Total charges for Hour-Ahead Buyback of Non-Spinning Reserve for the Settlement Period t for Region z or Scheduling Point k which is connected directly to Region z.

C.3.129. $NonSpinNetOblig_{jt}$ – MW

The Net Non-Spinning Reserve Obligation for Scheduling Coordinator j for Settlement Period t. The Charge is negative when the Scheduling Coordinator has Excess Qualified Self-Provision of Non-Spinning Reserve .

C.3.130. $NonSpinGrossOblig_{jt}$ – MW

The Gross Non-Spinning Reserve Obligation for Scheduling Coordinator j for Settlement Period t.

C.3.131. $NonSpinQualifySelf_{jt}$ – MW

The Qualified Self-Provision of Non-Spinning Reserve for Scheduling Coordinator j for Settlement Period t.

C.3.132. $NonSpinQualifySelfDA_{jt}$ – MW

The Qualified Day-Ahead Self-Provision of Non-Spinning Reserve for Scheduling Coordinator j for Settlement Period t.

C.3.133. $NonSpinQualifySelfHA_{jt}$ – MW

The Qualified Hour-Ahead Self-Provision of Non-Spinning Reserve for Scheduling Coordinator j for Settlement Period t.

C.3.134. $NonSpinQualifySelfDA_{jyt}$ – MW

The Qualified Day-Ahead Self-Provision of Non-Spinning Reserve for Scheduling Coordinator j in Region y for Settlement Period t.

C.3.135. $NonSpinQualifySelfHA_{jzt}$ – MW

The Qualified Hour-Ahead Self-Provision of Non-Spinning Reserve for Scheduling Coordinator j in Region z for Settlement Period t.

C.3.136. $NonSpinGrossOblig_{jyt}$ – MW

The Gross Non-Spinning Reserve Obligation for Scheduling Coordinator j in Region y (defined in Day-Ahead) for Settlement Period t.

C.3.137. $NonSpinGrossOblig_{jzt}$ – MW

The Gross Non-Spinning Reserve Obligation for Scheduling Coordinator j in Region z (defined in Hour-Ahead) for Settlement Period t.

C.3.138. NonSpinNeutraAdjRate - $/MW

The ISO will charge each Scheduling Coordinator a Non-Spinning Reserve Neutrality Adjustment Charge according to Metered Demand. The rate for this charge is the difference between the total amount that the ISO pays out and the total amount that the ISO collects divided by the total Metered Demand of the control area.

C.3.139. **$SpinCCDA_{ijxt}$ - $**

Congestion charge to Scheduling Coordinator j for providing Spinning Reserve capacity in the Day-Ahead Market from resource i at Scheduling Point x in Settlement Period t.

C.3.140. **$NonSpinCCDA_{ijxt}$ - $**

Congestion charge to Scheduling Coordinator j for providing Non-Spinning Reserve capacity in the Day-Ahead Market from resource i at Scheduling Point x in Settlement Period t.

C.3.141. **$SpinCCHA_{ijxt}$ - $**

Congestion charge to Scheduling Coordinator j for providing Spinning Reserve capacity in the Hour-Ahead Market from resource i at Scheduling Point x in Settlement Period t.

C.3.142. **$SpinCPHA_{ijxt}$ - $**

Congestion payment to Scheduling Coordinator j for providing Spinning Reserve capacity in the Hour-Ahead Market from resource i at Scheduling Point x in Settlement Period t.

C.3.143. **$NonSpinCCHA_{ijxt}$ - $**

Congestion charge to Scheduling Coordinator j for providing Non-Spinning Reserve capacity in the Hour-Ahead Market from resource i at Scheduling Point x in Settlement Period t.

C.3.144. **$NonSpinCPHA_{ijxt}$ - $**

Congestion payment to Scheduling Coordinator j for providing Non-Spinning Reserve capacity in the Hour-Ahead Market from resource i at Scheduling Point x in Settlement Period t.

C.3.145. **$AGCUpNeutraAdjChg_{jt}$ - $**

Regulation Up Neutrality Adjustment Charge to Scheduling Coordinator j for Settlement Period t.

C.3.146. **$MeteredLoad_{jt}$ - MW**

The Demand of Scheduling Coordinator j for Settlement Period t.

C.3.147. **$AGCUpNeutraAdjRate_{t}$ - $/MW**

The Regulation Up Neutrality Adjustment Rate for Settlement Period t. The rate is the difference between the total amount of charge and the total amount of payment for the service divided by the total Demand in the ISO Control Area.

