ATTACHMENT E

RATIONAL BUYER

2.5.3.6 The ISO, whenever possible, will increase its purchases of an Ancillary Service that can substitute for another Ancillary Service, when doing so is expected to reduce its total cost of procuring Ancillary Services while meeting reliability requirements. The ISO will make such adjustments in accordance with the following principles:

(a) The Regulation requirement must be satisfied by Regulation bids from Resources qualified to provide Regulation;

(b) Additional Regulation capacity can be used to satisfy requirements for any types of reserves (Spinning Reserve, Non-Spinning Reserve or Replacement Reserve);

(c) Regulation and Spinning Reserve requirements must be satisfied by the combination of Regulation and Spinning Reserve bids;

(d) Additional Regulation and Spinning Reserve capacity can be used to satisfy requirements for Non-Spinning and Replacement Reserve;

(e) Regulation, Spinning Reserve, and Non-Spinning Reserve requirements must be satisfied by the combination of Regulation, Spinning Reserve and Non-Spinning Reserve bids;

(f) Additional Regulation, Spinning Reserve, and Non-Spinning Reserve capacity can be used to satisfy requirements for Replacement Reserve;

(g) Total MW purchased from the Regulation, Spinning Reserve, Non-Spinning Reserve, and Replacement Reserve markets will not be changed by this Section 2.5.3.6; and

(h) All quantities of Ancillary Services so procured must be non-negative.

2.5.20.1 Ancillary Service Obligations. Each Scheduling Coordinator shall be assigned a share of the total Regulation, Spinning Reserve, Non-Spinning and Replacement Reserve requirements by the ISO. The share assigned to each Scheduling Coordinator is described in Section 2.5.20 and in Section 2.5.28 as that Scheduling Coordinator's obligation. Each Scheduling Coordinator's Regulation obligation in each Zone shall be pro rata based upon the same proportion as the Scheduling Coordinator's metered hourly Demand bears to the total metered Demand served in each hour in that Zone. Each Scheduling Coordinator's Operating Reserve obligation in each Zone shall be pro rata based upon the same proportion as the ratio of the product of its percentage obligation based on Schedules and the sum of its metered Demand and firm exports bears to the total of such products for all Scheduling Coordinators in the Zone. The Scheduling Coordinator's percentage obligation based on Schedules shall be calculated as the sum of 5% of its scheduled Demand (except the Demand covered by firm purchases from outside the ISO Control Area) scheduled to be met by Generation from hydroelectric resources plus 7% of its scheduled Demand (except the Demand covered by firm purchases from outside the ISO Control Area) scheduled to be met by Generation from non-hydroelectric resources in that Zone, plus 100% of any Interruptible Imports and on-demand obligations which it schedules. Each Scheduling Coordinator's Replacement Reserve obligation in each Zone ~~shall be pro rata based upon the same proportion as the metered Demand of the Scheduling Coordinator bears to the total metered Demand in the Zone~~ is calculated as described in Section 2.5.28.4.

2.5.28 Settlement for User Charges for Ancillary Services.

The ISO shall determine a separate hourly user rate for Regulation, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve for each Settlement Period purchased in the Day-Ahead market, and in the Hour-Ahead Market. Each rate will be charged to Scheduling Coordinators on a volumetric basis applied to each Scheduling Coordinator's obligation for the Ancillary Service concerned which it has not self provided.

Each Scheduling Coordinator's obligation for Regulation, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve for each Zone shall be calculated in accordance with Section 2.5.20.1.

The cost of Voltage Support and Black Start shall be allocated to Scheduling Coordinators as described in Sections 2.5.28.

Quantities and rates for the Hour-Ahead markets shall be calculated by substituting the Hour-Ahead quantities and prices in the relevant formulae (including self provided quantities of the Ancillary Service) except that the user rates for Regulation, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve capacity shall be calculated by dividing the net payments made by the ISO for each service by the obligation for each service which has not been self-provided. The net payments are the total payments for each service net of sums payable by Scheduling Coordinators who have bought back in the Hour-Ahead Regulation, Spinning Reserve, Non-Spinning Reserve or Replacement Reserve capacity, as the case may be, which they had sold to the ISO in the Day-Ahead Market.

