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 2.1.1 Uninstructed Imbalance Energy Charges on Scheduling Coordinators

Uninstructed Imbalance Energy attributable to each Load Take-Out Point, Generating Unit, System Unit, or System Resource for which a Scheduling Coordinator has a Final Hour-Ahead Schedule or Metered Quantity, for each Settlement Interval shall be deemed to be sold or purchased, as the case may be, by the ISO and charges or payments for Uninstructed Imbalance Energy shall be settled by debiting or crediting, as the case may be, the Scheduling Coordinator with an amount for each Settlement Interval.

Uninstructed Imbalance Energy within a Settlement Interval shall be settled in two tiers that are defined in relation to the expected Energy associated with the Final Hour-Ahead Schedule, if any, and the Dispatch Instruction as follows:

1) Deviations from the expected Energy associated with a Dispatch Instruction resulting in: 1) under delivery of Instructed Imbalance Energy that is also equal to or greater than the Final Hour-Ahead Schedule, or 2) over delivery of Instructed Imbalance Energy that is also less than or equal to the Final Hour-Ahead Schedule constitutes tier 1 Uninstructed Imbalance Energy that shall be settled at a Resource-Specific Settlement Interval Ex Post Price as described in Appendix D 2.4.

2) Deviations from the expected Energy associated with a Dispatch Instruction resulting in: 1) over delivery of Instructed Imbalance Energy that is also greater than the Final Hour-Ahead Schedule, or 2) under delivery of Instructed Imbalance Energy that is also less than the Final Hour-Ahead Schedule constitutes tier 2 Uninstructed Imbalance Energy and shall be settled at the Zonal Settlement Interval Ex Post Price as described in Appendix D 2.5.

Imbalance Energy is calculated as follows:

Generator Calculation for ISO Metered Entities:

$$IE_{i,h,o} = ME_{i,h,o} - SE_{i,h,o}$$

Load Calculation:

$$IE_{i,h,o} = SE_{i,h,o} - ME_{i,h,o}$$

System Resource Calculation:

$$IE_{i,h,o} = \sum_{1}^{k}\sum_{1}^{v} REAL\_TIME\_FLOW_{i,h,o,k,v} - SE_{i,h,o}$$

where,

$$SE_{i,h,o} = \frac{HAfin_{i,h}}{6}$$

$ME_{i,h,o}$ actual Meter Data for each resource *i* of each Settlement Interval *o* for each hour *h*.

Uninstructed Imbalance Energy is calculated as follows:

$$UIE_{i,h,o} = E_{i,h,o} - IIE\_REG_{i,h,o}$$

where:

$$E_{i,h,o} = IE_{i,h,o} - \sum_{1}^{k} IIE\_LOSS_{i,h,o,k} - \sum_{1}^{k} IIE\_ML_{i,h,o,k} - \sum_{1}^{k}\sum_{1}^{m} IIE\_PREDISPATCH_{i,h,o,k,m} - \sum_{1}^{k} RE\_STANDARD_{i,h,o,k} - \sum_{1}^{k} RED_{i,h,o,k} - \sum_{1}^{k}\sum_{1}^{m} IIE\_ECON_{i,h,o,k,m} - \sum_{1}^{k}\sum_{1}^{L} OOS\_P_{i,h,o,k,L} - \sum_{1}^{k}\sum_{1}^{L} OOS\_N_{i,h,o,k,L} - \sum_{1}^{k}\sum_{1}^{m} RIE_{i,h,o,k,m} - \sum_{1}^{k} IIE\_RERATE_{i,h,o,k}$$

$IIE\_REG_{i,h,o}$ is the Regulating Energy for resource *i* during Settlement Interval *o* in hour *h*

$$UIE\_1_{i,h,o} = \begin{cases} \min\left(UIE_{i,h,o}, -\min\left(0, \sum_{1}^{k}\sum_{1}^{m} IIE\_ECON_{i,h,o,k,m} + \sum_{1}^{k}\sum_{1}^{m} IIE\_PREDISPATCH_{i,h,o,k,m} \right.\right. \\ \quad + \sum_{1}^{k}\sum_{1}^{L} OOS\_P_{i,h,o,k,L} + \sum_{1}^{k}\sum_{1}^{L} OOS\_N_{i,h,o,k,L} + \sum_{1}^{k} RED_{i,h,o,k} & \therefore UIE_{i,h,o} \geq 0 \\ \quad \left.\left. + \sum_{1}^{k} IIE\_LOSS_{i,h,o,k} + \sum_{1}^{k}\sum_{1}^{m} RIE_{i,h,o,k,m} + \sum_{1}^{k} IIE\_ML_{i,h,o,k} + \sum_{1}^{k} RERATE_{i,h,o,k} \right)\right) \\ \max\left(UIE_{i,h,o}, -\max\left(0, \sum_{1}^{k}\sum_{1}^{m} IIE\_ECON_{i,h,o,k,m} + \sum_{1}^{k}\sum_{1}^{m} IIE\_PREDISPATCH_{i,h,o,k,m} \right.\right. \\ \quad + \sum_{1}^{k}\sum_{1}^{L} OOS\_P_{i,h,o,k,L} + \sum_{1}^{k}\sum_{1}^{L} OOS\_N_{i,h,o,k,L+} + \sum_{1}^{k} RED_{i,h,o,k} & \therefore UIE_{i,h,o} < 0 \\ \quad \left.\left. + \sum_{1}^{k} IIE\_LOSS_{i,h,o,k} + \sum_{1}^{k}\sum_{1}^{m} RIE_{i,h,o,k,m} + \sum_{1}^{k} IIE\_ML_{i,h,o,k} + \sum_{1}^{k} RERATE_{i,h,o,k} \right)\right) \end{cases}$$

$$UIE\_2_{i,h,o} = UIE_{i,h,o} - UIE\_1_{i,h,o}$$

$$UIEC_{i,h,o} = \left(-1 * UIE\_1_{i,h,o} * STLMT\_PRICE_{i,h,o}\right) + \left(-1 * UIE\_2_{i,h,o} * ZONAL\_EX\_POST\_PRICE_{j,h,o}\right)$$

D 2.1.2 Instructed Imbalance Energy Charges on Scheduling Coordinators

Standard Ramping Energy is Energy associated with a Standard Ramp and shall be deemed delivered and settled at a price of zero dollars per MWh.

