**ATTACHMENT B**

## I. LBMP CALCULATION METHOD

The Locational Based Marginal Prices ("LBMPs") for Generators and Loads will be based on the system marginal costs produced by either the Security Constrained Dispatch ("SCD") program for Real-Time Market prices, or the Security Constrained Unit Commitment ("SCUC") program for Day-Ahead Market prices. The marginal cost of a Fixed Block Unit may only set LBMP when some portion of its Energy is necessary to meet Load, displace higher cost Energy, or satisfy Operating Reserves requirements. The marginal cost of a Fixed Block Unit may not set LBMP at any other time. During periods when Fixed Block Units are precluded from setting LBMP, the marginal cost of the most economical unit backed down to accommodate a Fixed Block Unit shall set LBMP. TheseSystem marginal costs will be utilized in an *ex post* computation to produce LBMP bus prices using the following equations.

The LBMP at bus 1 can be written as:

$$\gamma_i = \lambda^R + \gamma^L{}_i + \gamma^C{}_i$$

Where:

| | | |
|---|---|---|
| $\gamma_i$ | = | LBMP at bus i in $/MWh |
| $\lambda^R$ | = | the system marginal price at the Reference Bus |
| $\gamma_i^L$ | = | Marginal Losses Component of the LBMP at bus i which is the marginal cost of losses at bus i relative to the Reference Bus |
| $\gamma_i^C$ | = | Congestion Component of the LBMP at bus i which is the marginal cost of Congestion at bus i relative to the Reference Bus |

The Marginal Losses Component of the LBMP at any bus i within the NYCA is calculated using the equation:

$$\gamma_i^L = (DF_i - 1)\,\lambda^R$$

Where:

$DF_i$ = delivery factor for bus i to the system Reference Bus And:

$$DF_i = \left( 1 - \frac{\partial L}{\partial P_i} \right)$$

Where:

$L$ = system losses; and
$P_i$ = generation injection at bus i

The Congestion Component of the LBMP at bus i is calculated using the equation:

$$\gamma_i^c = -\left( \sum_{k \in K}^{n} GF_{ik} \mu_k \right)$$

Where:

$K$ = the set of thermal or Interface Constraints;

$GF_{ik}$ = Shift Factor for the Generator at bus 1 on Constraint k in the pre- or post-Contingency case which limits flows across that Constraint (the Shift Factor measures the incremental change in flow on Constraint k, expressed in per unit, for an increment of generation at bus i and a corresponding decrement of generation at the Reference Bus); and

$\mu_k$ = the reduction in system cost that results from an incremental relaxation of Constraint k expressed in $/MWh.

Substituting the equations for $\gamma_i^L$ and $\gamma_i^C$ into the first equation yields:

$$\gamma_i = \lambda^R + (DF_i - 1)\lambda^R - \sum_{k \in K} GF_{ik} \mu_k$$

The SCD program execution in a given interval may terminate without observing the limits on all Constraints, usually due to Generator ramp rate limitations on the dispatch. Under these conditions, rules have been developed which the ISO will use to set Generator output levels and to calculate LBMPs. These rules state that the LBMPs are to be calculated from the output of the SCD execution in which Constraints were violated. Prices calculated in this manner closely reflect the marginal cost of Energy on the system. However, the Generator output levels will be set by a second SCD execution in which Generator ramp rate Constraints are relaxed. This execution of SCD usually eliminates the Constraint violations and will provide the dispatcher with information to correct the situation. Often Generators will be able to operate at the levels set in the second SCD execution, since they frequently can change their output levels at rates exceeding those included in the Bid data provided to the ISO. Failure to achieve the output levels determined in the second SCD execution will not cause the Generator's performance ratings in the Performance Tracking System to be adversely affected.

LBMPs will be calculated for the Day-Ahead and the Real-Time Markets. In the Day-Ahead Market, the three components of the LBMP at each location will be calculated from the SCUC results and posted for each of the 24 hours of the next day. The Real-Time LBMPs will be calculated and posted for each execution of SCD.

