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 Scheduling Coordinator in each Settlement Period in the relevant Zone shall be deemed to be sold or purchased, as the case may be, by the ISO and 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 BEEP Interval of each Settlement Period calculated in accordance with the following formulae:

$$DevC = \sum_i GenDevC_i + \sum_i LoadDevC_i + \sum_q ImpDevC_q + \sum_q ExpDevC_q + UFEC$$

$$ASSEDevC = \sum_i ASSEGenDevCi + \sum_i ASSELoadDevCi + \sum_q ASSEImpDevCq$$

$$DevC_{bjxt} = NetDev_{bjxt} * BIP_{bxt}$$

$$NetDev_{bjxt} = \left(\begin{array}{c} \sum_{i \in SC_j} GenDev_{bixt} - \sum_{i \in SC_j} LoadDev_{bixt} + \\ \sum_{q \in SC_j} ImpDev_{bqxt} - \sum_{q \in SC_j} ExpDev_{bqxt} \end{array} \right)$$

Where P_{bxt} is the BEEP Interval Price for Imbalance Energy in Zone x during BEEP Interval b in Settlement Period t.

The deviation quantity between scheduled and actual Energy Generation for Generator i represented by Scheduling Coordinator j in Zone x during BEEP Interval b of Settlement Period t is calculated as follows:

$$GenDev_{bixt} = GenDev'_{bixt} + UnavailAncServMW_{bixt}$$
$$GenDev'_{bixt} = G_{s,bixt} * GMM_{f,ixt} - \left[\left(G_{a,bixt} - G_{adj,bixt} \right) * GMM_a - G_{a/s,bixt} - G_{s/e,bixt} \right]$$

Where:

If the BEEP Interval Ex Post Price is negative or zero, then:

$UnavailAncServMW_{bixt} = 0$

If the BEEP Interval Ex Post Price is positive, then:

$$UnavailAncServMW_{bixt} =$$

$$\max\left(0, \min\left(\begin{array}{c} -GenDev'_{bixt}, G_{a,bixt} * GMM_{a,ixt} - \\ \left[\dfrac{P_{max,ixt}}{HBI} * GMM_{a,ixt} - \max\left(0, \dfrac{G_{oblig,ixt}}{HBI} - G_{a/s,bixt} \right) \right] \end{array} \right) \right)$$

The value of $G_{a,bixt}$ for Generation scheduled on behalf of Participating Generators for each BEEP Interval in each Settlement Period shall be the actual meter data aggregated on a 10-minute basis. The value of $G_{s,bixt}$ for Generation scheduled on behalf of Participating Generators for each BEEP Interval in each Settlement Period shall be determined as follows for BEEP Intervals 2 through 5:

$$G_{s,bixt} = \frac{G_{s,ixt}}{HIB}$$

For BEEP Interval 1 and BEEP Interval 6, implicit Dispatch instructions for ramping will be applied to adjust the Schedules attributed to those BEEP Intervals as follows:

$$G_{s,6ixt} = \left(\frac{G_{s,ixt}}{HIB} \right) - \left(\frac{\left(G_{s,ixt+1} - G_{s,ixt} \right)}{4\,HIB} \right)$$

The value of $G_{s,bit}$ and $G_{a,bit}$ for Generation which has not undertaken in writing to be bound by the ISO Tariff in accordance with Article 5 shall be determined as follows for all six BEEP Intervals:

$$G_{s,bixt} = \frac{G_{s,ixt}}{HIB}$$

$$G_{a,bixt} = \frac{G_{a,ixt}}{HIB}$$

The deviation quantity between scheduled and actual Load consumption for Load i represented by Scheduling Coordinator j in Zone x during BEEP Interval b of Settlement Period t is calculated as follows:

$$LoadDev_{bixt} = LoadDev'_{bixt} - UnavailDispLoadMW_{bixt}$$
$$LoadDev'_{bixt} = L_{s,bixt} - \left(L_{a,bixt} - L_{adj,bixt} + L_{a/s,bixt} + L_{s/e,bixt} \right)$$

Where:

If the BEEP Interval Ex Post Price for decremental Energy is negative or zero, then:

$UnavailDispLoadMW_{bixt} = 0$

If the BEEP Interval Ex Post Price for Imbalance Energy is positive, then:

$UnavailDispLoadMW_{bixt} =$

$$\max\left(0, \min\left(LoadDev'_{bixt}, \max\left(0, \frac{L_{\text{oblig},ixt}}{HBI} - L_{a/s,bixt} \right) - L_{a,bixt} \right) \right)$$

The value of $L_{a/s,bixt}$, $L_{s/e,bixt}$ and $L_{adj,bixt}$ are determined on a 10-minute basis. The value of L_a for Load scheduled on behalf of Participating Loads for each BEEP Interval in each Settlement Period shall be the actual meter data aggregated on a 10-minute basis. The value of $L_{s,bixt}$ for Load scheduled on behalf of Participating Loads for each BEEP Interval in each Settlement Period t, shall be determined as follows:

For BEEP Intervals 2 through 5,

$$L_{s,bit} = \frac{L_{s,it}}{HIB}$$

For BEEP Interval 1 and BEEP Interval 6, implicit Dispatch instructions for ramping will be applied to adjust the schedules attributed to those BEEP Intervals as follows:

$$L_{s,1ixt} = \left(\frac{L_{s,ixt}}{HIB} \right) - \left(\frac{\left(L_{s,ixt} - L_{s,ixt-1} \right)}{4\,HIB} \right)$$

$$L_{s,6ixt} = \left(\frac{L_{s,ixt}}{6} \right) + \left(\frac{\left(L_{s,ixt+1} - L_{s,ixt} \right)}{4\,HIB} \right)$$

The value of $L_{s,bixt}$ and $L_{a,bixt}$ for Loads that are not Participating Loads shall be determined as follows for all six BEEP Intervals:

$$L_{s,bixt} = \frac{L_{s,ixt}}{HIB}$$

$$L_{a,bixt} = \frac{L_{a,ixt}}{HIB}$$

*Where $L_{a,ix}$ is Load i hourly metered quantity for Settlement Period t.

The deviation quantity between forward scheduled and Real Time adjustments to Energy imports[*], adjusted for losses, for Scheduling

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

Point q represented by Scheduling Coordinator j into Zone x during each BEEP Interval b of each Settlement Period t is calculated as follows:

$$ImpDev_{bqxt} = I_{s,bqxt} * GMM_{f,qxt} - \left(I_{a,bqxt} - I_{adj,bqxt} + I_{a/s,bqxt}\right) * GMM_{a,qxt} +$$
$$I_{a/s,bqxt} * GMM_{a,qxt}$$

The values of $I_{a/s,bqxt}$, $I_{a,bqxt}$ and $I_{adj,bqxt}$ are determined on a 10-minute basis. The value of $I_{s,bqxt}$ in all BEEP Intervals shall be determined as follows:

$$I_{s,bqxt} = \frac{I_{s,qxt}}{HIB}$$

The deviation quantity between forward scheduled and Real Time adjustments to Energy exports* for Scheduling Point q represented by Scheduling Coordinator j from Zone x during BEEP Interval b for Settlement Period *t* is calculated as follows:

$$ExpDev_{bqxt} = E_{s,bqxt} - E_{a,bqxt} - E_{adj,bqxt}$$

The values of $E_{a,bqxt}$ and $E_{adj,bqxt}$ are determined on a 10-minute basis. The value of $E_{s,qit}$ in all BEEP Intervals shall be determined as follows:

$$E_{s,bqxt} = \frac{E_{s,qxt}}{HIB}$$

D 2.1.2   Instructed Imbalance Energy Charges on Scheduling Coordinators

Implicit Dispatch instructions for ramping Energy shall be calculated based on Final Hour Ahead Schedules for Energy to result in a linear ramp by all Participating Generators and Participating Loads beginning 10 minutes prior to the start, and ending 10 minutes after the start of

each Settlement Period. Ramping Energy shall be deemed delivered and settled at a price of zero dollars per MWh.

The amount of Instructed Imbalance Energy to be delivered in each BEEP Interval will be determined based on the ramp rates and time delays bid in accordance with SBP 5 and 6 and shall be deemed delivered to the ISO Controlled Grid. Any excess delivery or shortfall will be accounted for as Uninstructed Imbalance Energy. Payment due a Load, Generator, Import or Export for Instructed Imbalance Energy to be delivered in a BEEP Interval shall be calculated based on the actual Energy delivered to the ISO Grid in accordance with the Dispatch instruction.

