APPENDIX [#]

Market-to-Market Coordination Process

DRAFT

Version 1.0

NYISO & PJM
Market-to-Market Coordination Schedule
Table of Contents

1 Overview of the Market-to-Market Coordination Process

The purpose of theM2M coordination process is to set forth the rules that apply to M2M coordination between PJM and NYISO and the associated settlements processes.

The fundamental philosophy of the PJM/NYISO M2M coordination process is to set up procedures to allow any transmission constraints that are significantly impacted by generation dispatch changes in both markets to be jointly managed in the security-constrained economic dispatch models of both RTOs. This joint management of transmission constraints near the market borders will provide the more efficient and lower cost transmission congestion management solution, while providing coordinated pricing at the market boundaries.

The M2M coordination process focuses on Real-Time market coordination to manage transmission limitations that occur on the M2M Flowgates in a more cost effective manner. This Real-Time coordination will result in a more efficient economic dispatch solution across both markets to manage the Real-Time transmission constraints that impact both markets, focusing on the actual flows in Real-Time to manage constraints. Under this approach, the flow entitlements on the M2M Flowgates do not impact the physical dispatch; the flow entitlements are used in market settlements to ensure appropriate compensation based on comparison of the actual Market Flows to the flow entitlements.

[*See* MISO/PJM Attachment 3 Interregional Coordination Process Version 3.0 Section 1]

2 M2M Flowgates

Only a subset of all transmission constraints that exist in either market will require coordinated congestion management. This subset of transmission constraints will be identified as M2M Flowgates. Flowgates eligible for the M2M coordination process are called M2M Flowgates. For the purposes of the M2M coordination process (in addition to the studies described in section 3 below) the following will be used in determining M2M Flowgates.

2.1 NYISO and PJM will only be performing the M2M coordination process on M2M Flowgates that are under the operational control of NYISO or PJM. NYISO and PJM will not be performing the M2M coordination process on Flowgates that are owned and controlled by third party entities.

2.2 The Parties will lower their generator binding threshold to match the lower generator binding threshold utilized by the other Party. The generator binding threshold will not be set below 1%, except by mutual consent. This requirement applies to M2M Flowgates. It is not an additional criteria for determination of M2M Flowgates.

2.3 For the purpose of determining whether a monitored element Flowgate is eligible for the M2M coordination process, a progressive threshold for determining a significant GLDF will be based on the number of monitored elements.

Implementation of M2M Flowgates will ordinarily occur through mutual agreement.

[*See* MISO/PJM Attachment 3 Interregional Coordination Process Version 3.0 Section 1.1]

3 M2M Flowgate Studies

a. Perform an off-line study to determine if the significant GLDF for at least one generator within the Non-Monitoring RTO on a potential M2M Flowgate within the Monitoring RTO is greater than or equal to the progressive thresholds as described below. The study shall be based on an up to date common representation of the Eastern Interconnection

b. The progressive GLDF thresholds for M2M Flowgates with multiple monitored elements are defined as:

   i. Single monitored element, 5% GLDF

   ii. Two monitored elements, 7.5% GLDF

   iii. Three or more monitored elements, 10% GLDF

c. For those Flowgates that pass the above criteria, PJM and NYISO must still mutually agree to add each Flowgate as an M2M Flowgate.

d. PJM and NYISO can also mutually agree to add a M2M Flowgate that does not satisfy the above criteria.

[*See* MISO/PJM Attachment 3 Interregional Coordination Process Version 3.0 Section 1.2]

4 Removal of M2M Flowgates

Removal of M2M Flowgates from the systems may be necessary under certain conditions including the following:

4.1 A M2M Flowgate is no longer valid when (a) a transmission system change is implemented that eliminates significant impacts from either entity's generation such that the Flowgate no longer passes the M2M Flowgate Studies, and (b) the Parties mutually agree to remove said M2M Flowgate. Once a M2M Flowgate has been removed, it will no longer be eligible for M2M settlement.

4.2 The Parties can mutually agree to remove a M2M Flowgate from the M2M coordination process whether or not it passes the coordination tests. A M2M Flowgate should be removed when the Parties agree that the M2M coordination process is not, or will not be, an effective mechanism to manage congestion on that Flowgate.

[*See* MISO/PJM Attachment 3 Interregional Coordination Process Version 3.0 Section 1.3]

5 Market Flow Determination

[MISO/PJM Attachment 2 Congestion Management Process (CMP) Master Version 1.9 Section 4.1]

Each RTO will independently calculate their Market Flow for all M2M Flowgates using the equations set forth in this section. The Market Flow calculation is broken down into the following steps:

- Determine Shift Factors for M2M Flowgates
- Compute RTO Load and Losses (less imports)
- Compute RTO Generation (less exports)
- Compute RTO Generation to Load impacts on the Market Flow
- Compute RTO interchange scheduling impacts on the Market Flow
- Compute PAR impacts on the Market Flow
- Compute Market Flow

5.1 Determine Shift Factors for M2M Flowgates

The first step to determining the Market Flow on a M2M Flowgate is to calculate generator, load and PAR shift factors for the each of the M2M Flowgates. For Real-Time M2M coordination, the shift factors will be based on the Real-Time transmission system topology. For purposes of determining M2M Entitlements or M2M Flowgates, the shift factors will be based on an all lines in representation of the eastern United States transmission interconnection.

5.2 Compute RTO Load Served by RTO Generation

Using area load and losses for each load zone, compute the RTO Load, in MWs, by summing the load and losses for each load zone to determine the total zonal load for each RTO load zone.

$Zonal\_Total\_Load_{zone} = Load_{zone} + Losses_{zone}$, for each RTO load zone

Where:

zone = the relevant RTO load zone;

$Zonal\_Total\_Load_{zone}$ = the sum of the RTO's load and transmission losses for the zone;

$Load_{zone}$ = the load within the zone; and

$Losses_{zone}$ = the transmission losses for transfers through the zone.