When Market Clearing Prices for Ancillary Services differ, substituting Demand for one Ancillary Service with Demand for another pursuant to Section 2.5.3.6 may cause an imbalance to arise between the total payments to suppliers and the total payments to users. For each Settlement Period, this imbalance is equal to the sum of

payments for Regulation, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve pursuant to Section 2.5.27 for the Day-Ahead and Hour-Ahead Markets summed across all Zones in each Settlement Period, less the sum of corresponding charges for such Ancillary Services pursuant to this Section. Charges or credits associated with such imbalance shall be assigned to each Scheduling Coordinator in proportion to its share of such corresponding charges.

~~Separate rates shall be calculated for each Service as follows:~~

2.5.28.4 Replacement Reserve. The user rate per unit of purchased Replacement Reserve for each Settlement Period ~~in the Day-Ahead Market and Hour-Ahead Markets for each Zone shall be calculated by dividing the total cost to ISO of purchasing Replacement Reserve capacity within the Zone, for the Settlement Period by the ISO's total Replacement Reserve requirement for the Settlement Period in the Day-Ahead Market less that which has been self provided by Scheduling Coordinators within the Zone. The ISO will calculate the user rate for Replacement Reserve in each Zone for each Settlement Period as:~~ for each Zone shall be as follows:

$$\sim\sim ReplRateDA_{xt} = \frac{\sum_{j} ReplPayTotalDA_{jxt}}{ReplObligTotal_{xt}} \sim\sim$$

$$ReplRate_{xt} = \frac{Re\ plPayTotalDA_{xt} + Re\ plPayTotalHA_{xt} - Re\ plBuyBackTotal_{xt}}{ReplObligTotal_{xt}}$$

where

ReplPayTotalDA$_{xt}$ = Total Replacement Reserve payments for the Settlement Period t in the Day-Ahead Market for the Zone x.

ReplPayTotalHA$_{xt}$ = Total Replacement Reserve payments for the Settlement Period t in the Hour-Ahead Market for the Zone x.

ReplBuyBackTotal = payments from Scheduling Coordinators buying back Ancillary Service capacity sold in the Day-Ahead Market or replacing capacity that was self-provided in the Day-Ahead Market.

ReplObligTotal$_{xt}$ = the total ISO Replacement Reserve requirement procured in the Day-Ahead Market and Hour-Ahead Market for the Settlement Period t for the Zone x less that which has been self provided by Scheduling Coordinators.

For each Settlement Period, each Scheduling Coordinator shall pay to the ISO a sum calculated as follows for each Zone:

*ReplRateDA*ReplOblig*

where

ReplOblig = DevReplOblig + RemRepl - SelfProv

DevReplOblig is the Scheduling Coordinator's obligation for deviation Replacement Reserve in the Zone in the Settlement Period and *RemRepl* is the Scheduling Coordinator's obligation for remaining Replacement Reserve. ~~for which it has not self provided.~~

Deviation Replacement Reserve for Scheduling Coordinator j in Zone x for Settlement Period t is calculated as follows:

If $ReplObligTotal_{xt} > DevReplOblig_{xt}$ then:

$$DevReplOblig_{xjt} = \left[Max\left(0, \sum_i GenDev_{ixt}\right) - Min\left(0, \sum_i LoadDev_{ixt}\right) \right]$$

If $ReplObligTotal_{xt} < DevReplOblig_{xt}$ then:

$$DevReplOblig_{xjt} = \frac{ReplObligTotal_{xt}}{DevReplOblig_{xt}} * \left[Max\left(0, \sum_i GenDev_{ixt}\right) - Min\left(0, \sum_i LoadDev_{ixt}\right) \right]$$

where,

$GenDev_i$ = The deviation between scheduled and actual Energy generation for Generator i represented by Scheduling Coordinator j in Zone x during Settlement Period t as referenced in Section 11.2.4.1.