C.3.148. **$AGCUpChgTotal_t$ - $**

Total amount of charges collected by the ISO from Scheduling Coordinators for provision of Regulation Up Service for the Settlement Period t.

C.3.149. **$AGCUpPayTotal_t$ - $**

Total amount of payment from the ISO to Scheduling Coordinators for procuring Regulation Up Service for the Settlement Period t in both the Day-Ahead and the Hour-Ahead Markets.

C.3.150. **$AGCUpCCDA_{ijxt}$ - $**

Congestion charge to Scheduling Coordinator j for providing Regulation Up in the Day-Ahead Market from resource i at Scheduling Point x in Settlement Period t.

C.3.151. **$AGCUpCCHA_{ijxt}$ - $**

Congestion charge to Scheduling Coordinator j for providing Regulation Up in the Hour-Ahead Market from resource i at Scheduling Point x in Settlement Period t.

C.3.152. **$AGCUpCPHA_{ijxt}$ - $**

Congestion payment to Scheduling Coordinator j for providing Regulation Up in the Hour-Ahead Market from resource i at Scheduling Point x in Settlement Period t.

C.3.153. **$AGCUpCCTotal_t$ - $**

Total amount of Congestion charge incurred to the ISO for procuring Regulation Up over Congested interties for the Settlement Period t. This amount should be transferred into the FTR Balancing Account to balance the Congestion charge receivables booked in the Day-Ahead Market and the Hour-Ahead Market when the Regulation Up Services are procured.

C.3.154. **$AGCDownNeutraAdjChg_{jt}$ - $**

Regulation Down Neutrality Adjustment Charge to Scheduling Coordinator j for Settlement Period t.

C.3.155. **$AGCDownNeutraAdjRate_t$ - $/MW**

The Regulation Down Neutrality Adjustment Rate for Settlement Period t. The rate is the difference between the total amount of charge and the

total amount of payment for the service divided by the total Demand in the ISO Control Area.

C.3.156. **$AGCDownChgTotal_t$ - $**

Total amount of charges collected by the ISO from Scheduling Coordinators for provision of Regulation Down Service for the Settlement Period t.

C.3.157. **$AGCDownPayTotal_t$ - $**

Total amount of payment from the ISO to Scheduling Coordinators for procuring Regulation Down service for the Settlement Period t in both the Day-Ahead and the Hour-Ahead Markets.

C.3.158. **$SpinNeutraAdjChg_{jt}$ - $**

Spinning Reserve Neutrality Adjustment Charge to Scheduling Coordinator j for Settlement Period t.

C.3.159. **$MeteredDemand_{jt}$ – MW**

The Metered Demand of Scheduling Coordinator j for Settlement Period t.

C.3.160. **$SpinNeutraAdjRate_t$ - $/MW**

The Spinning Reserve Neutrality Adjustment Rate for Settlement Period t. The rate is the difference between the total amount of charge and the total amount of payment adjusted by the total congestion charge for the service divided by the total Metered Demand in the ISO Control Area.

C.3.161. **$SpinChgTotal_t$ - $**

Total amount of charges collected by the ISO from Scheduling Coordinators for provision of Spinning Reserve service for the Settlement Period t.

C.3.162. **$SpinPayTotal_t$ - $**

Total amount of payment from the ISO to Scheduling Coordinators for procuring Spinning Reserve service for the Settlement Period t in both the Day-Ahead and the Hour-Ahead Markets.

C.3.163. **$SpinCCTotal_t$ - $**

Total amount of Congestion charge incurred to the ISO for procuring Spinning Reserve over Congested interties for the Settlement Period t. This amount should be transferred into the FTR Balancing Account to balance the Congestion charge receivables booked in the Day-Ahead Market and the Hour-Ahead Market when the Spinning Reserves are procured.

C.3.164. **$NonSpinNeutraAdjChg_{jt}$ - $**

Non-Spinning Reserve Neutrality Adjustment Charge to Scheduling Coordinator j for Settlement Period t.

C.3.165. **$NonSpinNeutraAdjRate_t$ - $/MW**

The Non-Spinning Reserve Neutrality Adjustment Rate for Settlement Period t. The rate is the difference between the total amount of charge and the total amount of payment adjusted by the total congestion charge for the service divided by the total Metered Demand of the ISO Control Area.

C.3.166. **$NonSpinChgTotal_t$ - $**

Total amount of charges collected by the ISO from Scheduling Coordinators for provision of Non-Spinning Reserve service for the Settlement Period t.

C.3.167. **$NonSpinPayTotal_t$ - $**

Total amount of payment from the ISO to Scheduling Coordinators for procuring Non-Spinning Reserve service for the Settlement Period t in both the Day-Ahead and the Hour-Ahead Markets.

