ATTACHMENT C

EFFECTIVE PRICE

23. Temporary Changes to the Real-Time Market for Imbalance Energy

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11.2.4.1 Net Settlements for *Uninstructed* Imbalance Energy.

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:

$$DevC = \sum_i GenDevC_i - \sum_i LoadDevC_i + \sum_q \mathrm{ImpDevC}_q - \sum_q ExpDevC_q + UFEC$$

$$ASSEDevC = \sum_i ASSEGenDevC_i + \sum_i ASSELoadDevC_i + \sum_q ASSEImpDevC_q$$

and

The deviation between scheduled and actual Energy Generation for Generator i represented by the Scheduling Coordinator for the Settlement Period is calculated as follows:

$$GenDev_i = G_s * GMM_f - \left|\left(G_a - G_{adj}\right) * GMM_{ah} - G_{a/s} - G_{s/e}\right| - UnavailAncServMW_{ixt}$$

$UnavialAncServMW_{ixt}$ =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$_{eff-I}$ -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$_{eff-I}$ -P) in case of (a) above

The deviation between scheduled and actual Load consumption for Load i represented by the Scheduling Coordinator for the Settlement Period is calculated as follows:

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

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$_{eff-I}$ -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$_{eff-I}$ -P) in case of (a) above

The deviation between forward, scheduled and Real Time adjustments to Energy imports, adjusted for losses, for Scheduling Point q represented by the Scheduling Coordinator for the Settlement Period is calculated as follows:

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

ImpDevC$_{qi}$= ImpDev$_{iq}$ * P in case of (b) above, and

If I$_{a/s}$ > 0 and P < P$_{eff}$ then

ASSEImpDevC$_{iq}$=Max[0,[L$_{a/s}$ -Max[0,(L$_a$ -L$_{adj}$-L$_s$)]]]* (P$_{eff-g}$ -P) in case of (a) above, or

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

$ASSEImpDevC_{iq}$=Min[0,[$L_{a/s}$ -Min[0,(L_a -L_{adj}-L_s)]]]* (P_{eff-g} -P) in case of (a) above

The deviation between forward, scheduled and Real Time adjustments to Energy exports for Scheduling Point q represented by the Scheduling Coordinator for the Settlement Period is calculated as follows:

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

$ExpDevC_g$= $ExpDev_g$ * P

and where:

G_s = sum of effective schedules for Day-Ahead and Hour-Ahead

GMM_f = estimated GMM for Day-Ahead

G_a = actual metered Generation

G_{adj} = deviations in real time ordered by the ISO for purposes such as Congestion Management

GMM_{ah}= hour-ahead GMM (proxy for ex-post GMM)

$G_{a/s}$ = Energy generated from Ancillary Service resource ~~or Supplemental Energy resource~~ due to ISO dispatch instruction

$G_{s/e}$ = Energy generated from Supplemental Energy resource due to ISO dispatch instruction

L_s = sum of Demand scheduled for Day-Ahead and Hour-Ahead

L_a = actual metered Demand

L_{adj} = Demand deviation in real time ordered by ISO for

purposes such as Congestion Management

$L_{a/s}$ = Demand reduction from Ancillary Service resource due to ISO dispatch instruction

$L_{s/e}$ = Demand reduction from Supplemental Energy resource due to ISO dispatch instruction.

GMM_{fq} = estimated GMM for an Energy import at Scheduling Point q for Day-Ahead

GMM_{ahq} = estimated GMM for an Energy import at Scheduling Point q for Hour-Ahead (proxy for ex-post GMM)

I_S = sum of Scheduled Energy import scheduled through Scheduling Point q for Day-Ahead and Hour-Ahead

I_a = sum of actual Energy import scheduled through Scheduling Point q.

I_{adj} = deviation in real time import ordered by ISO for purposes such as Congestion Management, and import curtailment.

$I_{a/s}$ = Energy generated from Ancillary Service System Resources or Supplemental Energy from interties due to dispatch instruction

E_S = sum of scheduled Energy export scheduled through Scheduled Point q for Day-Ahead and Hour-Ahead

E_a = sum of actual Energy export scheduled through Scheduling Point q for Day-Ahead and Hour-Ahead

E_{adj} = deviation in real time export ordered by ISO for purposes such as Congestion Management, and export curtailment

P = Hourly Ex Post Price for ***Uninstructed*** Imbalance Energy for the relevant hour***, as defined in Section 2.5.23.2.2***

P_{eff} = Effective Price for Instructed Imbalance Energy for the relevant Settlement Period

$G_{i, oblig}$ = the amount of Spinning Reserve, the amount of Non-Spinning Reserve, and the amount of Replacement Reserve that Generating Unit or System Refource i has been selected to supply to the ISO, as reflected in final Ancillary Services schedules.

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

$L_{i, oblig}$ = 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.

UFEC = the Unaccounted for Energy Charge for the Scheduling Coordinator calculated as follows:

Unaccounted for Energy Charge

The hourly Unaccounted for Energy Charge on Scheduling Coordinator j for 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,

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

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

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

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

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

The UFE charge for Scheduling Coordinator j per Settlement Period per relevant Zone is then,

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

Where the terms used in the equations have the following meaning:

$E_{UFE\_UDC\_k}$ -- MWh

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

E_{UFE_z} -- MWh

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

I_k -- MWh

The total metered imports into utility service territory k in Settlement Period t.

E_k -- MWh

The total metered exports from utility service territory k in Settlement

Period t.

G_k -- MWh

The total metered Generation in Settlement Period t in utility service territory k.

RTM_k -- MWh

The Settlement Period t total of the real-time metering in utility service territory k in Settlement Period t.

LPM_k -- MWh

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

TL_k -- MWh

The Transmission Losses per Settlement Period t in utility service territory k.

D_Z -- MWh

The Demand including Exports in Settlement Period t at metered point z

The ISO shall develop protocols and procedures for the monitoring of persistent intentional excessive imbalances by Scheduling Coordinators and for the imposition of appropriate sanctions and/or penalties to deter such behavior. The net balance of the charges attributable to all Scheduling Coordinators represents the Transmission Losses imbalance total for each hourly Settlement Period.

Effective Price	The price, applied to undelivered Instructed Imbalance Energy, calculated by dividing ~~the absolute value of~~ the total payment or charge for Instructed Imbalance Energy by ~~the absolute value of~~ the total Instructed Imbalance Energy, for the Settlement Period~~; provided that, if both the total payment or charge and quantity of Instructed Imbalance Energy for the Settlement Period are negative, the Effective Price shall be multiplied by -1.0 (minus one)~~.

23.5 Amendments to the Settlement and Billing Protocol

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~~D 2.1~~*~~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:

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

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

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

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

and

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

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

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

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:

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

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

$ASSEGenDevC_i = Min[0,[G_{a/s} + G_{s/e} - Min[0,(G_a - G_{adj} - G_s)]]] * (P_{eff-I} - P)$ 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:

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

$$LoadDev_i = L_s - \left|\left(L_a - L_{adj}\right) + L_{a/s} + L_{s/e}\right| - UnavailDispLoadMW_{ixt}$$

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:

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

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

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

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

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

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

$ASSEImpDevC_q = Min[0,[I_{a/s} - Min[0,(I_a - I_{adj} - I_s)]]] * (P_{eff\text{-}q} - P)$ 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 ~~***Trading Interval t***~~ ***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_{ix} = BEEP Interval Ex Post Price

P_{xt} = the Hourly Ex Post Price 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.

IIEC $_{jix}$ ***= the Instructed Imbalance Energy Charges for Scheduling Coordinator j for BEEP Interval i in Zone x***

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 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:

where:

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