**Zonal LBMP Calculation Method**

The computation described above is at the bus level. This will be suitable for Generator buses because adequate metering is available, or will be provided, to measure Real-Time injections. An eleven (11) zone model will be used for the LBMP billing related to Loads. The LBMP for a zone will be a Load weighted average of the Load bus LBMPs in the zone. The Load weights which will sum to unity will be predetermined by the ISO. Each component of the LBMP for a zone will be calculated as a Load weighted average of the Load bus LBMP components in the zone. The LBMP for a zone *j* can be written as:

$$\gamma_j^Z = \lambda^R + \gamma_j^{L,Z} + \gamma_j^{C,Z}$$

where:

$\gamma_j^Z$ = LBMP for zone j,

$\gamma_j^{L,Z} = \sum_{i=1}^{n} W_i \gamma_i^L$ is the Marginal Losses Component of the LBMP for zone j;

$\gamma_j^{C,Z} = \sum W_i \gamma_i^C$ is the Congestion Component of the LBMP for zone j;

n = number of Load buses in zone j for which LBMPs are calculated; and

$W_i$ = load weighting factor for bus i.

Until the ISO's software can compute LBMPs at Load buses, the zonal LBMPs will be a weighted average of the Generator bus LBMPs in the zone. The weightings will be pre-determined by the ISO.

**LBMP Prices for External Locations**

External Generators and Loads can bid into the LBMP Market or participate in Bilateral Transactions. External Generators may arrange Bilateral Transactions with Internal or External Loads and External Loads may arrange Bilateral Transactions with Internal Generators.

The Generator and Load locations for which LBMPs will be calculated will initially be limited to a pre-defined set of buses External to the NYCA. LBMPs will be calculated for each bus within this limited set. The three components of LBMP will be calculated from the results of SCD and posted in the Day-Ahead and Real-Time Markets as described above, except that the Marginal Losses Component of LBMP will be calculated differently for Internal locations. The Marginal Losses Component of the LBMP at each bus, as described above, includes the difference between the marginal cost of losses at that bus and the Reference Bus. If this formulation were employed for an External bus, then the Marginal Losses Component would include the difference in the cost of Marginal Losses for a section of the transmission system External to the NYCA. Since the ISO will not charge for losses incurred Externally, the

formulation will exclude these loss effects. To exclude these External loss effects, the Marginal Losses Component will be calculated from points on the boundary of the NYCA to the Reference Bus.

The Marginal Losses Component of the LBMP at the External bus will be a weighted average of the Marginal Losses Components of the LBMPs at the Interconnection Points. To derive the Marginal Losses Component of the LBMP at an External location, a Transaction will be assumed to be scheduled from the External bus to the Reference Bus. The Shift Factors for this Transaction on the tie lines into these Interconnection buses, which measure the per-unit effect of flows over each of those tie lines that results from the hypothetical transaction, will provide the weights for this calculation. Since all the power from this assumed Transaction crosses the NYCA boundary, the sum of these weights is unity.

The sum of the products of these Shift Factors and the Marginal Losses Component of the LBMP at each of these Interconnection buses yields the Marginal Losses Component of the LBMP that will be used for the External bus. Therefore, the Marginal Losses Component of the LBMP at an External bus E is calculated using the equation:

$$\gamma_E^L = \sum_{b \in I} F_{Eb}(DF_b - 1)\lambda^R$$

where:

$\gamma_E^L$ = Marginal Losses Component of the LBMP at an External bus E;

$F_{Eb}$ = Shift Factor for the tie line going through bus b, computed for a hypothetical Bilateral Transaction from bus E to the Reference Bus;

$(DF_b - 1)\lambda^R$ = Marginal Losses Component of the LBMP at bus b; and

$I$ = The set of Interconnection buses between the NYCA and adjacent Control Areas.

## II. ACCOUNTING FOR TRANSMISSION LOSSES

### 1.0 Charges

Subject to Attachment K to the ISO OATT, the ISO shall charge all Transmission Customers for transmission system losses based on the marginal cost of losses on either a bus or zonal basis, described below.

