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:

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

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 the ISO procures Replacement Reserves on a Zonal basis in the Day-Ahead Market the ISO will allocate the Replacement Reserve capacity Charges (both Dispatched and Un-Dispatched) on a Zonal basis. If the ISO procures Replacement Reserves on a ISO Control Area-wide basis in the Day Ahead Market the ISO will allocate the Replacement Reserve capacity Charges (both Dispatched and Un-Dispatched) on a ISO Control Area-wide basis (irrespective of whether any additional Replacement Reserves are procured on a Zonal basis 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

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 Instructed Imbalance 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 Instructed Imbalance 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 Uninstructed 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 **$SpinReceiveHA_{ljxt}$ - \$**

The payment from Scheduling Coordinator j for buying back from the ISO in the Hour-Ahead, Spinning Reserve capacity which the

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

Deviations in real time ordered by the ISO for purposes such as Congestion Management.

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.

In the Hour-Ahead Market:

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

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:

$$PayUCTO_{ntd} = \sum_{y} \mu_{ytd} * K_{yn} * L_{ytd}$$

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:

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

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 Scheduling Coordinators 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:

(a)   Participating TOs and FTR Holders will be charged for the Usage Charge payments they received for the relevant Trading Interval t in the Day-Ahead Market with respect to the reduced interface limits;

(b)   Any Scheduling Coordinator whose Schedule was adjusted for the relevant Trading Interval t in the Hour-Ahead Market due to the reduced interface limits will be credited with μ_{yth} for each MW of the adjustment; and

(c)   Each Scheduling Coordinator will be charged an amount equal to it proportionate share, based on Schedules in the Day-Ahead Market in the direction of Congestion, of the difference between $\mu_{yth}(L_{yth}$ - $L_{ytd})$ and the total amount charged to Participating TOs and FTR Holders in accordance with item (a) above.

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.

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:

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

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:

$$RMR\ PayTotal\ A_{om} = \sum_u RMRPayA_{uom} + OPA_{om} + IAA_{om} + IDA_{om}$$

(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:

$$RMR\ Pay\ B_{uom} = \sum_m \left[AP_{uot} + (EM_{uot} * EMR_{uot}) + (E_{uot} * HVO\&M_{uot}) + (SCAC_{uot}) \right]$$

$$+ HOF_{uom} + SUFC_{uom} + SUPC_{uom} + OSUC_{uom} +$$

$$\sum_m \left[ASPDP_{uot} + VS_{uot} \right]$$

$$- 0.9 * \sum_m \left[EMT_{uot} * PXM_t \right] - \sum_m \left[EA_{uot} * SCP_{uot} \right]$$

$$- \sum_m \left[SCASCP_{uot} \right] - \sum_m \left[SCASEP_{uot} \right] - \sum_m \left[ER_{uot} * P_{xuot} \right]$$

$$+ \sum_m \left[(ER_{uot} - E_{uot}) * P_{xuot} \right]$$

The total payment to each Owner for Reliability Must-Run services under Agreement 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:

$$RMR\ PayTotal\ B_{om} = \sum_u RMRPayB_{uom} + OPB_{om} + IAB_{om} + IDB_{om}$$

(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:

$$RMR\ Pay\ C_{uom} = \sum_{m} \left[AP_{uot} + \left(EM_{uot} * EMR_{uot} \right) + \left(E_{uot} * HVO\&M_{uot} \right) + \left(SCAC_{uot} \right) \right]$$

$$+ HOF_{uom} + SUFC_{uom} + SUPC_{uom} + OSUC_{uom}$$

$$+ \sum_{m} \left[VS_{uot} \right] - \sum_{m} \left[EA_{uot} * SCP_{uot} \right]$$

$$- \sum_{m} \left[SCASCP_{uot} \right] - \sum_{m} \left[SCASEP_{uot} \right] - \sum_{m} \left[ER_{uot} * P_{xuot} \right]$$

$$+ \sum_{m} \left[\left(ER_{uot} - E_{uot} \right) * P_{xuot} \right]$$

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   **EMR$_{uot}$**   **($/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.

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
EMR_{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