Ramping Energy Deviation is Energy produced or consumed due to hourly schedule changes in excess of Standard Ramping Energy and shall be paid or charged, as the case may be, at a Resource-Specific Settlement Interval Ex Post Price calculated using the applicable Dispatch Interval Ex Post Prices as described in this Appendix D 2.4. For Scheduling Coordinators scheduling a MSS that has elected to follow its Load, this Ramping Energy Deviation will account for the units following Load.

Ramping Energy Deviation shall be settled as an explicit component of Instructed Imbalance Energy for each resource *i* in Dispatch Interval *k* of Settlement Interval *o* for hour *h*, and calculated as follows:

$$REDC_{i,h,o} = \left(\sum_{1}^{k} RED_{i,h,o,k} \right) * STLMT\_PRICE_{i,h,o}$$

The amount of Instructed Imbalance Energy that will be deemed delivered in each Dispatch Interval will be based on Dispatch Instructions, as provided for in Section 2.5.22.6, and Final Hour-Ahead Schedules. The amount of Instructed Imbalance Energy to be settled in a Settlement Interval will be equal to the sum of all Instructed Imbalance Energy for all Dispatch Intervals within the relevant Settlement Interval. Instructed Imbalance Energy for each Settlement Interval shall be settled at the relevant Resource Specific Settlement Interval Ex Post Price. Generating Units, Participating Loads, and System Units may be eligible to recover their Energy Bid costs in accordance with Section 11.2.4.1.1.1. Instructed Imbalance Energy from System Resources shall be settled in accordance with Section 11.2.4.1.1.2.

The Instructed Imbalance Energy amount for each resource *i* in Settlement Interval *o* for hour *h* shall be determined as follows:

$$IIEC_{i,h,o} = \left(\begin{array}{l} \sum_{1}^{k} \sum_{1}^{m} IIE\_ECON_{i,h,o,k,m} + \sum_{1}^{k} \sum_{1}^{m} IIE\_PREDISPATCH_{i,h,o,k,m} + \sum_{1}^{k} \sum_{1}^{m} RIE_{i,h,o,k,m} + \\ \sum_{1}^{k} IIE\_RERATE_{i,h,o,k} + \sum_{1}^{k} IIE\_ML_{i,h,o,k} \end{array} \right)$$

$$* STLMT\_PRICE_{i,h,o} * (-1) + IIEC\_OOS_{i,h,o} + REDC_{i,h,o} + IIEC\_REG_{i,h,o}$$

Uninstructed Imbalance Energy is Imbalance Energy due to non-compliance with a Dispatch Instruction and shall be settled as provided for in SABP Appendix D Section 2.1.1.

D 2.2 Unaccounted for Energy Charge

The Unaccounted for Energy Charge on Scheduling Coordinator *g* in Settlement Interval *o* of Settlement Period *h* for each relevant Zone *j* is calculated in the following manner:

The UFE for each utility Service Area *s,* for which separate UFE calculation is performed, is calculated as follows,

$$UFE_{UDC,s,h,o} = \sum_{q \in UDC_s} I_{a,q,j,h,o} - \sum_{q \in UDC_s} E_{a,q,j,h,o} + \sum_{i \in UDC_s} G_{a,i,j,h,o} - \sum_{i \in UDC_s} L_{a,i,j,h,o} - TL_{s,h,o}$$

The Transmission Loss $TL_{s,h,o}$ in Settlement Interval *o* of Settlement Period *h* for utility Service Area *s* is calculated as follows:

$$TL_{s,h,o} = \left(\sum_i \left[G_{a,i,j,h,o} * (1 - GMM_{a,i,h}) \right] + \sum_q \left[I_{a,q,j,h,o} * (1 - GMM_{a,q,h}) \right] \right) * \frac{PFL_{s,h}}{\sum_s PFL_{s,h}}$$

Where $PFL_{s,h}$ are the Transmission Losses for utility Service Area *s* as calculated by a power flow solution for Settlement Period *h*, consistent with the calculation of final forecasted Generation Meter Multipliers.

Each metered demand point *z* in utility Service Area *s*, either ISO grid connected or connected through UDC *s*, is allocated a portion of the UFE as follows:

$$UFE_{i,j,h,o} = UFE_{UDC,s,h,o} * \frac{L_{i,j,h,o}}{\sum_{i \in UDC_s} L_{i,j,h,o}}$$

The UFE charge for Scheduling Coordinator *g* for Settlement Interval *o* of Settlement Period *h* in Zone *j* is calculated as a charge or payment using the applicable Zonal Settlement Interval Ex Post Price as follows:

$$UFEC_{g,j,h,o} = \left(\sum_{i \in SCg} UFE_{i,j,h,o,} \right) * ZONAL\_EX\_POST\_PRICE_{j,h,o}$$

D 2.3 Hourly Ex Post Price

The Hourly Ex Post Price is the Energy-weighted average of the Dispatch Interval Ex Post Prices in each Zone *j* during each Settlement Period using the absolute value of Instructed Imbalance Energy procured from all Participating Generators, Participating Load, System Units, and System Resources in each applicable Dispatch Interval. The Hourly Ex Post Price may vary between Zones if Congestion is present.

$$HP_{j,h} = \frac{\sum_{1}^{p}\sum_{1}^{i}\left|IIE\_TOTAL_{j,i,h,p}\right| * EX\_POST\_PRICE_{j,h,o,p}}{\sum_{1}^{p}\sum_{1}^{i}\left|IIE\_TOTAL_{j,i,h,p}\right|}$$

where,

p is the Dispatch Interval index for hour *h*.