Next, reduce the Zonal Loads by the scheduled line real-time import transaction schedules that sink in that particular load zone:

$$Zonal\_\text{Reduced}\_Load_{zone} = Zonal\_Total\_Load_{zone} - \sum_{scheduled\_line=1}^{all} \left(\text{Import\_Schedules}_{scheduled\_line}\right)$$

Where:

zone = the relevant RTO load zone;

scheduled_line = each of the transmission facilities identified in Table 1 below;

$Zonal\_Reduced\_Load_{zone}$ = the sum of the RTO's load and transmission losses in a zone reduced by the sum of import schedules over scheduled lines to the zone;

$Zonal\_Total\_Load_{zone}$ = the sum of the RTO's load and transmission losses for the zone; and

$Import\_Schedules_{scheduled\_line}$ = import schedules over a scheduled line to a zone.

The Real-Time import schedules over scheduled lines will only reduce the load in the sink load zones identified in Table 1 below:

Table 1. List of Scheduled Lines

Scheduled Line	NYISO Load Zone	PJM Load Zone
Dennison Scheduled Line	North	Not Applicable
Cross-Sound Scheduled Line	Long Island	Not Applicable
Linden VFT Scheduled Line	New York City	Mid-Atlantic Control Zone
Neptune Scheduled Line	Long Island	Mid-Atlantic Control Zone
Northport – Norwalk Scheduled Line	Long Island	Not Applicable

Once import schedules over scheduled lines have been accounted for, it is then appropriate to reduce the net RTO Load by the remaining real-time import schedules at the proxies identified in Table 2 below:

Table 2. List of Proxies

Proxy	**Scheduled Lines <u>not</u> included in Proxy**	**Balancing Authorities Responsible**
IESO-NYISO	None	IESO and NYISO
HQT-NYISO	Dennison Scheduled Line	HQT and NYISO
ISONE-NYISO	Cross-Sound and Northport-Norwalk Scheduled Lines	ISONE and NYISO
MISO-PJM	None	MISO and PJM
NYISO-PJM	Linden VFT and Neptune Scheduled Lines	NYISO and PJM
TVA-PJM	None	PJM and TVA
Others for PJM?		

$$RTO\_Net\_Load = \sum_{zone=1}^{all} \left(Zonal\_Reduced\_Load_{zone} \right)$$

Where:

zone = the relevant RTO load zone;

RTO_Net_Load = the sum of load and transmission losses for the entire RTO footprint reduced by the sum of import schedules over all scheduled lines; and

$Zonal\_Reduced\_Load_{zone}$ = the sum of the RTO's load and transmission losses in a zone reduced by the sum of import schedules over scheduled lines to the zone.

$$RTO\_Final\_Load = RTO\_Net\_Load - \sum_{proxy=1}^{all} \left(Import\_Schedules_{proxy} \right)$$

Where:

proxy = representations of defined sets of transmission facilities that (i) interconnect neighboring Balancing Authorities, (ii) are collectively scheduled, and (iii) are identified in Table 2 above;

RTO_Final_Load = the sum of the RTO's load and transmission losses for the entire RTO footprint, sequentially reduced by (i) the sum of import schedules over all scheduled lines, and (ii) the sum of all proxy import schedules;

RTO_Net_Load = the sum of load and transmission losses for the entire RTO footprint reduced by the sum of import schedules over all scheduled lines; and

$Import\_Schedules_{proxy}$ = the sum of all proxy import schedules.

Next, calculate the Zonal Load weighting factor for each RTO load zone:

$$Zonal\_Weighting_{zone} = \left(\frac{Zonal\_Reduced\_Load_{zone}}{RTO\_Net\_Load} \right)$$

Where:

zone = the relevant RTO load zone;

$Zonal\_Weighting_{zone}$ = the percentage of the RTO's load contained within the zone;

RTO_Net_Load = the sum of load and transmission losses for the entire RTO footprint reduced by the sum of import schedules over all scheduled lines; and

$Zonal\_Reduced\_Load_{zone}$ = the sum of the RTO's load and transmission losses in a zone reduced by the sum of import schedules over scheduled lines to the zone.

Using the Zonal Weighting Factor compute the zonal load reduced by RTO imports for each load zone:

$$Zonal\_Final\_Load_{zone} = Zonal\_Weighting_{zone} \times RTO\_Final\_Load$$

Where:

zone = the relevant RTO load zone;

$Zonal\_Final\_Load_{zone}$ = the final RTO load served by internal RTO generation in the zone;

Zonal_Weighting$_{zone}$ = the percentage of the RTO's load contained within the zone; and

RTO_Final_Load = the sum of the RTO's load and transmission losses for the entire RTO footprint, sequentially reduced by (i) the sum of import schedules over all scheduled lines, and (ii) the sum of all proxy import schedules.

Using the Load Shift Factors ("LSFs") calculated above, compute the weighted RTO LSF for each M2M Flowgate as:

$$RTO\_LSF_{M2M\_Flowgate-m} = \sum_{zone=1}^{all} LSF_{(zone,M2M\_Flowgate-m)} \times \left(\frac{Zonal\_Final\_Load_{zone}}{RTO\_Final\_Load} \right)$$

Where:

M2M_Flowgate-m = the relevant flowgate;

zone = the relevant RTO load zone;

RTO_LSF$_{M2M_Flowgate-m}$ = the load shift factor for the entire RTO footprint on M2M Flowgate m;

LSF$_{(zone,M2M_Flowgate-m)}$ = the load shift factor for the RTO zone on M2M Flowgate m;

Zonal_Final_Load$_{zone}$ = the final RTO load served by internal RTO generation in the zone; and

RTO_Final_Load = the sum of the RTO's load and transmission losses for the entire RTO footprint, sequentially reduced by (i) the sum of import schedules over all scheduled lines, and (ii) the sum of all proxy import schedules.