$LoadDev_i$ = The deviation between scheduled and actual Load consumption for resource i represented by Scheduling Coordinator j in Zone x during Settlement Period t as referenced in Section 11.2.4.1.

DevReplOblig is total deviation Replacement Reserve in Zone x for Settlement Period t.

Remaining Replacement Reserve for Scheduling Coordinator j in Zone x for Settlement Period t is calculated as follows:

$$RemRepl_{xjt} = \frac{MeteredDemand_{xt}}{TotalMeteredDemand_{xt}} * Total\ Rem\ Repl_{xt}$$

where:

MeteredDemand is the Scheduling Coordinator's total metered Demand excluding exports in Zone x for Settlement Period t.

TotalMeteredDemand is total metered Demand excluding exports in Zone x for Settlement Period t.

$TotalRemRepl_{xt} = Max[0, ReplObligTotal_{xt} - DevReplOblig_{xt}]$

C 2.2.1 Day-Ahead Market

(a) Regulation. The ISO will charge the zonal cost of providing Regulation capacity that is not self provided by Scheduling Coordinators, in the Day-Ahead Market, through the application of a charge to each Scheduling Coordinator for each Trading Interval. This charge will be computed by multiplying the Regulation user rate for the Trading Interval by the Scheduling Coordinator's Regulation obligation, for which it has not self provided, for the same period.

The zonal Regulation user rate for the Day-Ahead Market is calculated by dividing the total cost to ISO of purchasing Regulation Capacity within the Zone, for the Trading Interval, by the total ISO Regulation obligation for the Trading Interval within the Zone. The Day-Ahead Regulation user rate in Zone x for Trading Interval t is calculated as follows:

$$AGCRateDA_{xt} = \frac{\sum_{j} AGCPayTotalDA_{jxt}}{AGCObligTotal_{xt}}$$

The Regulation capacity charge for Scheduling Coordinator j in the Day-Ahead Market in Zone x for Trading Interval t is calculated as follows:

$$AGCChgDA_{jxt} = AGCOblig_{jxt} * AGCRateDA_{xt}$$

(b) Spinning Reserve. The ISO will charge the zonal cost of providing Spinning Reserve capacity that is not self provided by Scheduling Coordinators, in the Day-Ahead Market, through the application of a charge to each Scheduling Coordinator for each Trading Interval. This charge will be computed by multiplying the Spinning Reserve capacity user rate for the Trading Interval by the Scheduling Coordinator's Spinning Reserve obligation, for which it has not self provided, for the same period.

The zonal Spinning Reserve capacity user rate for the Day-Ahead Market is calculated by dividing the total cost to ISO of purchasing Spinning Reserve capacity within the Zone, for the Trading Interval, by the total ISO Spinning Reserve obligation for the Trading Interval within the Zone. The Day-Ahead Spinning Reserve capacity user rate in Zone x for Trading Interval t is calculated as follows:

$$SpinRateDA_{xt} = \frac{\sum_{j} SpinPayTotalDA_{jxt}}{SpinObligTotal_{xt}}$$

The Spinning Reserve capacity charge for Scheduling Coordinator j in the Day-Ahead Market in Zone x for Trading Interval t is calculated as follows:

$$SpinChgDA_{jxt} = SpinOblig_{jxt} * SpinRateDA_{xt}$$

(c) Non-Spinning Reserve. The ISO will charge the zonal cost of providing Non-Spinning Reserve capacity that is not self provided by Scheduling Coordinators, in the Day-Ahead Market, through the application of a charge to each Scheduling Coordinator for each Trading Interval. This charge will be computed by multiplying the Non-Spinning Reserve capacity user rate for the Trading Interval by the Scheduling Coordinator's Non-Spinning Reserve obligation, for which it has not self provided, for the same period.