D 2.4 Resource-Specific Settlement Interval Ex Post Price

The Resource-Specific Settlement Interval Ex Post Price is the weighted-average of the Dispatch Interval Ex Post Prices in each Settlement Interval using the Instructed Imbalance Energy from the respective Participating Generator, Participating Load, or System Resource, in each applicable Dispatch Interval. If there is no Instructed Imbalance Energy from a Participating Generator, Participating Load, or System Resource, in any of the applicable Dispatch Intervals, the Resource-Specific Settlement Interval Ex Post Price for that resource would be the simple average of the applicable Dispatch Interval Ex Post Prices in the Settlement Interval.

The Resource-Specific Settlement Interval Ex Post Price is calculated as follows:

$$STLMT\_PRICE_{i,h,o} = \frac{\sum_{1}^{k} IIE\_TOTAL_{i,h,o,k} * EX\_POST\_PRICE_{j,h,o,k}}{\sum_{1}^{k} IIE\_TOTAL_{i,h,o,k}}$$

Where:

$$IIE\_TOTAL_{i,h,o,k} = \sum_{1}^{m} IIE\_ECON_{i,h,o,k,m} + \sum_{1}^{m} IIE\_PREDISPATCH_{i,h,o,k,m} + IIE\_ML_{i,h,o,k} + \sum_{1}^{m} RIE_{i,h,o,k,m} + \sum_{1}^{L} OOS\_P_{i,h,o,k,L} + \sum_{1}^{L} OOS\_N_{i,h,o,k,L} + IIE\_LOSS_{i,h,o,k} + RED_{i,h,o,k} + \sum_{1}^{k} IIE\_RERATE_{i,h,o,k}$$

D 2.5 Zonal Settlement Interval Ex Post Price

The Zonal Settlement Interval Ex Post Price is the weighted-average of the Dispatch Interval Ex Post Prices in each Settlement Interval using the absolute value of Instructed Imbalance Energy procured from all Participating Generators, Participating Load, System Units, and System Resources in each applicable Dispatch Interval. If there is no Instructed Imbalance Energy from a Participating Generator, Participating Load, or System Resource, in any of the applicable Dispatch Intervals, the Zonal Settlement Interval Ex Post Price for that Zone would be the simple average of the applicable Dispatch Interval Ex Post Prices in the Settlement Interval.

The Zonal Settlement Interval Ex Post Price is calculated as follows:

$ZONAL\_EX\_POST\_PRICE_{j,h,o} =$

$$\frac{\sum_{p=1}^{2}\sum_{1}^{i}\left|IIE\_TOTAL_{i,h,p}\right| * EX\_POST\_PRICE_{j,h,o,p}}{\sum_{p=1}^{2}\sum_{1}^{i}\left|IIE\_TOTAL_{i,h,p}\right|}$$

where p is the Dispatch Interval index for hour h.

D 2.6 Calculation of Unrecovered Cost Payment for Generating Units, System Units, Dynamically Scheduled System Resources, and Curtailable Demand.

As set forth in 11.2.4.1.1.1, Generating Units, System Units, dynamically scheduled System Resources, and Curtailable Demand resources will be eligible to recover their bid costs (less than or equal to the Maximum Bid Level) for extra-marginal Energy dispatched above Pmin, if such costs are not recovered from the net of expected revenues earned through participation in the ISO's Real Time Market during the Trade Day (24-hour period).

The Unrecovered Cost Payment for each resource i shall be determined for the Trade Day *d* then evenly divided over n-Settlement Intervals as follows:

$COST\_RECOVERY_{i,d} =$

$$min(0, \sum_{1}^{h} \sum_{1}^{o} \left(MR\_DEFICIT_{i,h,o} + MR\_SURPLUS_{i,h,o} \right))$$

where,

$MR\_DEFICIT_{i,h,o}$ = Market Revenue deficit for resource i in hour h for Settlement interval o based on the difference between the expected revenues earned in the Settlement Interval and and/or its bid cost;$MR\_SURPLUS_{i,h,o}$= Market Revenue surplus for resource i in hour h for Settlement interval o based on the difference between the expected revenues earned in the Settlement Interval and/or its bid cost.

Resource i shall receive a share of its total cost recovery in each Settlement Interval o that is included in the $COST\_RECOVERY_{i,d}$ calculation.

$COST\_RECOVERY_{i,h,o} = COST\_RECOVERY_{i,d} / n$

where,

n is the number of Settlement Intervals o that are included in the $COST\_RECOVERY_{i,d}$ calculation for resource i in Trade Day d.