C.3.168. **$NonSpinCCTotal_t$ - $**

Total amount of Congestion charge incurred to the ISO for procuring Non-Spinning Reserve over Congested interties for the Settlement Period t. This amount should be transferred into the FTR Balancing Account to balance the Congestion charge receivables booked in the Day-Ahead Market and the Hour-Ahead Market when the Non-Spinning Reserves are procured.

APPENDIX D

IMBALANCE ENERGY CHARGE COMPUTATION

D.1 Scheduled Energy

"Scheduled Energy" is the Energy produced or consumed in each Dispatch Interval according to the Final Hour-Ahead Schedule as modified to account for Schedule changes between consecutive hours. A zero (0) MW Final Hour-Ahead Schedule is assumed by default for resources not scheduled in the Day-Ahead or Hour-Ahead Markets. All Schedule changes between consecutive hours shall be performed by a smooth linear ramp ("Scheduling Ramp") between the relevant Final Hour-Ahead Schedules. The Scheduling Ramp specifications, i.e., start time, end time, duration, and maximum ramp, may differ by resource depending on the resource's ramping ability and shall be specified by the ISO in the ISO Home Page. The ISO may periodically modify the Scheduling Ramp specifications as needed 24 hours after notifying Market Participants. The Scheduling Ramp specifications shall be taken into account in all scheduling and Dispatch tools used by the ISO to produce feasible Schedules and Dispatch Instructions consistent with the resource operational capabilities and constraints.

The Final Hour-Ahead Schedule and the associated Scheduling Ramp define the "Scheduled Operating Point (SOP)," which is the expected operating point of a resource as a function of time when no Dispatch Instructions are issued to that resource.

The Scheduled Energy shall be calculated in each Dispatch Interval as the integral of the SOP as follows:

$$SE_{i,h,k} = \int_{t=(k-1)T}^{kT} SOP_{i,h}(t)\,dt \qquad (1)$$

where:

T	is the time index;
I	is the resource index;
H	is the hour index;
K	is the Dispatch Interval index;
$SE_{i,h,k}$	is the Scheduled Energy from resource i during Dispatch Interval k of hour h;
$SOP_{i,h}(t)$	is the SOP of resource i during hour h as a function of time; and
T	is the duration of the Dispatch Interval (10 minutes).

D.2 Metered Energy

"Metered Energy" is Energy produced or consumed in real time during each Dispatch Interval. Metered Energy for ISO-Metered Entities is obtained from actual meter data that are aggregated for the duration of each Dispatch Interval. Metered Energy for non-ISO-Metered Entities is obtained from hourly meter data that are evenly distributed to the Dispatch Intervals of each hour. Meter data do not exist for individual System Resources. Therefore, Metered Energy for System Resources is obtained by inference from their Scheduled Energy and the Imbalance Energy that they are expected to produce or consume by responding to Dispatch Instructions.

D.3 Imbalance Energy

Imbalance Energy is real-time Energy deviation from Scheduled Energy. Positive Imbalance Energy is Energy that is produced in excess of Scheduled Energy or Scheduled Energy that is not consumed. Negative Imbalance Energy is Scheduled Energy that is not produced or Energy that is consumed in excess of Scheduled Energy. Imbalance Energy shall be measured, calculated, and settled in each Dispatch Interval for each resource separately. Imbalance Energy is composed

of Instructed Imbalance Energy, Uninstructed Imbalance Energy, and Unaccounted For Energy.

D.3.1 Instructed Imbalance Energy

Instructed Imbalance Energy is Energy produced or consumed as the result of responding to Dispatch Instructions. Dispatch Instructions specify the operating point where a dispatched resource is instructed to be after accounting for any start-up time (if the resource is off-line) and/or ramping with the relevant maximum ramp rate, as registered in the Master File. The start-up time must be less than ten (10) minutes for Non-Spinning Reserve. The Dispatch Instructions and the relevant start-up times and ramp rates define the Dispatch Operating Point (DOP) of resources in real time. The DOP of resources that are not dispatched defaults to the respective SOP.