5.3 Compute RTO Generation Serving RTO Load

Using the Real-Time generation output in MWs, compute the Generation serving RTO Load. Sum the output of RTO generation within each load zone:

$$RTO\_Gen_{zone} = \sum_{Unit=1}^{all} (Gen_{unit}), \text{ for each RTO load zone}$$

Where:

zone = the relevant RTO load zone;

unit = the relevant generator;

RTO_Gen$_{zone}$ = the sum of the RTO's generation in a zone; and

Gen_{unit} = the real-time output of the unit.

Next, reduce the RTO generation located within a load zone by the scheduled line real-time export transaction schedules that source from that particular load zone:

$$RTO\_Reduced\_Gen_{zone} = RTO\_Gen_{zone} - \sum_{scheduled\_line=1}^{all} \left(Export\_Schedules_{scheduled\_line} \right)$$

Where:

zone = the relevant RTO load zone;

scheduled_line = each of the transmission facilities identified in Table 1 above;

$RTO\_Reduced\_Gen_{zone}$ = the sum of the RTO's generation in a zone reduced by the sum of export schedules over scheduled lines from the zone; and

RTO_Gen_{zone} = the sum of the RTO's generation in a zone; and

$Export\_Schedules_{scheduled\_line}$ = export schedules from a zone over a scheduled line.

The real-time export schedules over scheduled lines will only reduce the generation in the source zones identified in Table 1 above.

Once export schedules over scheduled lines are accounted for, it is then appropriate to reduce the net RTO generation by the remaining real-time export schedules at the proxies identified in Table 2 above.

$$RTO\_Net\_Gen = \sum_{zone=1}^{all} \left(RTO\_Reduced\_Gen_{zone} \right)$$

Where:

zone = the relevant RTO load zone;

RTO_Net_Gen = the sum of the RTO's generation reduced by the sum of export schedules over all scheduled lines; and

$RTO\_Reduced\_Gen_{zone}$ = the sum of the RTO's generation in a zone reduced by the sum of export schedules over scheduled lines from the zone.

$$RTO\_Final\_Gen = RTO\_Net\_Gen - \sum_{proxy=1}^{all}\left(Export\_Schedules_{proxy}\right)$$

Where:

proxy = representation of defined sets of transmission facilities that (i) interconnect neighboring Balancing Authorities, (ii) are collectively scheduled, and (iii) are identified in Table 2 above;

RTO_Final_Gen = the sum of the RTO's generation output for the entire RTO footprint, sequentially reduced by (i) the sum of export schedules over all scheduled lines, and (ii) the sum of all proxy export schedules;

RTO_Net_Gen = the sum of the RTO's generation reduced by the sum of export schedules over all scheduled lines; and

$Export\_Schedules_{proxy}$ = the sum of all proxy export schedules.

Finally, weight each generator's output by the reduced RTO generation:

$$Gen\_Final_{unit} = Gen_{unit} \times \frac{RTO\_Final\_Gen}{RTO\_Net\_Gen}$$

Where:

unit = the relevant generator;

Gen_Final_{unit} = the portion of each unit's output that is serving the RTO Net Load;

Gen_{unit} = the real-time output of the unit;

RTO_Final_Gen = the sum of the RTO's generation output for the entire RTO footprint, sequentially reduced by (i) the sum of export schedules over all scheduled lines, and (ii) the sum of all proxy export schedules; and

RTO_Net_Gen = the sum of the RTO's generation reduced by the sum of export schedules over all scheduled lines.

5.4 Compute the RTO GTL for all M2M Flowgates

The generation-to-load flow for a particular M2M Flowgate, in MWs, will be determined as:

$$RTO\_GTL_{M2M\_Flowgate-m} = \sum_{unit=1}^{all} Gen\_Final_{unit} \times \left(GSF_{(unit,M2M\_Flowgate-m)} - RTO\_LSF_{M2M\_Flowgate-m} \right)$$

Where:

M2M_Flowgate-m =	the relevant flowgate;
unit =	the relevant generator;
$RTO\_GTL_{M2M\_Flowgate-m}$ =	the generation to load flow for the entire RTO footprint on M2M Flowgate m;
Gen_Final_{unit} =	the portion of each unit's output that is serving RTO Net Load;
$GSF_{(unit,M2M\_Flowgate-m)}$ =	the shift factor for each unit on M2M Flowgate m; and
$RTO\_LSF_{M2M\_Flowgate-m}$ =	the load shift factor for the entire RTO footprint on M2M Flowgate m.

5.5 Compute the RTO Interchange Scheduling Impacts for all M2M Flowgates

For each scheduling point that the participating RTO is responsible for determine the net interchange schedule in MWs. Table 3 below identifies both the participating RTO that is responsible for each listed scheduling point, and the "type" assigned to each listed scheduling point.

Table 3. List of Scheduling Points

Scheduling Point	Scheduling Point Type	Participating RTO(s) Responsible
IESO-NYISO	non-common	NYISO
HQT-NYISO	non-common	NYISO
Dennison Scheduled Line	non-common	NYISO
ISONE-NYISO	non-common	NYISO
Cross-Sound Scheduled Line	non-common	NYISO
Northport-Norwalk Scheduled Line	non-common	NYISO
MISO-PJM	non-common	PJM
NYISO-PJM	common	NYISO and PJM
Linden VFT Scheduled Line	common	NYISO and PJM

Neptune Scheduled Line	common	NYISO and PJM
TVA-PJM	None	PJM
Others for PJM?		

$$RTO\_Transfers_{\text{sched\_pt}} = \text{Imports}_{\text{sched\_pt}} + WheelsIn_{\text{sched\_pt}} - \text{Exports}_{\text{sched\_pt}} - WheelsOut_{\text{sched\_pt}}$$

Where:

sched_pt = the relevant scheduling point. A scheduling point can be either a proxy or a scheduled line;

$\text{RTO\_Transfers}_{\text{sched\_pt}}$ = the net interchange schedule at a scheduling point;

$\text{Imports}_{\text{sched\_pt}}$ = the import component of the interchange schedule at a scheduling point;

$\text{WheelsIn}_{\text{sched\_pt}}$ = the injection of wheels-through component of the interchange schedule at a scheduling point;

$\text{Exports}_{\text{sched\_pt}}$ = the export component of the interchange schedule at a scheduling point; and

$\text{WheelsOut}_{\text{sched\_pt}}$ = the withdrawal of wheels-through component of the interchange schedule at a scheduling point.