Calculation of Market Revenue Surplus or Deficit

The market revenue surplus or deficit for each resource i will be computed for each Settlement Interval o based on the difference between the revenues earned in the Settlement Interval at the relevant 10-minute Ex Post price and the resource's bid cost (less than or equal to the Maximum Bid Level) as follows:

$$MR\_DIFF_{i,h,o} = \left(\sum_{1}^{k}\sum_{1}^{m} IIE\_ECON_{i,h,o,k,m} + \sum_{1}^{k}\sum_{1}^{m} RIE_{i,h,o,k,m}\right) * STLMT\_PRICE_{i,h,o} - BID\_COST_{i,h,o} - BID\_COST\_RIE_{i,h,o}$$

for all incremental energy bid segments *m* with $IIE\_PRICE_{i,h,o,k,m}$ and $RIE\_PRICE_{i,h,o,k,m}$ less than or equal to the Maximum Bid Level and all decremental energy bid segments *m* with $IIE\_PRICE_{i,h,o,k,m}$ and $RIE\_PRICE_{i,h,o,k,m}$ greater than or equal to the Bid Floor.

$MR\_DEFICIT_{i,h,o} = \min(0, MR\_DIFF_{i,h,o})$

$MR\_SURPLUS_{i,h,o} = \max(0, MR\_DIFF_{i,h,o})$

where,

$$BID\_COST_{i,h,o} = \left(\sum_{1}^{k}\sum_{1}^{m} IIE\_ECON_{i,h,o,k,m} * IIE\_PRICE_{i,h,o,k,m}\right)$$

$$BID\_COST\_RIE_{i,h,o} = \sum_{1}^{k}\sum_{1}^{m} RIE_{i,h,o,k,m} * RIE\_PRICE_{i,h,o,k,m}$$

D 2.6.1 Tolerance Band and Performance Check

The ISO shall determine the Tolerance Band for each Settlement Interval *o* for PGA resources and dynamically scheduled System Resources based on the data from the Master File as follows:

$$TOLERANCE\_BAND_{i,h,o} = \pm \max(FIX\_LIM, TOL\_PERCENT * P\max_i) / 6$$

where,
FIX_LIM is a fixed MW limit and is initially equal to 5 MW.
TOL_PERCENT is a fixed percentage and is initially equal to 3%.$Pmax_i$ is the maximum operating capacity in MW of resource *i* specified in the Master File.

The ISO shall determine the Tolerance Band for each Settlement Interval o *for PLA resources as follows*:

$$TOLERANCE\_BAND_{i,h,o} = \pm \max(FIX\_LIM, TOL\_PERCENT * HAfin_{i,h}) / 6$$

where $HAfin_{i,h}$ *is the* Final Hour Ahead Energy Schedule.

Resources must operate within their relevant Tolerance Band in order to receive any above-Ex Post Price payments. The ISO shall determine the performance status of the resource for each Settlement Interval o.

A resource shall have met its performance requirement if its $UIE_{i,h,o}$ is within its relevant Tolerance Band. A resource meeting its performance requirement in Settlement Interval o will have a $PERF\_STAT_{i,h,o} = 1$. A resource that has not met its performance requirement in Settlement Interval *o* will have a $PERF\_STAT_{i,h,o} = 0$.

Must-offer resources that produce a quantity of Energy above Minimum Load due to an ISO Dispatch Instruction during a Waiver Denial Period are not subject to the Tolerance Band requirement for purposes of receiving Minimum Load Cost Compensation, as defined in section 5.11.6.1.1. Accordingly, the $PERF\_STAT_{i,h,o}$ for eligible must-offer resources, as defined in section 5.11.6.1.1, shall be set to 1, irrespective of deviations outside of the Tolerance Band, for the purpose of determining eligibility for Minimum Load Cost Compensation during a Waiver Denial Period. The Tolerance Band shall be used to apply UDP during a Waiver Denial Period.

Non-dynamically scheduled System Resources do not have a Tolerance Band. Non-Participating Load Agreement (PLA) load resources are not subject to the performance requirement.

D 2.6.2 Unrecovered Costs Neutrality Allocation

For each Settlement Interval *o*, the total Unrecovered Costs for Trade Day *d* shall be allocated pro-rata to each Scheduling Coordinator *g* based on its Metered Demand, calculated as follows:

$URC\_ALLOC_{g,h,o} = M_{g,h,o} * Per\ Unit\ Price$

where,

$M_{g,h,o}$ = the Metered Demand in the ISO control area for Scheduling Coordinator *g* in Settlement Interval *o* for hour *h*;

$$Per\ Unit\ Price = \frac{-1 * \sum_{1}^{i} COST\_RECOVERY_{i,h,o}}{\sum_{1}^{g} M_{g,h,o}}$$

D 2.6.3 Calculation of Unrecovered Cost Payment for System Resources

As set forward in Section 11.2.4.1.1.2, System Resources that are dispatched and deliver hourly-predispatched Instructed Imbalance Energy will be paid the higher of the simple average of the twelve Dispatch Interval Ex Post prices for the hour or their Energy bid costs for the quantity of Energy delivered in each hour. The determination of the hourly uplift payment shall be determined as follows: (1) Market deficits or surpluses are calculated as the difference between the resource-specific price and the resource's (hourly) bid cost; (2) An hourly uplift payment will be determined for any amount less than zero;

(3) This hourly amount will then be divided evenly by the relevant number of *n*-Settlement Intervals and paid this portion for each Settlement Interval of the hour.