Dispatch Instructions include pre-dispatch instructions issued after the Day-Ahead and Hour-Ahead Residual Unit Commitment Processes, pre-dispatch instructions issued after the Hourly Pre-Dispatch process, and Dispatch Instructions issued within the hour. Hourly Pre-dispatch instructions are for a full hour. The associated Energy deviations are settled as Instructed Imbalance Energy. Dispatch Instructions issued within the hour are 10-minute (or until the end of the hour, whichever less) instructions issued after a SCED execution or after an Exceptional Dispatch. Such instructions issued to resources with start-up times longer than ten minutes shall be issued sufficiently in advance to allow the resource time to start up. Dispatch Instructions also include implicit "end-of-hour instructions" that instruct a resource to return to its Final Hour-Ahead Schedule for the next hour and apply by default at the end of the hour to all resources that are not pre-dispatched for the next hour or not dispatched for the

first Dispatch Interval of the next hour. All Dispatch Instructions are deemed delivered. Instructed Imbalance Energy shall be calculated in each Dispatch Interval as the integral of the difference between the DOP and the SOP as follows:

$$IIE_{i,h,k} = \int_{t=(k-1)T}^{kT} \left(DOP_{i,h}(t) - SOP_{i,h}(t)\right)dt = \int_{t=(k-1)T}^{kT} DOP_{i,h}(t)\,dt - SE_{i,h,k} \qquad (2)$$

where:

$IIE_{i,h,k}$ is the Instructed Imbalance Energy from resource *i* during Dispatch Interval *k* of hour *h*; and

$DOP_{i,h}(t)$ is the DOP of resource *i* during hour *h* as a function of time.

Positive Instructed Imbalance Energy shall be paid the relevant Dispatch Interval Locational Marginal Price and negative Instructed Imbalance Energy shall be charged the relevant Dispatch Interval Locational Marginal Price. In algebraic terms, adopting the injection convention (injections are positive whereas ejections are negative), the Instructed Imbalance Energy charge is given by:

$$IIEC_{i,h,k} = -IIE_{i,h,k}\, LMP_{i,h,k} \qquad (3)$$

where:

$IIEC_{i,h,k}$ is the Instructed Imbalance Energy charge for resource *i* during Dispatch Interval *k* of hour *h*; and

$LMP_{i,h,k}$ is the LMP at the Location of resource *i* during Dispatch Interval *k* of hour *h*, as determined in accordance with Section 31.4.3.2.4.

Side payments may apply in addition to the Instructed Imbalance Energy charge as set forth in Section 31.4.3.4.4.

D.3.2 Uninstructed Imbalance Energy

Uninstructed Imbalance Energy is Energy produced or consumed due to deviations from the DOP. Uninstructed Imbalance Energy shall be calculated in each Dispatch Interval as the difference between Metered Energy and the integral of the DOP over that Dispatch Interval as follows:

$$UIE_{i,h,k} = ME_{i,h,k} - \int_{t=(k-1)T}^{kT} DOP_{i,h}(t)\,dt = ME_{i,h,k} - \left(SE_{i,h,k} + IIE_{i,h,k}\right) \qquad (4)$$

where:

$UIE_{i,h,k}$ is the Uninstructed Imbalance Energy from resource *i* during Dispatch Interval *k* of hour *h*; and

$ME_{i,h,k}$ is the Metered Energy from resource *i* during Dispatch Interval *k* of hour *h*.

Positive Uninstructed Imbalance Energy shall be paid the relevant Dispatch Interval Locational Marginal Price and negative Uninstructed Imbalance Energy shall be charged the relevant Dispatch Interval Locational Marginal Price. In algebraic terms, adopting the injection convention, the Uninstructed Imbalance Energy charge is given by:

$$UIEC_{i,h,k} = -UIE_{i,h,k}\, LMP_{i,h,k} \qquad (5)$$

where:

$UIEC_{i,h,k}$ is the Uninstructed Imbalance Energy charge for resource *i* during Dispatch Interval *k* of hour *h*.

Uninstructed Deviation Penalties may apply in addition to the Uninstructed Imbalance Energy charge as set forth in Section 11.2.4.1.2.

D.3.3 Unaccounted For Energy

Unaccounted For Energy (UFE) shall be calculated for each UDC Service Area and for each Dispatch Interval as the difference between the net Energy delivered into the UDC Service Area, adjusted for UDC Service Area Transmission Losses, and the total metered Demand within the UDC Service Area. The net Energy delivered into the UDC Service Area is obtained by aggregating the meter data of all UDC Interconnections in the import direction and the Metered Energy from all Generators within the UDC Service Area. The total metered Demand within the UDC Service Area is obtained by aggregating the Metered Energy from all Loads within the UDC Service Area. The UDC Service Area Transmission Losses are obtained by the State Estimator function of the Energy Management System as set forth in Section 31.4.3.2.1. Before the State Estimator is available, the ISO shall estimate UDC Service Area Transmission Losses using power flow calculations.