Next, compute the scheduling point generation shift factor for an M2M Flowgate and subtract the RTO Load-weighted shift factor for that M2M Flowgate to determine the transfer distribution factor ("TDF") for that M2M Flowgate. Then, multiply the TDF by the net interchange at a scheduling point to determine the M2M Flowgate impacts related to the interchange schedule at that scheduling point.

$$TDF_{(\text{sched\_pt, M2M\_Flowgate-m})} = GSF_{(\text{sched\_pt, M2M\_Flowgate-m})} - RTO\_LSF_{\text{M2M\_Flowgate-m}}$$

Where:

sched_pt = the relevant scheduling point. A scheduling point can be either a proxy or a scheduled line;

M2M_Flowgate-m = the relevant flowgate;

$\text{TDF}_{(\text{sched\_pt, M2M\_Flowgate-m})}$ = the transfer distribution factor of the scheduling point on M2M Flowgate m;

$GSF_{(sched\_pt,\ M2M\_Flowgate\text{-}m)}$ = the generation shift factor of the scheduling point on M2M Flowgate m; and

$LSF_{(sched\_pt,\ M2M\_Flowgate\text{-}m)}$ = the load shift factor of the scheduling point on M2M Flowgate m.

The equation below applies to all non-common scheduling points that only one of the participating RTOs is responsible for. *Parallel_Transfers* are applied to the Market Flow of the responsible participating RTO. For example, the *Parallel_Transfers* computed for the IESO-NYISO non-common scheduling point are applied to the NYISO Market Flow.

$$Parallel\_Transfers_{M2M\_Flowgate\text{-}m} = \sum_{nc\_sched\_pt=1}^{all} RTO\_Transfers_{nc\_sched\_pt} \times TDF_{(nc\_sched\_pt,M2M\_Flowgate\text{-}m)}$$

Where:

M2M_Flowgate-m = the relevant flowgate;

nc_sched_pt = the relevant non-common scheduling point. A non-common scheduling point can be either a proxy or a scheduled line. Non-common scheduling points are identified in Table 3, above;

$Parallel\_Transfers_{M2M\_Flowgate\text{-}m}$ = the flow on M2M Flowgate m due to the net interchange schedule at the non-common scheduling point;

$RTO\_Transfers_{nc\_sched\_pt}$ = the net interchange schedule at the non-common scheduling point; and

$TDF_{(nc\_sched\_pt,\ M2M\_Flowgate\text{-}m)}$ = the transfer distribution factor of the non-common scheduling point on M2M Flowgate m.

The equation below applies to common scheduling points that directly interconnect the participating RTOs. *Shared_Transfers* are applied to the Monitoring RTO's Market Flow only. NYISO to PJM transfers would be considered part of NYISO's Market Flow for NYISO-monitored Flowgates and part of PJM's Market Flow for PJM-monitored Flowgates.

$$Shared\_Transfers_{M2M\_Flowgate\text{-}m} = \sum_{cmn\_sched\_pt=1}^{all} RTO\_Transfers_{cmn\_sched\_pt} \times TDF_{(cmn\_sched\_pt,M2M\_Flowgate\text{-}m)}$$

Where:

M2M_Flowgate-m = the relevant flowgate;

cmn_sched_pt = the relevant common scheduling point. A common scheduling point can be either a proxy or a scheduled line.

Common scheduling points are identified in Table 3, above;

$Shared\_Transfers_{M2M\_Flowgate-m}$ = the flow on M2M Flowgate m due to interchange schedules on the common scheduling point;

$RTO\_Transfers_{cmn\_sched\_pt}$ = the net interchange schedule at a common scheduling point; and

$TDF_{(cmn\_sched\_pt,\ M2M\_Flowgate-m)}$ = the transfer distribution factor of a common scheduling point on M2M Flowgate m.

5.6 Compute the PAR Effects on M2M Flowgates

For the PARs listed in Table 4 below, the RTOs will determine the generation-to-load flows and interchange schedules, in MWs, that each PAR is redirecting.

Table 4. List of Phase Angle Regulators

PAR	Description	PAR Type	Actual Schedule	Target Schedule	Responsible Participating RTO(s)
1	RAMAPO PAR3500	common	From telemetry	PJM-NY Scheduled Interchange*30.5%	NYISO and PJM
2	RAMAPO PAR4500	common	From telemetry	PJM-NY Scheduled Interchange*30.5%	NYISO and PJM
3	FARRAGUT TR11	common	From telemetry	From telemetry	NYISO and PJM
4	FARRAGUT TR12	common	From telemetry	From telemetry	NYISO and PJM
5	GOETHSLN BK_1N	common	From telemetry	From telemetry	NYISO and PJM
6	WALDWICK O2267	common	From telemetry	From telemetry	NYISO and PJM
7	WALDWICK F2258	common	From telemetry	From telemetry	NYISO and PJM
8	WALDWICK E2257	common	From telemetry	From telemetry	NYISO and PJM
9	STLAWRNC PS_33	non-common	From telemetry	0	NYISO
10	STLAWRNC PS_34	non-common	From telemetry	0	NYISO

Compute the PAR control as the actual flow less the target flow across each PAR:

$$PAR\_Control_{par} = Actual\_MW_{par} - Target\_MW_{par}$$

Where:

pars =	each of the phase angle regulators listed in Table 4, above;
$PAR\_Control_{par}$ =	the sum of flow on the pars due to the operation of the pars;
$Actual\_MW_{par}$ =	the actual flow on each of the pars, determined consistent with Table 4 above; and
$Target\_MW_{par}$ =	the target flow that each of the pars should be achieving, determined in accordance with Table 4 above.