The hourly-predispatched uplift payment is calculated as follows:

$$PREDISPATCH\_UPLIFT_{i,h} = \min\left(0, \sum_{1}^{o}\left(\left(\sum_{k=1}^{2}\sum_{1}^{m} IIE\_PREDISPATCH_{i,h,o,k,m}\right) * STMLT\_PRICE_{i,h,o} - \left(\sum_{k=1}^{2}\sum_{1}^{m} IIE\_PREDISPATCH_{i,h,o,k,m} * IIE\_PRICE_{i,h,o,k,m}\right)\right)\right)$$

$$PREDISPATCH\_PMT_{i,h,o} = PREDISPATCH\_UPLIFT_{i,h} / n$$

where,
n is the relevant number of Settlement Intervals *o* in the relevant hour *h* for resource *i.*

for the portion of incremental energy bid segments with $IIE\_PRICE_{i,h,o,k,m}$ less than or equal to the Maximum Bid Level and all decremental energy bid segments with $IIE\_PRICE_{i,h,o,k,m}$ greater than or equal to the Bid Floor.

D 2.6.4 Allocation of Unrecovered Cost Payments for Hourly Pre-dispatched System Resources

For each Settlement Interval *o*, the total uplift payments ($PREDISPATCH\_PMT_{i,h,o}$) for all hourly pre-dispatched System Resources will be included in the Excess Cost Payments to be allocated to a Scheduling Coordinator's Net Negative Deviation through allocation of excess costs and/or ISO metered Demand through excess cost neutrality allocation.

D 2.6.5 Excess Cost Payments for Instructed Incremental Energy Bids above the Maximum Bid Level

Incremental Instructed Imbalance Energy above the Maximum Bid Level will receive an additional Excess Cost Payment subject to operating within a resource's Tolerance Band.

Excess cost payments are calculated as follows:

$$EXCESS\_COST_{i,h,o} = \left[\left(\sum_{1}^{k}\sum_{1}^{m} IIE\_ECON_{i,h,o,k,m} + \sum_{1}^{k}\sum_{1}^{m} IIE\_PREDISPATCH_{i,h,o,k,m} + \sum_{1}^{k}\sum_{1}^{m} RIE_{i,h,o,k,m}\right) * STLMT\_PRICE_{i,h,o} - BID\_COST_{i,h,o} - BID\_COST\_RIE_{i,h,o}\right] * PERF\_STAT_{i,h,o}$$

for the portion of energy bid segments with $IIE\_PRICE_{i,h,o,k,m}$ and $RIE\_PRICE_{i,h,o,k,m}$ greater than the Maximum Bid Level.

D 2.7 Transmission Loss Obligation

The transmission loss obligation charge shall be determined as follows:
For Generators:

$TL_{i,h,o} = ME_{i,h,o} * (1 – GMMa_h)$

For System Resources, the transmission loss obligation shall be determined as follows:

$TL_{i,h,o}$ =

$$\sum_{1}^{k}\sum_{1}^{v} REAL\_TIME\_FLOW_{i,h,o,k,v} * (1 - GMMa_h)$$

The transmission loss charge will be calculated based on the following formulation:

$TLC_{i,h,o}$ =

$$-\sum_{1}^{k} IIE\_LOSS_{i,h,o,k} * STLMT\_PRICE_{i,h,o} + TL_{i,h,o} * STLMT\_PRICE_{i,h,o}$$

D 2.8 Uninstructed Deviation Penalty Charges

The ISO will calculate but not assess charges for UDP according to this Section 2.8 until the first day of the month two months after the software that calculates UDP is put into service.

For negative Uninstructed Deviation Penalty billable quantities where $UDP\_BQ_{h,o} < 0$ and $ZONAL\_EX\_POST\_PRICE_{j,h,o} > 0$,
$UDP\_NEG\_Amt_i\ AMT_{i\,h,o}$ =
-1 * $UDP\_BQ_{i,h,o}$ * $ZONAL\_EX\_POST\_PRICE_{j,h,o}$ * .5

For positive UDP billable quantities where $UDP\_BQ_{i,h,o} > 0$ and $ZONAL\_EX\_POST\_PRICE_{j,h,o} > 0$, then
$UDP\_POS\_AMT_{i,h,o} = UDP\_BQ_{i,o,h} * ZONAL\_EX\_POST\_PRICE_{j,h,o}$

where,

$UDP\_BQ_{i,o,h}$ is the Uninstructed Deviation Penalty (UDP) billable quantity in MWh for a resource, or aggregated resource, denoted by i for Settlement Interval *o* of hour *h.*

$UDP\_POS\_AMT_{i,o,h}$ or $UDP\_NEG\_AMT_{i,o,h}$ are the penalty amounts in Dollars for either an aggregated or individual resource *i* for Settlement Interval *o* of hour *h.*

The ISO will not calculate UDP settlement amounts for Settlement Intervals when the corresponding Zonal Settlement Interval Ex Post Price is negative or zero.

For an MSS that has elected to follow its own Load, the Scheduling Coordinator for the MSS Operator will be assessed the Uninstructed Deviation Penalty charges based on the Deviation Band and Deviation Price in Section 23.12.2 of the ISO Tariff.

D 2.9 Minimum Load Cost Compensation

The ISO shall calculate a Must-Offer Generator's Minimum Load Cost Compensation (MLCC), pursuant to section 5.11.6.1.1 of the ISO Tariff, as the Minimum Load Cost for each resource *i* during Settlement Interval *o* of hour *h,* as defined in section 5.11.6.1.2 of the ISO Tariff.

D 3 Meaning of terms in the formulae

D 3.1 [Not Used]

D 3.2 **[Not Used]**

D 3.3 **[Not Used]**

D 3.4 **[Not Used]**

D 3.5 **[Not Used]**

D 3.6 **[Not Used]**

D 3.6.1 **[Not Used]**

D 3.6.2 **[Not Used]**

D 3.6.3 **[Not Used]**

D 3.7 **$G_{a,i,j,h,o}$ – MWh**

The total actual metered Generation of Generator i in Zone j during Settlement Interval o during Settlement Period h.