In algebraic terms, adopting the injection convention, the UFE is given by:

$$UFE_{j,h,k} = \sum_{l \in UDC_j} I_{l,h,k} + \sum_{i \in UDC_j} ME_{i,h,k} - TL_{j,h,k} \qquad (6)$$

where:

J is the UDC index;

L is the UDC Interconnection index;

UDC_j is the set of UDC Interconnections into UDC Service Area j or the set of Generators and Loads within UDC Service Area j;

$UFE_{j,h,k}$ is the UFE in UDC Service Area j during Dispatch Interval k of hour h;

$I_{l,h,k}$ is the net import into UDC Service Area j from UDC Interconnection l during Dispatch Interval k of hour h; and

$TL_{l,h,k}$ is the transmission loss in UDC Service Area j during Dispatch Interval k of hour h.

The UFE in each UDC Service Area shall be distributed to all Loads and exports within the UDC Service Area in proportion to their Metered Energy as follows:

$$UFE_{i,h,k} = UFE_{j,h,k} \frac{ME_{i,h,k}}{\sum_{i \in UDC_j} ME_{i,h,k}} \qquad (7)$$

where:

i is the index of Loads within UDC Service Area j or exports from UDC Service Area j outside the ISO Control Area; and

$UFE_{i,h,k}$ is the UFE allocated to Load within the UDC Service Area j or exports from UDC Service Area j outside the ISO Control Area during Dispatch Interval k of hour h;

Positive UFE shall be paid the relevant Dispatch Interval Locational Marginal Price and negative UFE shall be charged the relevant Dispatch Interval

Locational Marginal Price. In algebraic terms, adopting the injection convention, the UFE charge is given by:

$$UFEC_{i,h,k} = -UFE_{i,h,k}\, LMP_{i,h,k} \qquad (8)$$

where:

$UFEC_{i,h,k}$ is the UFE charge for Load *i* within UDC Service Area *j* or export *i* from UDC Service Area *j* outside the ISO Control Area during Dispatch Interval *k* of hour *h*.

Uninstructed Deviation Penalties shall not apply to UFE.

D.4 Hourly Ex Post Price

For each Settlement Period and Location where Instructed Imbalance Energy is procured, the ISO shall calculate the Hourly Ex Post Price as the weighted average of the relevant six Dispatch Interval Locational Marginal Prices during the Settlement Period. The weights shall be the Instructed Imbalance Energy procured during the corresponding Dispatch Intervals, as follows:

$$HEPP_{i,h,k} = \frac{\sum_{k=1}^{6}\left(\left|IIE_{i,h,k}\right| LMP_{i,h,k}\right)}{\sum_{k=1}^{6}\left|IIE_{i,h,k}\right|} \qquad (9)$$

where:

$HEPP_{i,h,k}$ is the Hourly Ex Post Price at Location *i* during Dispatch Interval *k* of hour *h*; and

$IIE_{i,h,k}$ is the total Instructed Imbalance Energy procured at Location *i* during Dispatch Interval *k* of hour *h*.

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APPENDIX E

USAGE CHARGE COMPUTATION

E 1 Purpose of Charge

Scheduling Coordinators will be charged for the use of Congested transmission or will receive payments for relieving the Congestion through the Settlement of Final Day-Ahead and Hour-Ahead Energy Schedules and through the Real-Time Imbalance Energy Market at the relevant Locational Marginal Prices. Scheduling Coordinators will also be charged for using Congested interties to import Ancillary Services.

Terms used in this Appendix:

Ancillary Service Congestion Charge is a charge to a Scheduling Coordinator for importing Spinning Reserve or Non-Spinning Reserve across a Congested intertie. The charge for each service from each resource in each market (Day-Ahead Market or Hour Ahead Market) in each Settlement Period at each intertie equals the amount of import multiplied by the Ancillary Service Congestion Price at the intertie.

Ancillary Service Congestion Price is the Shadow Price of the transmission interface for a given market (Day-Ahead Market or Hour-Ahead Market) for a Settlement Period.

Shadow Price is the marginal price of reserving transmission capacity on the congested intertie to accommodate the associated Ancillary Services capacity.