The zonal Non-Spinning Reserve capacity user rate for the Day-Ahead Market is calculated by dividing the total cost to ISO of purchasing Non-Spinning Reserve capacity within the Zone, for the Trading Interval, by the total ISO Non-Spinning Reserve obligation for the Trading Interval within the Zone. The Day-Ahead Non-Spinning Reserve capacity user rate in Zone x for Trading Interval t is calculated as follows:

$$NonSpinRateDA_{xt} = \frac{\sum_{j} NonSpinPayTotalDA_{jxt}}{NonSpinObligTotal_{xt}}$$

The Non-Spinning Reserve capacity charge for Scheduling Coordinator j in the Day-Ahead Market in Zone x for Trading Interval t is calculated as follows:

$$NonSpinChgDA_{jxt} = NonSpinOblig_{jxt} * NonSpinRateDA_{xt}$$

~~*(d) Replacement Reserve*. The ISO will charge the zonal cost of providing Replacement Reserve capacity that is not self provided by Scheduling Coordinators, in the Day-Ahead Market, through the application of a charge to each Scheduling Coordinator for each Trading Interval. This charge will be computed by multiplying the Replacement Reserve user rate for the Trading Interval by the Scheduling Coordinator's Replacement Reserve obligation, for which it has not self provided, for the same period.~~

~~The zonal Replacement Reserve user rate for the Day-Ahead Market is calculated by dividing the total cost to ISO of purchasing Replacement Reserve Capacity within the Zone, for the Trading Interval, by the total ISO Replacement Reserve obligation for the Trading Interval within the~~

Zone. The Day-Ahead Replacement Reserve user rate in Zone x for Trading Interval t is calculated as follows:

$$ReplRateDA_{xt} = \frac{\sum_{j} ReplPayTotalDA_{jxt}}{ReplObligTotal_{xt}}$$

The Replacement Reserve capacity charge for Scheduling Coordinator j in the Day-Ahead Market in Zone x for Trading Interval t is calculated as follows:

$$ReplChgDA_{jxt} = ReplOblig_{jxt} * ReplRateDA_{xt}$$

C 2.2.2 Hour-Ahead Market

(a) Regulation. The ISO will charge the zonal net cost of providing Regulation capacity that is not self provided by Scheduling Coordinators, in the Hour-Ahead Market through the application of a charge to each Scheduling Coordinator for the Trading Interval concerned. This charge will be computed by multiplying the Regulation user rate for the Trading Interval by the Scheduling Coordinator's Regulation obligation, for which it has not self provided, for the same period.

The zonal Regulation capacity user rate for the Hour-Ahead Market is calculated by dividing the total cost to the ISO of purchasing Regulation capacity within the Zone less any amounts payable to the ISO by Scheduling Coordinators for Regulation bought back from the ISO in the Hour-Ahead Market on behalf of resources located in the Zone, for the Trading Interval, by the total ISO Regulation capacity obligation for the Trading Interval within the Zone. The Hour-Ahead Regulation capacity user rate in Zone x for Trading Interval t is calculated as follows:

$$AGCRateHA_{xt} = \frac{\sum_{j} AGCPayTotalHA_{jxt}}{AGCObligTotal_{xt}}$$

The Regulation capacity charge for Scheduling Coordinator j in the Hour-Ahead Market in Zone x for Trading Interval t is calculated as follows:

$$AGCChgHA_{jxt} = (AGCOblig_{jxt} * AGCRateHA_{xt})$$

(b) Spinning Reserve. The ISO will charge the zonal net cost of providing Spinning Reserve capacity that is not self provided by Scheduling Coordinators, in the Hour-Ahead Market, through the application of a charge to each Scheduling Coordinator for the Trading Interval. This charge will be computed by multiplying the Spinning Reserve capacity user rate for the Trading Interval by the Scheduling Coordinator's Spinning Reserve obligation, for which it has not self provided, for the same period.