D 3.8 **[Not Used]**

D 3.9 **[Not Used]**

D 3.9.1 **[Not Used]**

D 3.10 **[Not Used]**

D 3.11 **[Not Used]**

D 3.12 **$GMM_{a,i,h}$ – fraction**

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

D 3.13 **$GMM_{a,j,h}$ – fraction**

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

D 3.14 **[Not Used]**

D 3.15 **$L_{a,i,j,h,o}$ – MWh**

The actual metered Demand of Demand i in Zone j in Settlement Interval o during Settlement Period h.

D 3.15.1 **[Not Used]**

D 3.15.2 **[Not Used]**

D 3.16 **[Not Used]**

D 3.17 **[Not Used]**

D 3.17.1 **[Not Used]**

D 3.18 **[Not Used]**

D 3.19 **$I_{a,q,j,h,o}$ – MWh**

The total actual Energy import of Scheduling Coordinator g through Scheduling Point q in Settlement Interval o during Settlement Period h. This is deemed to be equal to the scheduled Energy over the same interval.

D 3.20 **[Not Used]**

D 3.21 [Not Used]

D 3.22 [Not Used]

D 3.23 **$E_{a,q,j,h,o}$ – MWh**

The total actual Energy export of Scheduling Coordinator g through Scheduling Point q in Settlement Interval o for Settlement Period *h*. This is deemed to be equal to the total scheduled Energy export during the same interval.

D 3.24 **[Not Used]**

D 3.25 **[Not Used]**

D 3.25.1 **[Not Used]**

D 3.26 **$UFEC_{jxt}$ – $**

The Unaccounted for Energy Charge for Scheduling Coordinator j in Zone x in Settlement Period t. It is the cost for the Energy difference between the net Energy delivered into each utility Service Area, adjusted for utility Service Area Transmission Losses (calculated in accordance with ISO Tariff Section 7.4.2), and the total metered Demand within that utility Service Area adjusted for distribution losses using Distribution System loss factors approved by the Local Regulatory Authority.

This Energy difference (UFE) is attributed to meter measurement errors, power flow modeling errors, energy theft, statistical Load profile errors, and distribution loss deviations.

D 3.27 **$UFE_{UDC,bkt}$ – MWh**

The Unaccounted for Energy (UFE) for utility Service Area k.

D 3.28 **UFE – MWh**

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

D 3.29 **[Not Used]**

D 3.30 **[Not Used]**

D 3.31 **[Not Used]**

D 3.32 **[Not Used]**

D 3.33 **[Not Used]**

D 3.34 **[Not Used]**

D 3.35 **[Not Used]**

D 3.36 **[Not Used]**

D 3.37 **TLs,h,o – MWh**

The Transmission Losses per Settlement Interval *o* in Settlement Period hour h in utility Service Area *s*.

D 3.38 **[Not Used]**

D 3.39 **[Not Used]**

D 3.40 **[Not Used]**

D 3.41 **[Not Used]**

D 3.42 **[Not Used]**

D 3.43 **[Not Used]**

D 3.44 **[Not Used]**

D 3.45 **[Not Used]**

D 3.46 **[Not Used]**

D 3.47 **[Not Used]**

D 3.48 **[Not Used]**

D 3.49 **$EX\_POST\_PRICE_{j,h,o,k}$ – $/MWh**

The Ex-Post Price in Dispatch Interval *k* of Settlement Interval *o* in Settlement Period *h* in Zone *j.*

D 3.50 **$HRLY\_EX\_POST\_PRICE_{j,h}$ – $/MWh**

The energy-weighted Ex Post Price for Settlement Period *h* in Zone *j*.

D 3.51 **$STLMT\_PRICE_{i,h,o}$ – $/MWh**

The 10-minute Settlement price (Resource-Specific Settlement Interval Ex Post Price) for resource *i* in the Settlement Interval *o* for the Settlement Period *h.*

D 3.52 **$SE_{i,h,o}$ – MWh**

The Scheduled Energy from resource *i* during Settlement Interval *o* of Settlement Period *h.*

D 3.53 **$TOLERANCE\_BAND_{i,h,o}$ – MWh**

The Tolerance Band limit for resource *i* during Settlement Interval *o* of Settlement Period *h*.

D 3.54 **$IIE\_ECON_{i,h,o,k,m}$ – MWh**

The dispatched incremental or decremental Instructed Imbalance Energy (IIE) for resource *i* during Dispatch Interval *k* in Settlement Interval *o* of Settlement Period *h* for bid segment *m.*
Decremental Energy shall be represented as a negative quantity.
$IIE\_ECON_{i,h,o,k,m}$ shall be comprised of any of the four *IIE_TYPE*'s: SUPP, SPIN, NSPN or RPLC and be associated with its respective $IIE\_PRICE_{i,h,o,k,m}$

D 3.55 **$IIE\_PRICE_{i,h,o,k,m}$ – $/MWh**

The bid price for energy bid segment *m* for resource *i* during Dispatch Interval *k* in Settlement Interval *o* of Settlement Period *h* for bid segment *m*

D 3.56 **$IIE\_PREDISPATCH_{i,h,o,k,m}$ – MWh**

The Settlement Period pre-dispatched Energy for resource *i* during Dispatch Interval *k* of Settlement Interval *o* of Settlement Period *h* for bid segment *m* (MWh).