E 2 Fundamental Formulae

E 2.1 ISO Credits and Debits to Transmission Owners and FTR Holders of Congestion Revenues

E 2.1.1 Day-Ahead Market

The ISO will pay or charge to FTR Holder *n* of a Point-To-Point FTR Obligation from node *i* to node *j* its share of the Congestion Revenue (which will be positive for payments or negative for charges) for Settlement Period t in the Day-Ahead Market as follows:

$$PayCR_{ntd}^{i\to j} = \left(\lambda_{jtd} - \lambda_{itd}\right) * L_{nt}^{i\to j}$$

The ISO will pay to FTR Holder *n* of a Point-To-Point FTR Option from node *i* to node *j* its share of the Congestion Revenue (only if positive) for Settlement Period t in the Day-Ahead Market as follows:

$$PayCR_{ntd}^{i\to j} = \max\left(0, \left(\lambda_{jtd} - \lambda_{itd}\right) * L_{nt}^{i\to j}\right)$$

To avoid double subscripts in notations, any Network Service Right can be described, without loss of generality, as the right for sending (p_1, p_2, ..., p_s) % of one MW at nodes (1,2, ..., *s*) and receiving (p_{s+1}, p_{s+2}, ..., p_{s+r}) % of one MW at nodes (*s*+1, *s*+2, ..., *s*+r). Using this notation, the ISO will pay or charge to FTR Holder *n* of Network Service Rights from node set {*i*} to node set {*j*} its share of the Congestion Revenue (which

will be positive for payments or negative for charges) for Settlement Period t in the Day-Ahead Market as follows:

$$PayCR_{ntd}^{\{i\}\to\{j\}} = \left(\sum_{j=s+1}^{s+r} \lambda_{jtd} p_{jt} - \sum_{i=1}^{s} \lambda_{itd} p_{it} \right) * L_{nt}^{\{i\}\to\{j\}}$$

The Congestion Revenue that remains after deducting the payments to FTR holders will accumulate in the FTR Balancing Account.

E 2.1.2 Hour-Ahead Market

The Congestion Revenue collected through Settlement of Energy at Hour-Ahead LMPs and through the Ancillary Service Congestion Charge in the Hour-Ahead Market will accumulate in the FTR Balancing Account.

FTR holders are not entitled or obligated to any Congestion Revenue collected through Hour-Ahead Market.

E 3 Meaning of terms of formulae

E 3.1 λ_{jtd} **($/MWh)**

The reference Locational Marginal Price for node j for the relevant Settlement Period t in the Day-Ahead Market, as calculated by SCUC.

E 3.2 $PayCR_{ntd}^{i\to j}$ **($)**

The amount calculated by the ISO to be paid to or by the FTR Holder n of Point-To-Point FTR from node *i* to node *j* for the relevant Settlement Period t in the Day-Ahead Market.

E 3.3 $PayCR_{ntd}^{\{i\}\to\{j\}}$ **($)**

The amount calculated by the ISO to be paid to or by the FTR Holder n of Network Service Rights from node set {*i*} to node set {*j*} for the relevant Settlement Period t in the Day-Ahead Market.

E 3.4 $L_{nt}^{i\to j}$ **($)**

The amount FTR owned by the FTR Holder n of Point-To-Point FTR from node *i* to node *j* for the relevant Settlement Period t.

E 3.5 $L_{nt}^{\{i\}\to\{j\}}$ **($)**

The amount FTR owned by the FTR Holder n of Network Service Rights from node set {*i*} to node set {*j*} for the relevant Settlement Period t.

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F 3.3 **Q_n (MW)**

The Available Transmission 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 Transmission 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 Dispatch 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 Dispatch 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 ($/MWh). Subject to any locational requirements the ISO will select the Generating Unit with the highest decremental Supplemental Energy Bid to reduce MW output by such amount as is necessary to achieve the instructed MVar reactive energy production. Each Dispatch the ISO will pay Scheduling Coordinator j for that Generating Unit i in Location x, the lost opportunity cost ($) resulting from the reduction of MW output in Dispatch 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 at Location 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 Dispatch 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 Load Zone y for Dispatch Interval t will be calculated using the following formula:

$$VSSTRate_{yt} = \frac{\sum_{ijx} VSST_{xijt}}{\sum_{j} QChargeVS_{yjt}}$$

The user rate ($/MWh) for month m for long term voltage support referred to in G2.1.2 in Load Zone y will be calculated using the following formula:

$$VSSTRate_{ym} = \frac{\sum_{jx} VSLT_{xjm}}{\sum_{jm} QChargeVS_{yjt}}$$

G 2.2.2 Voltage Support Charges

The lost opportunity cost Voltage Support charge ($)payable to recover the sums under G2.1.1 for Load Zone y for Dispatch Interval t for Scheduling Coordinator j will be calculated using the following formula:

$$VSSTCharge_{yjt} = VSSTRate_{ym} * QChargeVS_{yjt}$$

The monthly long term voltage support charge ($) payable to recover sums under G2.1.2 for Load Zone y for month m for Scheduling Coordinator j will be calculated using the following formula:

$$VSLTCharge_{yjm} = VSLTRate_{ym} * \sum_m QCharge_{yjt}$$

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 Dispatch 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 Dispatch 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 Dispatch 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 Dispatch 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 at Location x, resulting from the reduction of MW output in Dispatch Interval t.