Common PARs

In the equations below, the Non-Monitoring RTO is credited for or responsible for *PAR_REDIRECT* on the Monitoring RTO's M2M Flowgates. The common PAR Redirect allocation only applies to the common PARs identified in Table 4 above.

Compute control deviation for all common PARs on M2M Flowgate m based on the $PAR\_Control_{par}$ MWs calculated above:

$$Cmn\_PAR\_Control_{M2M\_Flowgate-m} = \sum_{cmn\_par=1}^{ALL} \left(PAR\_SF_{(cmn\_par, M2M\_Flowgate-m)} \right) \times PAR\_Control_{cmn\_par}$$

Where:

M2M_Flowgate-m =	the relevant flowgate;
cmn_par =	each of the common phase angle regulators identified in Table 4, above;
$Cmn\_PAR\_Control_{M2M\_Flowgate-m}$ =	the sum of flow on M2M Flowgate m after accounting for the operation of common pars;
$PAR\_SF_{(cmn\_par,M2M\_Flowgate-m)}$ =	the shift factor of each of the common pars on M2M Flowgate m; and
$PAR\_Control_{cmn\_par}$ =	the sum of flow on each of the common pars after accounting for the operation of the common pars.

Compute the impact of generation-to-load and interchange schedules across all common PARs on M2M Flowgate m as the Market Flow across each common PAR multiplied by that PAR's shift factor on M2M Flowgate m:

$$Cmn\_PAR\_MF_{M2M\_Flowgate-m} = \sum_{cmn\_par=1}^{ALL} \left(\begin{array}{l} \left(PAR\_SF_{(cmn\_par, M2M\_Flowgate-m)}\right) \times \\ \left(RTO\_GTL_{cmn\_par} + Parallel\_Transfers_{cmn\_par}\right) \end{array} \right)$$

Where:

M2M_Flowgate-m =	the relevant flowgate;
cmn_par =	the set of common phase angle regulators identified in Table 4 above;
$Cmn\_PAR\_MF_{M2M\_Flowgate\text{-}m}$ =	the sum of flow on M2M Flowgate m due to the generation to load flows and interchange schedules on the common pars;
$PAR\_SF_{(cmn\_par, M2M\_Flowgate\text{-}m)}$ =	the shift factor of each of the common pars on M2M Flowgate m;
$RTO\_GTL_{cmn\_par}$ =	the generation to load flow for the Non-Monitoring RTO's entire footprint on each of the common pars; and
$Parallel\_Transfers_{par}$ =	the flow on each of the common pars caused by interchange schedules at non-common scheduling points.

Next, compute the common PAR redirect for M2M Flowgate m as:

$$Cmn\_PAR\_REDIRECT_{M2M\_Flowgate-m} = Cmn\_PAR\_MF_{M2M\_Flowgate-m} - Cmn\_PAR\_Control_{M2M\_Flowgate-m}$$

Where:

M2M_Flowgate-m =	the relevant flowgate;
$Cmn\_PAR\_Redirect_{M2M\_Flowgate\text{-}m}$ =	potential flow on M2M Flowgate m that is redirected by the operation of the common pars;
$Cmn\_PAR\_MF_{M2M\_Flowgate\text{-}m}$ =	the sum of flow on M2M Flowgate m due to the generation to load and interchange schedules on the common pars; and
$Cmn\_PAR\_Control_{M2M\_Flowgate\text{-}m}$ =	the sum of flow on M2M Flowgate m after accounting for the operation of common pars.

<u>Non-Common PARs</u>

For the equations below, the NYISO will be credited or responsible for *PAR_REDIRECT* on all M2M Flowgates because the NYISO is the participating RTO that has input into the operation of these devices. The "non-common PARs" shall mean the Saint Lawrence phase angle regulators and this non-common PAR Redirect allocation only applies to the Saint Lawrence PARs.

Compute control deviation for all non-common PARs on M2M Flowgate m based on the PAR control MW above:

$$NC\_PAR\_Control_{M2M\_Flowgate-m} = \sum_{nc\_par=1}^{ALL} \left(PAR\_SF_{(nc\_par, M2M\_Flowgate-m)}\right) \times PAR\_Control_{nc\_par}$$

Where:

M2M_Flowgate-m = the relevant flowgate;

nc_par = each of the non-common phase angle regulators identified in Table 4 above;

$NC\_PAR\_Control_{M2M\_Flowgate-m}$ = the sum of flow on M2M Flowgate m after accounting for the operation of non-common pars;

$PAR\_SF_{(par,M2M\_Flowgate-m)}$ = the shift factor of each of the non-common pars on M2M Flowgate m; and

$PAR\_Control_{par}$ = the sum of flow on each of the non-common pars after accounting for the operation of the non-common pars.

Compute the impact of generation-to-load and interchange schedules across all non-common PARs on M2M Flowgate m as the Market Flow across each PAR multiplied by that PAR's shift factor on M2M Flowgate m:

$$NC\_PAR\_MF_{M2M\_Flowgate-m} = \sum_{nc\_par=1}^{ALL} \left(\left(PAR\_SF_{(nc\_par, M2M\_Flowgate-m)}\right) \times \left(RTO\_GTL_{nc\_par} + Parallel\_Transfers_{nc\_par}\right) \right)$$

Where:

M2M_Flowgate-m = the relevant flowgate;

nc_par = the set of non-common phase angle regulators identified in Table 4 above;

$NC\_PAR\_MF_{M2M\_Flowgate-m}$ = the sum of flow on M2M Flowgate m due to the generation to load flows and interchange schedules on the non-common pars;

$PAR\_SF_{(par,M2M\_Flowgate-m)}$ = the shift factor of each of the non-common pars on M2M Flowgate m;

$RTO\_GTL_{nc\_par}$ = the generation to load flow for the Non-Monitoring RTO's entire footprint on each of the non-common pars; and

$Parallel\_Transfers_{nc\_par}$ = the flow on each of the non-common pars caused by interchange schedules at non-common scheduling points.