D 3.57 **$RIE_{i,h,o,k,m}$ – MWh**

The Residual Energy for resource *i* during Dispatch Interval *k* in Settlement Interval *o* of Settlement Period *h* for bid segment *m.*

D 3.58 **$RIE\_PRICE_{i,h,o,k,m}$ – $/MWh**

The reference bid price for the Residual Energy for resource *i* during Dispatch Interval *k* in Settlement Interval *o* of Settlement Period *h* for bid segment *m.*

D 3.59 **$OOS\_PRICE_{i,h,o,k,L}$ – $/MWh**

The Settlement price for the Instructed Out of Stack Energy for resource *i* during Dispatch Interval *k* in Settlement Interval *o* of Settlement Period *h* for index number *L.*

D 3.60 **$IIE\_REG_{i,h,o}$ – MWh**

The Regulating Energy for resource *i* during Settlement Interval *o* in Settlement Period *h.*

D 3.61 **$IIE\_PREDISPATCH_{i,h,p}$ – MWh**

The Settlement Period pre-dispatched Energy for resource *i* during Dispatch Interval *p* of Settlement Period *h*.

D 3.62 **$E_{i,h,o}$ – MWh**

Calculated as the difference of $IE_{i,h,o}$ and $IIE\_TOTAL_{i,h,o,k}$ and is equal to the sum of Uninstructed Imbalance Energy and Regulating Energy of resource *i* during Settlement Interval *o* in Settlement Period *h.*

D 3.63 **$IIEC_{i,h,o}$ – $**

The Instructed Imbalance Energy payment (charge) for resource *i* during Settlement Interval *o* of Settlement Period *h.*

D 3.64 **$IIEC\_OOS_{i,h,o}$ – $**

The total OOS Energy payment (charge) for resource *i* during Settlement Interval *o* of Settlement Period *h.*

D 3.65 **$IIEC\_OOS\_P_{i,h,o}$ – $**

The incremental Instructed OOS Imbalance Energy payment (charge) for resource *i* during Settlement Interval *o* of Settlement Period *h.*

D 3.66 **$IIEC\_OOS\_N_{i,h,o}$ – $**

The decremental Instructed OOS Imbalance Energy payment (charge) for resource *i* during Settlement Interval *o* of Settlement Period *h*.

D 3.67 **$IIE\_LOSS_{i,h,o,k}$ – MWh**

The transmission loss self-provided Energy from resource *i* during Dispatch Interval *k* in Settlement Interval *o* of Settlement Period *h*.

D 3.68 **$IIE\_ML_{i,h,o,k}$ – MWh**

The Imbalance Energy due to Minimum Load from resource *i* during Dispatch Interval *k* in Settlement Interval *o* of Settlement Period *h*.

D 3.69 **$IIE\_TOTAL_{i,h,o,k}$ – MWh**

The total Instructed Imbalance Energy from all energy sources except Regulation for resource *i* during Dispatch Interval *k* in Settlement Interval *o* of Settlement Period *h.*

D 3.70 **$IIE\_RERATE_{i,h,o,k}$ – MWh**

The SLIC derated Pmin or Pmax value as a result of an SC modifying its operating output level for a given resource *i* during Dispatch Interval *k* in Settlement Interval *o* of Settlement Period *h.*

D 3.71 **$UIE_{i,h,o}$ – MWh**

The total Uninstructed Imbalance Energy from resource *i* during Settlement Interval *o* of Settlement Period *h.*

D 3.72 **$UIE\_1_{i,h,o}$ – MWh**

The Uninstructed Imbalance Energy attributed to non-compliance of *IIE_ECON* from resource *i* during Settlement Interval *o* of Settlement Period *h.*

D 3.73 **$UIE\_2_{i,h,o}$ – MWh**

The Uninstructed Imbalance Energy exclusive of UIE_1 from resource *i* during Settlement Interval *o* of Settlement Period *h.*

D 3.74 **$UIEC_{i,h,o}$ – $**

The Uninstructed Imbalance Energy payment (charge) for resource *i* during Settlement Interval *o* of Settlement Period *h.*

D 3.75 **$ZONAL\_EX\_POST\_PRICE_{j,h,o}$ – $/MWh**

The energy weighted average Ex Post Price for Imbalance Energy for Zone *j* in Settlement Interval *o* for Settlement Period *h.*

D 3.76 **$ME_{i,h,o}$ – MWh**

The Metered Energy from resource *i* during Settlement Interval *o* of Settlement Period *h.*

D 3.77 **$RED_{i,h,o,k}$ – MWh**

The Ramping Energy Deviation from resource *i* during Dispatch Interval *k* in Settlement Interval *o* of Settlement Period *h.*

D 3.78 **$REDC_{i,h,o}$ – $**

The Ramping Energy Deviation payment (charge) for resource *i* during Settlement Interval *o* of Settlement Period *h*.

D 3.79 **$MR\_ML_{i,h,o}$ – $**

The expected Real Time Market revenue from Minimum Load Energy for resource *i* in Settlement Interval *o* for Settlement Period *h.*

D 3.80 **$COST\_RECOVERY_{i,d}$ – $**

The Unrecovered Cost Payment for resource *i* for Trading Day *d.*

D 3.81 **$MR\_DIFF_{i,h,o}$**

is the market revenue surplus or deficit for resource *i* in Settlement Period *h* for Settlement Interval *o.*

D 3.82 **$MR\_DEFICIT_{i,h,o}$ – $**

The market revenue deficit for resource *i* in Settlement Period *h* for Settlement Interval *o.*

D 3.83 **$MR\_SURPLUS_{i,h,o}$ – $**

The market revenue surplus for resource *i* in Settlement Period *h* for Settlement Interval *o.*

D 3.84 **$PERF\_STAT_{i,h,o}$ – True/False**

The performance status of resource *i* for Settlement Interval *o* of Settlement Period *h*. The performance status is equal to 1 (compliant) or 0 (non-compliant).