### 1.1 Loss Matrix

The ISO's Security Constrained Dispatch ("SCD") program will use a loss matrix (referred to as a B matrix) and penalty factors to estimate and model losses in performing generation dispatch and billing functions for losses.

### 1.2 Residual Loss Payment

The ISO will determine the difference between the payments by Transmission Customers for losses and the payments to Suppliers for losses associated with all

Transactions (LBMP Market or Transmission Service under Parts II, III and IV of the ISO OATT) for both the Day-Ahead and Real-Time Markets. The accounting for losses at the margin may result in the collection of more revenue than is required to compensate the Generators for the Energy they produced to supply the actual losses in the system. This over collection is termed residual loss payments. The ISO shall calculate residual loss payments revenue on an hourly basis and will credit them against the ISO's Residual Adjustment (See Rate Schedule 1 of the ISO OATT).

**2.0 Computation of Residual Loss Payments**

**2.1 Marginal Losses Component LBMP**

The ISO shall utilize the Marginal Losses Component of the LBMP on an Internal bus, an External bus, or a zone basis for computing the marginal contribution of each Transaction to the system losses. The computation of these quantities is described in this Attachment.

**2.1.1 Marginal Losses Component Day-Ahead**

The ISO shall utilize the Marginal Losses Component computed by the ISO's Security Constrained Unit Commitment ("SCUC") program for computing the marginal contributions of each Transaction in the Day-Ahead Market.

### 2.1.2 Marginal Losses Component Real-Time

The ISO shall utilize the Marginal Losses Component computed by the ISO's Security Constrained Dispatch ("SCD") program for computing the Marginal Losses Component associated with each Transaction scheduled in the Real-Time Market (or deviations from Transactions scheduled in the Day-Ahead Market). The computations will be performed on a SCD interval basis and aggregated to an hourly total.

## 2.2 Payments and Charges

Payments and charges to reflect the impact of Energy supplied by each Generator, consumed by each Load, or transmitted by each Transmission Customer on the Marginal Losses Component shall be determined as follows. Each of these payments or charges may be negative.

**Day-Ahead Payments and Charges**

As part of the LBMP paid to all ~~Suppliers~~ Customers scheduled Day-Ahead to provide Energy to the LBMP Market, the ISO shall pay each such ~~Supplier~~ Customer the product of: (a) the injection scheduled Day-Ahead from each Customer ~~of that Supplier's Generators~~ in each hour, in MWh; and (b) the Marginal Losses Component of the Day-Ahead LBMP at each of those Generator~~s~~' buses, in $/MWh.

As part of the LBMP charged to all ~~LSEs~~ Customers scheduled Day-Ahead to purchase Energy from the LBMP Market, the ISO shall charge each such ~~LSE~~ Customer the product of. (a) the withdrawal scheduled Day-Ahead in each Load Zone by that ~~LSE~~ Customer in each hour, in MWh; and (b) the Marginal Losses Component of the Day-Ahead LBMP in that Load Zone, in $/MWh.

As part of the TUC charged to all Transmission Customers whose Transmission Service has been scheduled Day-Ahead, the ISO shall charge each such Transmission Customer the product of. (a) the amount of Energy scheduled Day-Ahead to be injected and withdrawn by that Transmission Customer in each hour, in MWh; and (b) the Marginal Losses Component of the Day-Ahead LBMP at the Point of Delivery (i.e., Load Zone in which Energy is scheduled to be withdrawn or the bus where Energy is scheduled to be withdrawn if the Energy is scheduled to be withdrawn at a location outside the NYCA), minus the Marginal Losses Component of the Day-Ahead LBMP at the Point of Receipt, in $/MWh.

**Real-Time Payments and Charges**

As part of the LBMP paid to all Suppliers providing Energy to the LBMP Market in the real-time dispatch, the ISO shall pay each such Supplier the product of: (a) the amount of Energy actually injected by each of that Supplier's Generators in each

hour (to the extent that actual injections do not exceed the AGC or SCD Base Points Signals sent to that Supplier for those Generators plus any ~~e~~Compensable ~~e~~Overgeneration payable pursuant to ISO procedures), minus the amount of Energy each of those Generators was scheduled Day-Ahead to inject in that hour, in MWh; and (b) the loss component of the Real-Time LBMP at each of those Generator's buses, in $/MWh.