Next, compute the non-common PAR redirect for facility m as:

$$NC\_PAR\_REDIRECT_{M2M\_Flowgate\text{-}m} = NC\_PAR\_MF_{M2M\_Flowgate\text{-}m} - NC\_PAR\_Control_{M2M\_Flowgate\text{-}m}$$

Where:

M2M_Flowgate-m = the relevant flowgate;

$NC\_PAR\_Redirect_{M2M\_Flowgate\text{-}m}$ = the potential flow on M2M Flowgate m that is redirected by the operation of non-common pars;

$NC\_PAR\_MF_{M2M\_Flowgate\text{-}m}$ = the sum of flow on M2M Flowgate m due to the generation to load and interchange schedules on the non-common pars; and

$NC\_PAR\_Control_{M2M\_Flowgate\text{-}m}$ = the sum of flow on M2M Flowgate m after accounting for the operation of non-common pars.

Aggregate all PAR Effects for Each M2M Flowgate

The total PAR redirect for M2M Flowgate m is:

$$PAR\_REDIRECT_{M2M\_Flowgate-m} = PAR\_MF_{M2M\_Flowgate-m} - PAR\_Control_{M2M\_Flowgate-m}$$

Where:

M2M_Flowgate-m = the relevant flowgate;

$PAR\_Redirect_{M2M\_Flowgate\text{-}m}$ = the flow on M2M Flowgate m that is redirected after accounting for the operation of both common and non-common pars;

$PAR\_MF_{M2M\_Flowgate\text{-}m}$ = the sum of flow on M2M Flowgate m due to the generation to load and interchange schedules on both common and non-common pars; and

$PAR\_Control_{M2M\_Flowgate\text{-}m}$ = the sum of flow on M2M Flowgate m after accounting for the operation of both common and non-common pars.

5.7 Compute the RTO Aggregate Market Flow for all M2M Flowgates

With the *RTO_GTL* and *PAR_REDIRECT* known, we can now compute the *RTO_MFC* for all M2M Flowgates as:

$$RTO\_MFC_{M2M\_Flowgate-m} = RTO\_GTL_{M2M\_Flowgate-m} + Parallel\_Transfers_{M2M\_Flowgate-m} + Shared\_Transfers_{M2M\_Flowgate-m} - PAR\_REDIRECT_{M2M\_Flowgate-m}$$

or

$$RTO\_MFC_{M2M\_Flowgate-m} = RTO\_GTL_{M2M\_Flowgate-m} + Parallel\_Transfers_{M2M\_Flowgate-m} + Shared\_Transfers_{M2M\_Flowgate-m} + PAR\_REDIRECT_{M2M\_Flowgate-m}$$

Where:

M2M_Flowgate-m = the relevant flowgate;

$RTO\_MFC_{M2M\_Flowgate-m}$ = the Market Flow caused by RTO generation dispatch and transaction scheduling on M2M Flowgate m after accounting for the operation of both the common and non-common pars;

$RTO\_GTL_{M2M\_Flowgate-m}$ = the generation to load flow for the entire RTO footprint on M2M Flowgate m;

$Parallel\_Transfers_{M2M\_Flowgate-m}$ = the flow on M2M Flowgate m caused by interchange schedules that are not jointly scheduled by the participating RTOs;

$Shared\_Transfers_{M2M\_Flowgate-m}$ = the flow on M2M Flowgate m caused by interchange schedules that are jointly scheduled by the participating RTOs; and

$PAR\_Redirect_{M2M\_Flowgate-m}$ = the flow on M2M Flowgate m that is redirected after accounting for the operation of both the common and non-common pars.

The addition or subtraction of *PAR_REDIRECT* above depends on the modeling of the from bus/to bus of both the PARs and the M2M Flowgates in the RTOs EMS systems.

6 M2M Entitlement Determination

[*See* MISO/PJM Attachment 2 Congestion Management Process (CMP) Master Version 1.9 Section 4.3]

6.1 M2M Entitlement

[THE M2M ENTITLEMENT DETERMINATION/CALCULATION LANGUAGE IS NOT YET READY FOR DISCUSSION. THE NYISO AND PJM EXPECT TO HAVE A PROPOSAL READY TO SHARE AT THE NEXT JOINT TECHNICAL CONFERENCE.]

7 Real-Time Energy Market Coordination

When an M2M Flowgate that is under the operational control of either NYISO or PJM become binding in the Monitoring RTOs Real-Time security constrained economic dispatch, the Monitoring RTO will notify the Non-Monitoring RTO of the transmission constraint and will identify the appropriate M2M Flowgate that requires re-dispatch assistance. The Monitoring and Non-Monitoring RTOs will provide the economic value of the constraint (i.e., the shadow price) as calculated by their respective dispatch models. Using this information, the security-constrained economic dispatch of the Non-Monitoring RTO will include the transmission constraint; the Monitoring RTO will evaluate the shadow prices within each RTO and request that the Non-Monitoring RTO reduce its Market Flow if it can do so more efficiently than the Monitoring RTO (i.e., the Non-Monitoring RTO has a lower shadow price than the Monitoring RTO).

An iterative coordination process will be supported by automated data exchanges in order to ensure the process is manageable in a Real-Time environment. The process of evaluating the shadow prices between the RTOs will continue until the shadow prices converge and an efficient redispatch solution is achieved. The continual interactive process over the next several dispatch cycles will allow the transmission congestion to be managed in a coordinated, cost-effective manner by the RTOs. A more detailed description of this iterative procedure is discussed in Section 3.1 and the appropriate use of this iterative procedure is described in Section 8.