D 3.85 **$BID\_COST_{i,h,o}$ – $**

The bid costs for IIE, except OOS Energy and RIE, for resource *i* in Settlement Period *h* for Settlement interval *o*.

D 3.86 **$BID\_COST\_RIE_{i,h,o}$ – $**

The bid costs for RIE for resource *i* in Settlement Period *h* for Settlement Interval *o.*

D 3.87 **$PREDISPATCH\_PMT_{i,h,o}$ – $**

The unrecovered bid cost payment for a Settlement Period pre-dispatched System Resource *i* in Settlement Interval *o* for Settlement Period *h.*

D 3.88 **$EXCESS\_COST_{i,h,o}$ – $**

The excess cost payment for resource *i* in Settlement Interval *o* for Settlement Period *h.*

D 3.89 **$TL_{i,h,o}$ – MWh**

The Transmission Loss Obligation for resource *i* during Settlement Interval *o* of Settlement Period *h.*

D 3.90 **$EXCESS\_COST\_ALLOC_{g,h,o}$ – $**

The excess cost allocation for Scheduling Coordinator *g* in Settlement Period *h* for Settlement Interval *o.*

D 3.91 **$REAL\_TIME\_FLOW_{i,h,o,k,v}$ – MW*h***

The real-time actual flow for intertie resource *i* during Dispatch Interval *k* during Settlement Interval *o* of Settlement Period *h* for Real Time Flow Type index v. Real Time Flow Type index *v* must be one of the following Energy types: FIRM NFIRM, SUPP, WHEEL, DYN, ESPN, ENSPN, OOM, ERPLC.

D 3.92 **$RE\_STANDARD_{i,h,o,k}$ – MWh**

The Standard Ramping Energy from resource *i* during Dispatch Interval *k* of Settlement Interval *o* of Settlement Period *h.*

D 3.93 **$OOS\_P_{i,h,o,k,L}$ – MWh**

The incremental Out of Stack Energy for resource *i* during Dispatch Interval *k* in Settlement Interval *o* of Settlement Period *h* for index number *L.*

D 3.94 **$OOS\_N_{i,h,o,k,L}$ – MWh**

The decremental Out of Stack Energy for resource *i* during Dispatch Interval *k* in Settlement Interval *o* of Settlement Period *h* for index number *L.*

D 3.95 **$URC\_ALLOC_{g,h,o}$ – $**

The unrecovered cost neutrality allocation for Scheduling Coordinator *g* in Settlement Interval *o* for Settlement Period *h.*

D 3.96 **$IIE\_TYPE_{i,h,o,k,m}$**

is the energy type for $IIE\_ECON_{i,h,o,k,m.}$ Energy type is one of the following: Supplemental, Spin, Non-Spin or Replacement Reserve Energy.

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 and FTR Holders.

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

(e) Debits and 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) pay, or be paid, Usage Charges in Trading Interval t calculated in accordance with the following formulae:

In the Day-Ahead Market:

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

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) receive a Usage Charge payment from the ISO calculated in accordance with the formulae described in Section E 2.1.

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

E 2.3.1 Day-Ahead Market

The ISO will pay to the Participating TO n and FTR Holder n its share of the total net Usage Charge revenue for Trading Interval t in the Day-Ahead Market in accordance with the following formula:

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

E 2.3.2 Hour-Ahead Market

The ISO will pay to the Participating TO n and FTR Holder n its share of the total net Usage Charge revenue for Trading Interval t in the Hour-Ahead Market in accordance with the following formula:

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

Under normal operating conditions, (L_{yth} - L_{ytd}) is positive and Participating TOs and FTR Holders 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 FTR Holders and Debits/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 μ_{yth}(L_{yth} - L_{ytd}) and the total amount charged to Participating TOs and FTR Holders in accordance with item (a) above.

The ISO will issue a notice to Scheduling Coordinators of the operating hour, and extent, for which the derate will apply in the relevant Hour-Ahead Markets. The timing and form of such notices shall be set forth in ISO procedures.

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 $PayUC_{ntd}$ ($)

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

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

The amount calculated by the ISO to be paid to the Participating TO n (in respect of its Transmission Revenue Balancing Account) and FTR Holder n 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_{ytn} (%)**

The percentage of the Inter-Zonal Congestion revenue alocation for Participating TO n and FTR Holder n of the Congested Inter-Zonal interface y for the relevant Trading Interval t for both Day-Ahead and Hour-Ahead Markets.

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 shall be as specified in Section 7.1.4 of the ISO Tariff.

F 2.1.2 [Not Used]

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 Existing Rights) to the sum of all Participating TOs' TRRs (less the TRRs associated with Existing Rights) as specified in Section 7.1.4.3 of the ISO Tariff. The Low Voltage Wheeling Access Charge shall be disbursed to the appropriate Participating TO. 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 applicable Wheeling Access Charge rate for TAC Area or Participating TO n in $/kWh as set forth in Section 7.1.4 of the ISO Tariff and 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 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.

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 G 2.1.1 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 G 2.1.1 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 G 2.1.2 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 G 2.3.1 and G 2.3.2 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 G 2.3.1 and G 2.3.2 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

[NOT USED]

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		

Independent System Operator

FERC FEES 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
[Charge type to be determined]	____ FERC Annual Charges due ISO	**[Sample charge]**
Invoice Total		