The zonal Spinning Reserve capacity user rate for the Hour-Ahead Market is calculated by dividing the total cost to ISO of purchasing Spinning Reserve capacity within the Zone less any amounts payable

to the ISO by Scheduling Coordinators for Spinning Reserve bought back from the ISO in the Hour-Ahead Market on behalf of resources located in the Zone, for the Trading Interval, by the total ISO Spinning Reserve obligation for the Trading Interval within the Zone. The Hour-Ahead Spinning Reserve capacity user rate in Zone x for Trading Interval t is calculated as follows:

$$SpinRateHA_{xt} = \frac{\sum_{j} SpinPayTotalHA_{jxt}}{SpinObligTotal_{xt}}$$

The Spinning Reserve capacity charge for Scheduling Coordinator j in the Hour-Ahead Market in Zone x for Trading Interval t is calculated as follows:

$$SpinChgHA_{jxt} = (SpinOblig_{jxt} * SpinRateHA_{xt})$$

(c) Non-Spinning Reserve. The ISO will charge the zonal net cost of providing Non-Spinning Reserve capacity that is not self provided by Scheduling Coordinators, in the Hour-Ahead Market, through the application of a charge to each Scheduling Coordinator for the Trading Interval. This charge will be computed by multiplying the Non-Spinning Reserve capacity user rate for the concerned Trading Interval by the Scheduling Coordinator's Non-Spinning Reserve obligation, for which it has not self provided, for the same period.

The zonal Non-Spinning Reserve capacity user rate for the Hour-Ahead Market is calculated by dividing the total cost to ISO of purchasing Non-Spinning Reserve capacity within the Zone less any amounts payable to the ISO by Scheduling Coordinators for Non-Spinning Reserve bought back from the ISO in the Hour-Ahead Market on behalf of resources in the Zone, for the Trading Interval, by the total ISO Non-Spinning Reserve obligation for the Trading Interval within the Zone. The Hour-Ahead Non-Spinning Reserve capacity user rate in Zone x for Trading Interval t is calculated as follows:

$$NonSpinRateHA_{xt} = \frac{\sum_{j} NonSpinPayTotalHA_{jxt}}{NonSpinObligTotal_{xt}}$$

The Non-Spinning Reserve capacity charge for Scheduling Coordinator j in the Hour-Ahead Market in Zone x for Trading Interval t is calculated as follows:

$$NonSpinChgHA_{jxt} = (NonSpinOblig_{jxt} * NonSpinRateHA_{xt})$$

~~*(d) Replacement Reserve*. The ISO will charge the zonal cost of providing Replacement Reserve capacity that is not self provided by~~

Scheduling Coordinators, in the Hour-Ahead Market, through the application of a charge to each Scheduling Coordinator for each Trading Interval. This charge will be computed by multiplying the Replacement Reserve user rate for the Trading Interval by the Scheduling Coordinator's Replacement Reserve obligation, for which it has not self-provided, for the same period.

The zonal Replacement Reserve user rate for the Hour-Ahead Market is calculated by dividing the total cost to ISO of purchasing Replacement Reserve Capacity within the Zone less any amounts payable to the ISO by Scheduling Coordinators for Non-Spinning Reserve bought back from the ISO in the Hour-Ahead Market on behalf of resources in the Zone, for the Trading Interval, by the total ISO Replacement Reserve obligation for the Trading Interval within the Zone. The Hour-Ahead Replacement Reserve user rate in Zone x for Trading Interval t is calculated as follows:

$$ReplRateHA_{xt} = \frac{\sum_{j} ReplPayTotalHA_{jxt}}{ReplObligTotal_{xt}}$$

The Replacement Reserve capacity charge for Scheduling Coordinator j in the Hour-Ahead Market in Zone x for Trading Interval t is calculated as follows:

$$ReplChgHA_{jxt} = ReplOblig_{jxt} * ReplRateHA_{xt}$$

C 2.2.3 Replacement Reserve. The user rate per unit of purchased Replacement Reserve for each Settlement Period t for each Zone x shall be as follows:

$$ReplRate_{xt} = \frac{ReplPayTotalDA_{xt} + ReplPayTotalHA_{xt} - ReplBuyBackTotal_{xt}}{ReplObligTotal_{xt}}$$

where:

$ReplPayTotalDA_{xt}$ = Total Replacement Reserve payments for the Settlement Period t in the Day-Ahead Market for the Zone x.