As part of the LBMP charged to all ~~LSEs~~ Customers scheduled Day-Ahead to purchase Energy from the LBMP Market, the ISO shall charge each such ~~LSE~~ Customer the product of (a) the Actual Energy Withdrawals by that ~~LSE~~ Customer in each Load Zone in each hour, minus the Energy withdrawal scheduled Day-Ahead in that Load Zone by that ~~LSE~~ Customer for that hour, in MWh; and (b) the Marginal Losses Component of the Real-Time LBMP in that Load Zone, in $MWh.

As part of the TUC charged to all Transmission Customers whose Transmission Service was scheduled after the determination of the Day-Ahead schedule, or who schedule additional Transmission Service after the determination of the Day-Ahead schedule, the ISO shall charge each such Transmission Customer the product of: (a) the amount of Energy scheduled (as of the BME) to be injected and withdrawn by that Transmission Customer in each hour, minus the amount of Energy scheduled Day-Ahead to be injected and withdrawn by that Transmission Customer in that hour, in MWh; and (b) the Marginal Losses Component of the Real-Time LBMP at the Point of Delivery

(i.e., the Load Zone in which Energy is scheduled to be withdrawn or the External bus where Energy is scheduled to be withdrawn if Energy is scheduled to be withdrawn at a location outside the NYCA), minus the Marginal Losses Component of the Real-Time LBMP at the Point of Receipt, in $MWh.

As part of the LBMP paid to all Suppliers generating an amount of Energy that differs from the amount of Energy those Suppliers were scheduled (as of the BME) to generate in an hour in association with Bilateral Transactions, the ISO shall pay each such Supplier the product of: (a) the amount of Energy actually injected by each of that Supplier's Generators in each hour (to the extent that actual injections do. not exceed the AGC or SCD Base Points Signals sent to that Supplier for those Generators plus any ~~e~~Compensable ~~o~~Overgeneration payable pursuant to ISO procedures) minus the amount of Energy each of those Generators was scheduled (as of the BME) to inject in that hour in association with Bilateral Transactions, in MWh; and (b) the Marginal Losses Component of the Real-Time LBMP at each of those Generators' buses, in $/MWh.

As part of the LBMP charged to all ~~LSEs~~ Customers consuming an amount of Energy that deviates from the amount of Energy those ~~LSEs~~ Customer were scheduled (as of the BME) to consume in an hour in association with Bilateral Transactions, the ISO shall charge each such ~~LSE~~ Customer the product of: (a) the Actual Energy Withdrawals by that ~~LSE~~ Customer in each Load Zone in each hour, minus the Energy withdrawal scheduled (as of the BME) in

that Load Zone by that ~~LSE~~ Customer for that hour in association with Bilateral Transactions, in MWh; and (b) the Marginal Losses Component of the Real-Time LBMP in that Load Zone, in $/MWh.

## III. BILATERAL TRANSACTION BIDDING, SCHEDULING AND CURTAILMENT

### 1.0 Requests for Bilateral Transaction Schedules

Transmission Customers scheduling Transmission Service or to support a Bilateral Transaction with Energy supplied by an External Generator or Internal Generator shall submit the following information to the ISO:

(1) Point of Injection location. For Transactions with Internal sources, the Point of Injection is the LBMP bus; for Transactions with External sources, the Point of Injection is the Proxy Generator Bus; however, based upon such an advance notification to the ISO, an External Supplier will have the additional option of being modeled at a specific External LBMP bus (rather than an External Proxy Generator Bus) and being able to submit a bid curve. Otherwise, an External Supplier with Incremental or Decremental Bids at an External Proxy Generator Bus will be modeled as a single point price curve at that bus. An LBMP bus is a specific bus at