Instructed Imbalance Energy in each BEEP Interval shall be paid, if positive, or charged, if negative, the corresponding BEEP Interval Ex Post Price.

Due to ramp rate limitations, resources responding to Dispatch Instructions that revert partially or wholly Dispatch Instructions issued earlier within the same hour may generate or consume Instructed Imbalance Energy bid at prices higher or lower than the BEEP Interval Ex Post Price, respectively. This residual Instructed Imbalance Energy which may cross hourly boundaries, shall be priced based on the applicable BEEP Interval Ex Post Price for the BEEP Interval to which the original Dispatch instruction applied.

Subject to the above conditions, the Instructed Imbalance Energy charge for each BEEP Interval b of each Settlement Period t for Scheduling Coordinator j for Zone x is calculated using the following formulas:

The instructed Generation deviation payment/charge is calculated as follows:

$$IGDC_{ib} = G_{ib} * P_b$$

The instructed Load deviation payment/charge is calculated as follows:

$$ILDC_{bixt} = -\left(L_{a/s,bixt} + L_{se,bixt}\right) * P_{bxt}$$

The instructed import deviation payment/charge is calculated as follows:

$$IIDC_{bqxt} = -\left(I_{a/s,bqxt} + I_{se,bqxt}\right) * P_{bxt}$$

D 2.2 **Unaccounted for Energy Charge**

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

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

$$UFE_{UDC,bkt} = \sum_{q \in UDC_k} I_{a,bqxt} - \sum_{q \in UDC_k} E_{a,bqxt} + \sum_{i \in UDC_k} G_{a,bixt} - \sum_{i \in UDC_k} L_{a,bixt} - TL_{bkt}$$

The Transmission Loss TL_{bkt} for BEEP Interval b of Settlement Period t for utility service territory k is calculated as follows:

$$TL_{bkt} = \left(\sum_i \left[G_{a,bixt} * (1 - GMM_{a,ixt}) \right] + \sum_q \left[I_{a,bqxt} * (1 - GMM_{a,qxt}) \right] \right) * \frac{PFL_{kt}}{\sum_k PFL_{kt}}$$

Where PFL_{kt} are the transmission losses for utility service territory k as calculated by a power flow solution for Settlement Period t, consistent with the calculation of final forecasted Generation Meter Multipliers.

Each metered demand point z in utility service territory k, either ISO grid connected or connected through UDC k, is allocated a portion of the UFE as follows:

$$UFE_{bixt} = UFE_{UDC,bkt} * \frac{L_{bixt}}{\sum_{i \in UDC_k} L_{bixt}}$$

The UFE charge for Scheduling Coordinator j for BEEP Interval b of Settlement Period t in Zone x is calculated as follows:

$$UFEC_{jxt} = \left(\sum_{i \in SC_j} UFE_{bixt} \right) * P_{bxt}$$

D 2.3 **Hourly Ex Post Price**

The Hourly Ex Post Price in Zone x in Settlement Period t is determined as follows:

$$HP_{xt} = \frac{\sum_b |Q_{bxt}| P_{bxt}}{\sum_b |Q_{bxt}|}$$

Where Q_{bxt} is the total Instructed Imbalance Energy during BEEP Interval b in Zone x in Settlement Period t.

D 3 **Meaning of terms in the formulae**

D 3.1 **DevC$_{bjxt}$ – $**

The Uninstructed Imbalance Energy charge on Scheduling Coordinator j during BEEP Interval b in Settlement Period t in Zone x.

D 3.2 GenDev_{bixt} – **MWh**

The deviation between scheduled and actual Energy Generation for Generator i in Zone x during BEEP Interval b in Settlement Period t.

D 3.3 LoadDev_{bixt} – **MWh**

The deviation between scheduled and actual Load consumption for Load i in Zone x during BEEP Interval b in Settlement Period t.

D 3.4 ImpDev_{bqxt} – **MWh**

The deviation between forward scheduled and Real Time adjustments to Energy imports, as adjusted for losses, for Scheduling Point q in Zone x during BEEP Interval b in Settlement Period t.