$ReplPayTotalHA_{xt}$ = Total Replacement Reserve payments for the Settlement Period t in the Hour-Ahead Market for the Zone x.

ReplBuyBackTotal = payments from Scheduling Coordinators buying back Ancillary Service capacity sold in the Day-Ahead Market or replacing capacity that was -provided in the Day-Ahead Market.

$ReplObligTotal_{xt}$ = the total ISO Replacement Reserve requirement procured in the Day Ahead Market and the Hour-Ahead Market for the Settlement Period t for the Zone x less that which has been self-provided by Scheduling Coordinators.

For each Settlement Period, each Scheduling Coordinator shall pay to the ISO a sum calculated as follows for each Zone:

*ReplRate * ReplOblig*

where

ReplOblig = DevReplOblig + RemRepl - SelfProv

DevReplOblig is the Scheduling Coordinator's obligation for deviation Replacement Reserve in the Zone in the Settlement Period and *RemRepl* is the Scheduling Coordinator's obligation for remaining Replacement Reserve.

Deviation Replacement Reserve for Scheduling Coordinator j in Zone x for Settlement Period t is calculated as follows:

If $ReplObligTotal_{xt} > DevReplOblig_{xt}$ then:

$$DevReplOblig_{xjt} = \left[Max\left(0, \sum_i GenDev_{ixt}\right) - Min\left(0, \sum_i LoadDev_{ixt}\right) \right]$$

If $ReplObligTotal_{xt} < DevReplOblig_{xt}$ then:

$$DevReplOblig_{xjt} = \frac{ReplObligTotal_{xt}}{DevReplOblig_{xt}} * \left[Max\left(0, \sum_i GenDev_{ixt}\right) - Min\left(0, \sum_i LoadDev_{ixt}\right) \right]$$

where,

$GenDev_{ixt}$ = The deviation between scheduled and actual Energy generation for Generator i represented by Scheduling Coordinator j in Zone x during Settlement Period t as referenced in Section 11.2.4.1.

$LoadDev_{ixt}$ = The deviation between scheduled and actual Load consumption for resource i represented by Scheduling Coordinator j in Zone x during Settlement Period t as referenced in Section 11.2.4.1.

$DevReplOblig_{xt}$ is total deviation Replacement Reserve in Zone x for Settlement Period t.

Remaining Replacement Reserve for Scheduling Coordinator j in Zone x for Settlement Period t is calculated as follows:

$$RemRepl_{xjt} = \frac{MeteredDemand_{xt}}{TotalMeteredDemand_{xt}} * TotalRemReplReq_{xt}$$

where:

MeteredDemand is the Scheduling Coordinator's total metered Demand in Zone x for Settlement Period t.

TotalMeteredDemand is total metered Demand in Zone x for Settlement Period t.

$TotalRemRepl_{xt} = Max[0, ReplObligTotal_{xt} - DevReplOblig_{xt}]$

C 2.2.4 Rational Buyer Adjustment

When Market Clearing Prices for Ancillary Services differ, substituting Demand for one Ancillary Service with Demand for another pursuant to Section 2.5.3.6 may cause an imbalance to arise between the total payments to suppliers and the total payments to users. For each Settlement Period, this imbalance is equal to the sum of payments for Regulation, Spinning Reserve, Non-Spinning Reserve and Replacement Reserve pursuant to Section 2.5.27 for the Day-Ahead and Hour-Ahead Markets summed across all zones in each Settlement Period, less the sum of corresponding charges for such Ancillary Services pursuant to Section 2.5.28. Charges or credits associated with such imbalance shall be assigned to each Scheduling Coordinator in proportion to its share of such corresponding charges.

C 2.2.~~3~~5 Real-Time Market

The ISO will charge the costs of purchasing real time instructed Energy output from Dispatched Regulation, Spinning Reserve, Non-Spinning Reserve, Replacement Reserve and Supplemental Energy resources through the Imbalance Energy settlement process.