Please send payment to:

1000 South Fremont Avenue
Building A-11
Alhambra CA 91803

For all inquiries contact:
1-800-ISO-HELP

Comments:

Charges settlement date: 20-JUN-97 to 20-JUN-97

Charge Type	Description	Amount
0001	0001-Day-Ahead Spinning Reserve due SC	-$845.00
0002	0002-Day-Ahead Non-Spinning Reserve due SC	-$1,025.00
0003	0003-Day-Ahead AGC/Regulation due SC	-$1,025.00
0004	0004-Day-Ahead Replacement Reserve due SC	-$1,385.00
0051	0051-Hour-Ahead Spinning Reserve due SC	-$1,565.00
0052	0052-Hour-Ahead Non-Spinning Reserve due SC	-$1,745.00
0053	0053-Hour-Ahead AGC/Regulation due SC	-$1,925.00
0054	0054-Hour-Ahead Replacement Reserve due SC	-$2,105.00
0101	0101-Day-Ahead Spinning Reserve due ISO	$22,075.00
0102	0102-Day-Ahead Non-Spinning Reserve due ISO	$23,935.00
0103	0103-Day-Ahead AGC/Regulation due ISO	$25,795.00
0104	0104-Day-Ahead Replacement Reserve due ISO	$27,655.00
0251	0251-Hour-Ahead Intra-Zonal Congestion Settlement due ISO	$385.00
0252	0252-Hour-Ahead Intra-Zonal Congestion Charge/Refund due ISO	$4,925.00
0253	0253-Hour-Ahead Inter-Zonal Congestion Settlement due ISO	$5,285.00
0301	0301-Ex-Post A/S Energy due SC	-$6,005.00
0302	0302-Ex-Post Supplemental Reactive Power due SC	-$6,365.00
0303	0303-Ex-Post Replacement Reserve due ISO (Dispatched)	$6,725.00
0304	0304-Ex-Post Replacement Reserve due ISO (Undispatched)	$7,085.00
Invoice Total		