D 3.5 ExpDev_{bqxt} – **MWh**

The deviation between forward scheduled and Real Time adjustments to Energy exports for Scheduling Point q in Zone x during BEEP Interval b in Settlement Period t.

D 3.6 $G_{s,ixt}$ – **MWh**

The scheduled Generation of Generator i in Zone x in Settlement Period t as a result of both the Day-Ahead Final Schedule and the Hour-Ahead Final Schedule.

D 3.6.1 $G_{s,ixt-1}$ – **MWh**

The scheduled Generation of Generator i in Zone x in Settlement Period t–1 as a result of both the Day-Ahead Final Schedule and the Hour-Ahead Final Schedule.

D 3.6.2 $G_{s,ixt+1}$ – **MWh**

The scheduled Generation of Generator i in Settlement Period t+1 as a result of both the Day-Ahead Final Schedule and the Hour-Ahead Final Schedule.

D 3.6.3 $G_{adj,bixt}$ – **MWh**

The Deviation of Generator i in Zone x ordered by the ISO in BEEP Interval b in Settlement Period t according to Section 7.2.6.2, or for settlement according to Section 11.2.4.2.

D 3.7 $G_{a,bixt}$ – **MWh**

The total actual metered Generation of Generator i in Zone x during BEEP Interval b in Settlement Period t.

D 3.8 $G_{oblig,ixt}$ – **MWh**

The total Spinning, Non-Spinning, and Replacement Reserve committed capacity of Generator i in Zone x in Settlement Period t, as reflected in the final Ancillary Services Schedules.

D 3.9 $G_{a/s,bixt}$ – **MWh**

The Energy generated from Ancillary Service resource i in Zone x due to ISO dispatch instructions. This value will be calculated based on the expected Instructed Imbalance Energy during BEEP Interval b in Settlement Period t for which such Ancillary Services dispatch instruction(s) applies.

D 3.9.1 $G_{s/e,bixt}$ –**MWh**

The Energy generated from Supplemental Energy resource i in Zone x due to ISO dispatch instructions. This value will be calculated based on the expected Instructed Imbalance Energy during BEEP Interval b in Settlement Period t for which such Supplemental Energy dispatch instruction(s) applies.

D 3.10 $GMM_{f,ixt}$ – **fraction**

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

D 3.11 $GMM_{f,qxt}$ – **fraction**

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

D 3.12 $GMM_{a,ixt}$ – **fraction**

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

D 3.13 $GMM_{a,qxt}$ – **fraction**

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

D 3.14 $L_{s,bixt}$ – **MWh**

The scheduled Demand of Demand i in Zone x during BEEP Interval b in Settlement Period t as a result of both the Day-Ahead Final Schedule and the Hour-Ahead Final Schedule.

D 3.15 $L_{a,bixt}$ – **MWh**

The actual metered Demand of Demand i in Zone x during BEEP Interval b in Settlement Period t.

D 3.15.1 $L_{a,ixt}$ – **MWh**

The actual metered Demand of Demand i in Zone x in Settlement Period t.

D 3.15.2 $L_{adj,bixt}$

The Deviation of Demand i in Zone x ordered by the ISO in BEEP Interval b in Settlement Period t according to Section 7.2.6.2, or for settlement according to Section 11.2.4.2.

D 3.16 $L_{oblig,ixt}$

The total Non-Spinning and Replacement Reserve comitted capacity of Load i in Zone x in Settlement Period t, as reflected in the final Ancillary Services Schedules.

D 3.17 $L_{a/s,bixt}$ – **MWh**

The Energy reduction by curtailable Load i in Zone x 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 expected Instructed Imbalance Energy during BEEP Interval b in Settlement Period t for which such Ancillary Services dispatch instruction(s) applies.

D 3.17.1 $L_{s/e,bixt}$ – **MWh**

The Energy reduction by curtailable Load i in Zone x due to ISO dispatch of Supplemental Energy from such curtailable Load. This value will be calculated based on the projected impact of the expected Instructed Imbalance Energy during BEEP Interval b in Settlement Period t

D 3.18 $L_{s,qxt}$ – **MWh**

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

D 3.19 $L_{a,bqxt}$ – **MWh**

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

D 3.20 $I_{adj,bqxt}$ – **MWh**

The deviation in real time import of Scheduling Coordinator j through Scheduling Point q in BEEP Interval b during BEEP Interval b in Settlement Period t 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 BEEP Interval for which such Dispatch Instructions(s) (or curtailment event) applies.