G 3.2 P_{xt} ($/MWh)

The Locational Marginal Price for Imbalance Energy in Dispatch Interval t at Location x.

G 3.3 Sup_{xdecit} ($/MWh)

The Supplemental Energy Bid for Scheduling Coordinator j for Generating Unit i at Location x in Dispatch 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 at Location x in Dispatch 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 at Location x for Voltage Support in month m calculated in accordance with the relevant Reliability Must-Run Contract.

G 3.6 VSSTRateyt ($/MWh)

The Dispatch Interval lost opportunity cost Voltage Support user rate charged by the ISO to Scheduling Coordinators for Dispatch Interval t for Load Zone y.

G 3.7 $VSLTRate_{ym}$ ($/MWh)

The monthly long term voltage support user rate charged by the ISO to Scheduling Coordinators for month m for Load Zone y.

G 3.8 QChargeVSxyjt (MWh)

The charging quantity for Voltage Support for Scheduling Coordinator j for Dispatch Interval t in Load Zone y equal to the total metered Demand (including exports to neighboring Control Areas) for Scheduling Coordinator j in Load Zone y for Dispatch Interval t.

G 3.9 VSSTChargeyjt ($)

The lost opportunity cost Voltage Support user charge for Load y for Dispatch Interval t for Scheduling Coordinator j.

G 3.10 VSLTChargeyjm ($)

The long term charge for voltage support for month m for Load Zone y 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 Dispatch 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 Dispatch 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 Dispatch 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 Dispatch 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 Dispatch Interval t.

G 3.16 **$QChargeBlackstart_{jt}$** **(MW)**

The charging quantity for Black Start for Scheduling Coordinator j for Dispatch Interval t equal to the total metered Demand (excluding exports to neighboring Control Areas) of Scheduling Coordinator j for Dispatch Interval t.

APPENDIX H

UNIT COMMITMENT COST

H.1 Calculation of Unrecovered Commitment Cost

The Unrecovered Commitment Costs will be calculated ex post for each committed unit for each Commitment Period as follows:

1) The Minimum Load Cost *MLC* will be calculated from the average proxy cost at minimum load P_{min}, using the average heat rate function *AHR*(*P*) in Btu/kWh, the relevant gas price index *GPI* in $/Btu, and a $6/MWh adder for O&M costs:

$$MLC = \left(0.001\ AHR(P_{\min})\ GPI + 6\right) P_{\min} \quad (1)$$

2) For each Qualifying Hour *h*, the market revenue *MR* will be calculated for each Dispatch Interval *k* as the total of all Instructed Imbalance Energy and Uninstructed Imbalance Energy payments in that interval.

3) For each Qualifying Hour *h*, the operating cost *OC* will be calculated for each Dispatch Interval *k* as the proxy cost at the dispatched output P_k:

$$OC_{h,k} = \left(0.001\ AHR(P_k)\ GPI + 6\right) P_k \quad (2)$$

4) For each Qualifying Hour *h*, the market deficiency *MD* for recovering *MLC* will be calculated as follows:

$$MD_h = \min\left(0, \sum_{k=1}^{6} MR_{h,k} - MLC\right) \quad (3)$$

5) For each Qualifying Hour *h*, the market profit *MP* will be calculated as follows:

$$MP_h = \max\left(0, \sum_{k=1}^{6}\left(MR_{h,k} - OC_{h,k}\right)\right) \quad (4)$$

6) The Unrecovered Commitment Costs *UCC* for the Commitment Period will be calculated as the net of market deficiencies, market profits, and allocated startup costs *SC*, over all Qualifying Hours:

$$UCC = \min\left(0, \sum_{h} MP_h + \sum_{h} MD_h - \frac{m}{n} SC\right) \quad (5)$$

where *n* is the number of hours in an ISO Commitment Period and m is the number of Qualifying Hours within the Commitment Period.

Negative *UCC* indicates unrecovered cost that should be paid to eligible resources.