[*See* MISO/PJM Attachment 3 Interregional Coordination Process Version 3.0 Section 3]

7.1 Real-Time Energy Market Coordination Procedures

The following procedure will apply for managing M2M Flowgates in the Real-Time Energy market:

1. M2M Flowgates shall be monitored per each RTO's internal procedures. When an M2M Flowgate is constrained to a defined limit (actual or contingency flow), the Monitoring RTO shall consider it as a potential M2M constraint; limits are verified and updated as required.
2. The Monitoring RTO initiates M2M, notifies the Non-Monitoring RTO and updates required information.
3. The Non-Monitoring RTO shall acknowledge receipt of the notification and one of the following shall occur:
    a. The Non-Monitoring RTO refuses to activate M2M:

i. The Non-Monitoring RTO notifies the Monitoring RTO of the reason for refusal; and
ii. The M2M State is set to “Refused”; or
b. The Non-Monitoring RTO agrees to activate M2M:
i. Agreement shall be considered initiation of the M2M process for operational and settlement purposes; and
ii. The M2M State is set to “Activated”.

4. The Parties have agreed to transmit information required for the administration of this procedure, as per section 35.7.1 of the [NYISO/PJM JOA].
5. As Shadow Prices converge, the Monitoring RTO shall be responsible for the continuation or termination of the M2M process. Current and forecasted future system conditions shall be considered.[1]
6. Upon termination of M2M, the Monitoring RTO shall
   a. Notify the Non-Monitoring RTO; and
   b. Transmit M2M data to the Non-Monitoring RTO with the M2M State set to “Closed”. The timestamp with this transmission shall be considered termination of the M2M process for operational and settlement purposes.

7.2 Real-Time Energy Market Settlements

The Market Settlements under this M2M Schedule will be performed based on the Real-Time Market Flow contribution on the transmission flowgate from the Non-Monitoring RTO as compared to its flow entitlement.

The settlement for each M2M Flowgate will be calculated based on the following equation:

$$\boldsymbol{Settlement_i} = \left(\boldsymbol{MF_{RT_i}} - \boldsymbol{Ent_{M2M_i}}\right) \times \boldsymbol{Shad_i} \times {}^{\boldsymbol{s_i}}/_{\boldsymbol{3600sec}}$$

For the purpose of settlements calculations, each interval will be calculated separately and then integrated to an hourly value:

$$\boldsymbol{Settlement_h} = \sum_{\boldsymbol{i=1}}^{\boldsymbol{n}} \boldsymbol{Settlement_i}$$

Where:

$Settlement_i$ = Settlement for interval *i*. A positive value indicates a payment from the Non-Monitoring RTO to the Monitoring RTO; a

[1] Termination may be initiated by either RTO in the event of a system emergency.

negative settlement indicates a payment from the Monitoring RTO to the Non-Monitoring RTO.

$Settlement_h$ **= Settlement for hour *h*.**

MF_{RT_i} **= Real-Time Market Flow for interval *i*.**

Ent_{M2M_i} **= M2M Entitlement for interval *i*.**

$Shad_i$ **= Constraint shadow price for interval *i* that was used in the dispatch solution. If** MF_{RT_i} **is less than** Ent_{M2M_i}**,** $Shad_i$ **comes from the Non-Monitoring RTO dispatch. If** MF_{RT_i} **is greater than** Ent_{M2M_i}**,** $Shad_i$ **comes from on the Monitoring RTO dispatch.**

s_i **= Number of seconds in interval *i*.**

Section 9.1.8 of this M2M Schedule sets forth two circumstances under which the M2M coordination process and M2M settlements may be temporarily suspended.

8 When One of the RTOs Does Not Have Sufficient Redispatch

Under the normal M2M coordination process, sufficient redispatch for a M2M Flowgate may be available in one RTO but not the other. When this condition occurs, in order to ensure an operationally efficient dispatch solution is achieved, the RTO without sufficient redispatch will redispatch all effective generation to control the M2M Flowgate to a "relaxed" shadow cost limit. Then this RTO calculates the shadow price for the M2M Flowgate using the available redispatch which is limited by the maximum physical control action inside the RTO. Because the magnitude of the shadow price in this RTO cannot reach that of the other RTO with sufficient redispatch, unless further action is taken, there will be a divergence in shadow prices and the LMPs at the RTO border.

A special process is designed to enhance the price convergence under this condition. If the Non-Monitoring RTO cannot provide sufficient relief to reach the shadow price of the Monitoring RTO, the constraint relaxation logic will be deactivated. The Non-Monitoring RTO will then be able to use the Monitoring RTO's shadow price without limiting the shadow price to the maximum shadow price associated with a physical control action inside the Non-Monitoring RTO. With the M2M Flowgate shadow prices being the same in both RTOs, their resulting bus LMPs will converge in a consistent price profile.

[*See* MISO/PJM Attachment 3 Interregional Coordination Process Version 3.0 Section 7]

9 Appropriate Use of the M2M Process

Under normal operating conditions, the NYISO and PJM operators will model all M2M Flowgates in their respective Real-Time EMSs. M2M Flowgates will be controlled using M2M tools for coordinated redispatch and additionally will be eligible for M2M settlements.

[*See* MISO/PJM Attachment 3 Interregional Coordination Process Version 3.0 Section 8]

9.1 Qualifying Conditions for M2M Settlement

9.1.1 Purpose of M2M. M2M was established to address regional, not local issues. The intent is to implement the M2M coordination process and settle on such coordination where both Parties have significant impact.

9.1.2 Minimizing Less than Optimal Dispatch. The Parties agree that, as a general matter, they should minimize financial harm to one RTO that results from the M2M coordination process initiated by the other RTO that produces less than optimal dispatch.