D 3.21 $I_{a/s,bqxt}$ **– MWh**

The Energy generated from Ancillary Service System Resources of Scheduling Coordinator j through Scheduling Point q in BEEP Interval b during BEEP Interval b in Settlement Period t pursuant to Existing Contracts or Supplemental Energy from interties due to ISO's Dispatch instruction.

D 3.22 $E_{s,qxt}$ **– MWh**

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

D 3.23 $E_{a,bqxt}$ **– MWh**

The total actual Energy export of Scheduling Coordinator j through Scheduling Point q in BEEP Interval b of Settlement Period t. This is deemed to be equal to the total scheduled Energy export during the same interval.

D 3.24 $E_{adj,bqxt}$ **– MWh**

The deviation in Real Time export of Scheduling Coordinator j through Scheduling Point q in BEEP Interval b during BEEP Interval b in Settlement Period t 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 BEEP Interval for which such Dispatch Instruction (or curtailment event) applies.

D 3.25 P_{bxt} **– $/MWh**

The Ex Post Price for Imbalance Energy in Zone x during BEEP Interval b in Settlement Period t.

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 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 that UDC 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 territory 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 $\mathbf{TL_{bkt} - MWh}$

The Transmission Losses per BEEP Interval b of Settlement Period t in utility service territory k.

D 3.38 $\mathbf{IGDC_{bixt} - \$}$

The Instructed Imbalance Energy payments/charges for Generator i in Zone x during BEEP Interval b in Settlement Period t.

D 3.39 $\mathbf{ILDC_{bixt} - \$}$

The Instructed Imbalance Energy payments/charges for Load i in Zone x during BEEP Interval b in Settlement Period t.

D 3.40 $\mathbf{IIDC_{bqxt} - \$}$

The Instructed Imbalance Energy payments/charges for import at Scheduling Point q during BEEP Interval b in Settlement Period t.

D 3.41   **[Not Used]**

D 3.42   **[Not Used]**

D 3.43   **[Not Used]**

D 3.44   **[Not Used]**

D 3.45   **HBI – Number**

The number of BEEP Intervals in Settlement Period t, currently set to 6.

D 3.46   **[Not Used]**

D 3.47   **[Not Used]**

D 3.48   **$P_{max,ixt}$ – MW**

The maximum capability at which Energy and Ancillary Services may be scheduled from the Generating Unit or System Resource i.

D 3.49   **[Not Used]**

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 $\mu_{yth}(L_{yth} - L_{ytd})$ 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 $\mathbf{UC_{jtd}}$ **($)**

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

E 3.2 $\mathbf{UC_{jth}}$ **- $**

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

E 3.3 $\mathbf{NetZoneImp_{jtxd}}$ **(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 $\mathbf{NetZoneImp_{jtxh}}$ **(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 $\mathbf{\lambda_{dxt}}$ **($/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 $\mathbf{\lambda_{hxt}}$ **($/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 $\mathbf{PayUC_{ntd}}$ **($)**

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 G2.1.1 in Zone x for Trading Interval t will be calculated using the following formula:

$$VSSTRate_{xt} = \frac{\sum_{ij} VSST_{xijt}}{\sum_{j} QCharge\,VS_{xjt}}$$

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

[NOT USED]

APPENDIX I

DRAFT SAMPLE OF INVOICE

Independent System Operator

MARKET INVOICE

CUSTOMER 1   Invoice: 181
101 N. Harbor Blvd.   Date: 20-JUN-97
Anaheim   CA 92808   Customer Number: 1000
Please send payment to:

1000 South Fremont Avenue   For all inquiries contact:
Building A-11   1-800-ISO-HELP
Alhambra   CA 91803

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		

<u>Independent System Operator</u>

FERC FEES INVOICE

CUSTOMER 1	Invoice:	181
101 N. Harbor Blvd.	Date:	20-JUN-97
Anaheim CA 92808	Customer Number:	1000

Please send payment to:

1000 South Fremont Avenue	For all inquiries contact:
Building A-11	1-800-ISO-HELP
Alhambra CA 91803	

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		