H.2 Allocation of Unrecovered Commitment Cost

For cost allocation purposes, the *UCC* for each committed resource for each eligible Commitment Period will be distributed evenly over all Qualifying Hours in that Commitment Period:

$$UCC_h = \frac{UCC}{m} \quad (6)$$

The total of all distributed *UCC* from all resources in a given hour would constitute the total Unrecovered Commitment Cost *TUCC* that needs to be allocated in that hour. Then, the *TUCC* will be allocated in two tiers as follows:

$$TUCC_1 = TUCC \min\left(1, \frac{\max(0, D_M - D_S)}{\max(0, D_F - D_S)}\right) \quad (7)$$
$$TUCC_2 = TUCC - TUCC_1$$

where D_F is the forecasted Demand plus scheduled exports, adjusted for energy schedules and bids expected at subsequent markets, D_S is the scheduled Demand plus scheduled exports, and D_M is the metered Demand.

Tier 1, ($TUCC_1$), will be allocated to all SCs in proportion to their net negative demand deviations (demand under-scheduling). Tier 2, ($TUCC_2$) is due to ISO over-forecast and will be allocated to all SCs in proportion to their metered demand.

H.3 Phased Implementation

The proposed cost allocation scheme would work slightly differently in different markets and at different implementation phases of the Market Design 2002. Table 1 lists all the combinations. The short-term phase is 10/1/02–3/31/03 followed by the long-term phase on 4/1/03.

MP 2.2.5 Format for Data Requests

SCs may obtain Settlement Quality Meter Data relating to the ISO Metered Entities they represent by directly polling MDAS using the Meter Data Request Format. The ISO will use its best efforts to ensure that such data is made available to SCs within 5 business days of the relevant Trading Day.

MP 2.3 SC Metered Entities

MP 2.3.1 Method of Submitting Meter Data to ISO

SCs must submit Settlement Quality Meter Data for those SC Metered Entities they represent to MDAS when required to submit that data in order to meet the requirements of SABP and the ISO Payments Calendar.

MP 2.3.2 Interface with MDAS

SCs shall utilize a Compatible Meter Data Server to interface with MDAS via WEnet.

MP 2.3.3 Frequency of Submitting Data

SCs shall submit Settlement Quality Meter Data to the ISO when required to do so by the SABP and the ISO Payments Calendar. SCs must also submit Settlement Quality Meter Data on demand. The ISO will issue such demands using voice communications. If the ISO issues a demand for Settlement Quality Meter Data, the SC from which the ISO demands that data must submit it to the ISO within 4 hours of receiving the demand from the ISO.

MP 2.3.4 Format for Data Submission

SCs shall submit Settlement Quality Meter Data to MDAS for the SC Metered Entities they represent using the Meter Data Exchange Format. Subject to any exemption granted by the ISO under MP 13, SCs must ensure that Settlement Quality Meter Data submitted to the ISO is in intervals of:

(a) 5 minutes for Loads and Generators providing Ancillary Services and/or Supplemental Energy; and

(b) 1 hour for other SC Metered Entities.

Each SC shall submit Settlement Quality Meter Data for all of the SC Metered Entities that it schedules aggregated by:

(a) the same Load aggregation that was used in scheduling for Demand;

(b) the relevant unit for Generation; or

(c) the Scheduling Point for imports and exports.

The Settlement Quality Meter Data submitted by SCs may be in either kWh or MWh values.

iii. Loss Correction Factors

The ISO may grant an ISO Metered Entity an exemption from compliance with the metering standards referred to in this Protocol and the ISO Tariff if, in the ISO's sole discretion, applicable loss correction factors can be applied to existing meters without any materially adverse effect on the accuracy or security of the Meter Data obtained from such meters.

iv. **[Not Used]**

v. Request for Direct Polling

SCs may request the ISO to grant an exemption from the requirement to provide Settlement Quality Meter Data to the ISO for SC Metered Entities they represent if those entities are Generators which have requested the ISO, and the ISO has agreed, to directly poll them for Meter Data. Such Generators will be treated as ISO Metered Entities and must comply with all of the requirements relating to ISO Metered Entities in accordance with this Protocol and the ISO Tariff. The SC representing such Generators will be required to apply the relevant distribution loss factors to that Generator's Meter Data (the SC may obtain that Meter Data from the ISO).

vi. QF Exemptions

If a QF sells all of its Energy (excluding any Energy consumed by auxiliary load equipment electrically connected to that QF at the same point or any Energy sold through "over the fence" arrangements as authorized by Section 218(b) of the California Public Utilities Code) and Ancillary Services to the UDC in whose Service Area it is located pursuant to an existing power purchase agreement (which is authorized under Section 218(b) of the California Public Utilities Code) and there is any inconsistency between that existing power purchase agreement and this Protocol, Section 10 of the ISO Tariff or Appendix J to the ISO Tariff, the