9.1.3 Use M2M Whenever Binding a M2M Flowgate. During normal operating conditions, the M2M coordination process will be initiated by the Monitoring RTO whenever an M2M Flowgate is constrained and therefore binding in its dispatch.

9.1.4 Most Limiting Flowgate. Generally, controlling to the most limiting Flowgate provides the preferable operational and financial outcome. In principle and as much as practicable, the M2M coordination process will take place on the most limiting Flowgate, and to that Flowgate's actual limit (thermal, reactive, stability).

9.1.5 Abnormal Operating Conditions. A Party that is experiencing system conditions that require the system operators' immediate attention may temporarily delay implementation of the M2M coordination process or cease an active M2M Event until a reasonable time after the system condition that required the system operators' immediate attention is resolved.

9.1.6 Transient System Conditions. A Party that is experiencing intermittent congestion due to transient system conditions including, but not limited to, interchange ramping or transmission switching, is not required to implement the M2M coordination process unless the congestion continues after the transient condition(s) have concluded.

9.1.7 Operating Guides that refer to the M2M coordination process do so under the assumption that the M2M Flowgates for which the M2M coordination process takes place are, or are expected to be, constrained. Operating Guides are written by operators and are not intended to result in settlement not otherwise contemplated by the JOA or this ICP. Safe Operating Mode (SOM) is reserved for abnormal conditions when existing operating guides and normal tool sets are not sufficient to manage abnormal operating conditions. After declaring SOM, operator actions may include using M2M tools in addition to direct dispatch.

9.1.8 Temporary Cessation of M2M Coordination Process Pending Review

a. If the net charges to a Party resulting from implementation of the M2M coordination process for a market-day exceed one million dollars, then the Party that is responsible for paying the charges may (but is not required to) suspend implementation of this M2M coordination process until the Parties are able to complete a review to ensure that both the process and the calculation of settlements resulting from the M2M Coordination Process are occurring in a manner that is both (a) consistent with this M2M Coordination Schedule, and (b) producing a just and reasonable result. The Party requesting suspension must identify specific concerns that require investigation within one business day of requesting suspension of the M2M coordination process. If the Parties' investigation of the identified concerns indicates that the M2M coordination process is (a) being implemented in a manner that is consistent with this M2M Coordination Schedule and (b) producing a just and reasonable result, then the M2M coordination process shall be re-initiated as quickly as practicable.

b. If the net charges to a Party resulting from implementation of the M2M coordination process at a M2M Flowgate for a market-day exceeds five hundred thousand dollars, then the Party that is responsible for paying the charges may (but is not required to) suspend implementation of this M2M coordination process on that M2M Flowgate until the Parties are able to complete a review to ensure that both the process and the calculation of settlements resulting from the M2M Coordination Process are occurring in a manner that is both (a) consistent with this M2M Coordination Agreement, and (b) producing a just and reasonable result. The Party requesting suspension must identify specific concerns that require investigation within one business day of requesting suspension of the M2M Coordination Process for an M2M Flowgate. If the Parties' investigation of the identified concerns indicates that the M2M Coordination Process is (a) being implemented in a manner that is consistent with this M2M Coordination Schedule, and (b) producing a just and reasonable result, then the M2M Coordination Process for that M2M Flowgate shall be re-initiated as quickly as practicable.

9.2 <u>After-the-Fact Review to Determine M2M Settlement</u>

Based on the communication and data exchange that has occurred in real-time between the Monitoring RTO operator and the Non-Monitoring RTO operator, there will be an opportunity to review the use of the market-to-market process to verify it was an appropriate use of the market-to-market process and subject to M2M settlement. The Monitoring RTO or Non-Monitoring RTO will initiate the review as necessary to apply these conditions and settlements adjustments.

9.3 <u>Access to Data to Verify Market Flow Calculations</u>

Each Party shall provide the other Party with data to enable the other Party independently to verify the results of the calculations that determine the M2M settlements under this M2M Coordination Schedule. A Party supplying data shall retain that data for two years from the date of the settlement invoice to which the data relates, unless there is a legal or regulatory requirement for a longer retention period. The method of exchange and the type of information to be exchanged pursuant to section 35.7.1 of the [NYISO/PJM JOA] shall be specified in writing. The Parties will cooperate to review the data and mutually identify or resolve errors and anomalies in the calculations that determine the M2M settlements. If one Party determines that it is required to self report a potential violation to the Commission's Office of Enforcement regarding its compliance with this M2M Coordination Schedule, the reporting Party shall inform, and provide a copy of the self report to, the other Party. Any such report provided by one Party to the other shall be "confidential information" as defined in the [NYISO/PJM JOA].

10 M2M Change Management Process

10.1 Notice

Prior to changing any process that implements this M2M Schedule, the Party desiring the change shall notify the other Party in writing or via email of the proposed change. The notice shall include a complete and detailed description of the proposed change, the reason for the proposed change, and the impacts the proposed change is expected to have on the implementation of the M2M coordination process, including M2M settlements under this M2M Schedule.

10.2 Opportunity to Request Additional Information

Following receipt of the Notice described in Section 10.1, the receiving party may make reasonable requests for additional information/documentation from the other Party. Absent mutual agreement of the parties, the submission of a request for additional information under this Section shall not delay the obligation to timely note any objection pursuant to Section 10.3, below.

10.3 Objection to Change

Within ten business days after receipt of the Notice described in Section 10.1 (or within such longer period of time as the parties mutually agree), the receiving Party may notify in writing or via email the other Party of its disagreement with the proposed change. Any such notice must specifically identify and describe the concern(s) that required the receiving party to object to the described change.

10.4 Implementation of Change

The Party proposing a change to its implementation of the M2M coordination process shall not implement such change until (a) it receives written or email notification from the other Party that the other Party concurs with the change, or (b) the ten business day notice period specified in Section 10.3 expires, or (c) completion of any dispute resolution process initiated pursuant to this Agreement.

[*See* MISO/PJM JOA ARTICLE XX SECTION 20]