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 Settlement Period equal to the sum of:

(a) The quantity of undelivered Instructed Imbalance Energy, multiplied by the Effective Price, and

(b) The quantity of deviation from the final Hour-Ahead Schedule multiplied by the Hourly Ex Post Price.

Imbalance Energy charge will be calculated as follows:

IECharge = DevC + ASSEDevC

Where:

$$DevC = \sum_i GenDevC_i - \sum_i LoadDevC_i + \sum_q Im\,pDevC_q - \sum_q ExpDevC_q + UFEC$$

$$ASSEDevC = \sum_i ASSEGenDevC_i + \sum_i ASSELoadDevC_i + \sum_q ASSE\,Im\,pDevC_q$$

and

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

$GenDevC_i = G_S * GMM_f – [(G_a - G_{adj}) * GMM_{ah} – G_{a/s} – G_{s/e}] - UnavailAncServMW_{ixt}$

Where:

$UnavailAncServMW_{ixt} = Max[-(G_{i,oblig} - G_{a/s}), Min(0, PMax – Ga – (G_{i,oblig} – G_{a/s}))]$

$GenDevC_i = GenDev_i * P$ in case of (b) above, and

If $G_{a/s} + G_{s/e} > 0$ and $P < P_{eff}$ then:

$ASSEGenDevC_i = Max[0,[G_{a/s} + G_{s/e} - Max[0,(G_a - G_{adj} - G_s)]]]*(P_{eff-l} - P)$ in case of (a) above, or

If $G_{a/s} + G_{s/e} < 0$ and $P > P_{eff}$ then:

$ASSEGenDevC_i = Min[0,[G_{a/s} + G_{s/e} - Min[0,(G_a - G_{adj} - G_s)]]]*(P_{eff-l} - P)$ in case of (a) above

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

$$LoadDev_i = L_S - \left\lfloor \left(L_a - L_{adj}\right) + L_{a/s} + L_{s/e} \right\rfloor_-$$

$UnavailDispLoadMW_{ixt}$

Where:

$UnavailDispLoadMW_{ixt} = Max[0, (L_{i,\ oblig} – L_{a/s}) – L_a]$

$LoadDevC_i = LoadDev_i * P$ in case of (b) above, and

If $L_{a/s} + L_{s/e} > 0$ and $P < P_{eff}$ then:

$ASSELoadDevC_i = Max[0,[L_{a/s} + L_{s/e} - Max[0,-(L_a - L_{adj} - L_s)]]]*(P_{eff-l} - P)$ in case of (a) above, or

If $L_{a/s} + L_{s/e} < 0$ and $P > P_{eff}$ then:

$ASSELoadDevC_i = Min[0,[L_{a/s} + L_{s/e} - Min[0,-(L_a - L_{adj} - L_s)]]]*(P_{eff-l} - P)$ in case of (a) above

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

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

$ImpDevC_q = ImpDev_q * P$ in case of (b) above, and

If $I_{a/s} > 0$ and $P < P_{eff}$ then:

$ASSEImpDevC_q=Max[0,[I_{a/s}-Max[0,(I_a-I_{adj}-I_s)]]]*(P_{eff-q}-P)$ in case of (a) above, or

If $I_{a/s} < 0$ and $P > P_{eff}$ then:

$ASSEImpDevC_q=Min[0,[I_{a/s}-Min[0,(I_a-I_{adj}-I_s)]]]*(P_{eff-q}-P)$ in case of (a) above

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

$$ExpDev_q = E_S - (E_a - E_{adj})$$

$ExpDevC_q = ExpDev_q * P$

The Hourly Ex Post Price applicable to uninstructed deviations in Settlement Period t in each zone will equal the Energy weighted average of the BEEP Interval charges in each zone, calculated as follows:

$$P_{xt} = \frac{(\sum_{ji} |MWh_{jix}| * BIP_{ix})}{\sum_{ji} |IMWh_{jix}|}$$

Where:

BIP_{jx}= BEEP Interval Ex Post Price

P xt = the Hourly Ex Post Price in Zone x

IIEC jix = the Instructed Imbalance Energy Charges for Scheduling Coordinator j for BEEP Interval i in Zone x

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

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

IMWH jix = the Instructed Imbalance Energy for Scheduling Coordinator j for the BEEP Interval i in Zone x

D 2.1.2 Instructed Imbalance Energy Charges on Scheduling Coordinators

The Instructed Imbalance Energy charge for Settlement Period t for Scheduling Coordinator j for Zone x is calculated using the following formula:

$$IIEC_j = IGDC_j + ILDC_j + IIDC_j$$

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

$$IGDCj = \sum_{gi} \frac{G_{gi} * P_i}{HBI}$$

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

$$ILDCj = \sum_{Li} \frac{L_{Li} * P_i}{HBI}$$

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

$$IIDCj = \sum_{Ii} \frac{I_{Ii} * P_i}{HBI}$$

D 2.2 Unaccounted for Energy Charge

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

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

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

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

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

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

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

D 3.36 **LPM_k – MWh**

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

D 3.37 **TL_k – MWh**

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

D 3.38 **$IGDC_j$ - $**

The total of instructed Generation deviation payments/charges for Scheduling Coordinator j in Settlement Period t.

D 3.39 **$ILDC_j$ - $**

The total of instructed Load deviation payments/charges for Scheduling Coordinator j in Settlement Period t.

D 3.40 **$IIDC_j$ - $**

The total of instructed import deviation payments/charges for Scheduling Coordinator j in Settlement Period t.

D 3.41 **G_{gi} - MW**

Instructed Energy for Generating Unit g during BEEP Interval i.

D 3.42 **L_{Li} - MW**

Instructed Energy for Load L during BEEP Interval i.

D 3.43 **I_i – MW**

Instructed Energy for import I during BEEP Interval ***i***

D 3.44 **P_i -- $/MWh**

The BEEP Incremental Ex Post Price for BEEP Interval i if the net instructed Energy for resources is positive, or the BEEP decremental Ex Post Price for BEEP Interval i if the net instructed Energy for resources is negative.

D 3.45 **HBI – Number**

The number (2-12) of BEEP Intervals in Settlement Period t.

D 3.46 **$ReplObligRatio_{jxt}$ – fraction**

$$ReplObligRatio_{jxt} = \frac{ReplOblig_{jxt}}{\sum_{j} ReplOblig_{jxt}}$$

where:

$ReplOblig_{jxt}$ is the replacement reserve capacity obligation as defined in Appendix C section C3.67.

D 3.47 **$G_{i,\ oblig}$**

The amount of Spinning Reserve, the amount of Non-Spinning Reserve, and the amount of Replacement Reserve that Generating Unit or System Resource *i* has been selected to supply to the ISO, as reflected in final Ancillary Services Schedules.

D 3.48 **$PMax_i$**

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

D 3.49 **$L_{i,\ oblig}$**

The amount of Non-Spinning Reserve and Replacement Reserve that dispatchable Load *i* has been selected to supply to the ISO as reflected in final Ancillary Services schedules for Settlement Period *t*.