Hourly Emergency Maximum Limit will be used for a specific Resource for an Operating Hour. The notification that the Hourly Emergency Maximum Limit will be used will occur at least 10 minutes prior to the beginning of the Operating Hour but not more than 30 minutes prior to the beginning of the Operating Hour. Emergency commitment schedules, Emergency off-line Supplemental Reserve schedules and the use of Hourly Emergency Maximum Limits will become physically binding once communicated to affected MPs by MISO after MISO has verified and accepted the RAC/LAC results.

- For each affected Resource under the surplus conditions described under Section 6.3 above, a de-commitment schedule is produced and MISO will notify MPs electronically that the Hourly Emergency Minimum Limit will be used for a specific Resource for an Operating Hour. The notification that the Hourly Emergency Minimum Limit will be used will occur at least 10 minutes prior to the beginning of the Operating Hour but not more than 30 minutes prior to the beginning of the Operating Hour. Emergency de-commitment schedules and the use of Hourly Emergency Minimum Limits become physically binding once communicated to affected MPs by MISO after MISO has verified and accepted the RAC/LAC results.

6.6 MISO-PJM Coordinated Transaction Scheduling (CTS)

MISO-PJM Coordinated Transaction Scheduling (CTS) is an optional product available for scheduling real-time energy market transactions between MISO and PJM. CTS facilitates the efficient scheduling of interchange between the two regional transmission organizations (RTO) by utilizing forecasted LMPs, and participant-provided interface bids to clear only those transactions deemed economically consistent with projected interface price spreads.

Market Participants submit MISO-PJM CTS bids in PJM's ExSchedule system. Validated bids are then passed to both PJM and MISO's look-ahead commitment engines. In Real-Time, PJM sends MISO the forecasted LMPs calculated for PJM's MISO interface, while MISO sends PJM the forecasted LMPs calculated for MISO's PJM interface to use as inputs to the CTS clearing process. Every 15 minutes in real-time (i.e., HH:00the top, HH:15, HH:30 and HH:45 of each hour of the Real-Time Energy and Operating Reserves Market), each RTO uses its Look Ahead Commitment engine to clear only those CTS bids that have an interface bid price that is less than or equal to the projected interface price spread. PJM and MISO then exchange the CTS clearing results. A common clearing process reconciles the CTS bids independently cleared by MISO and

PJM. For each CTS bid, only those transaction MW cleared by both PJM and MISO will be scheduled to flow.

6.6.1 MISO-PJM Coordinated Transaction Scheduling Business Rules

A Coordinated Transaction Schedule (CTS) bid can have up to ten monotonically increasing price and MW quantity pairs with minimum price at $0.01 for each 15-minute scheduling interval. Coordinated Transaction Schedules must be submitted 75 minutes before the start of the scheduling interval.

Please refer to the BPM #007 Physical Scheduling document for rules governing the submission of MISO-PJM CTS transactions.

6.6.2 CTS Bid Clearing

The Intermediate Term Security Constrained Economic Dispatch (IT SCED) engine clears CTS bids in PJM. Look Ahead Commitment (LAC) engine clears CTS bids for MISO. Only the CTS bids commonly cleared between PJM and MISO will be scheduled to flow. The reconciliation of commonly cleared CTS bids is discussed in section 6.6.3.

MISO receives CTS bids plus the forecasted PJM interface price from PJM. Using these inputs plus MISO's forecasted LMP, CTS bids are cleared as noted below:

A CTS bid that is scheduled from MISO to PJM gets cleared if:

The CTS bid Segment Price <= $PJM_interface - $MISO_interface

A CTS bid that is scheduled from PJM to MISO gets cleared if:

The CTS bid Segment Price <= $MISO_interface - $PJM_interface

Where

$PJM_interface: LMP for the MISO interface as calculated by PJM
$MISO_interface: LMP for the PJM interface as calculated by MISO

In the case of a tie among multiple bids, cleared MWs will be prorated across tying bids based on the size of the marginal MW segment for each tying bid. The proration of cleared MW across tying bids is calculated based on the following formula:

*$MW_{transaction}$ = (MWneeded for power balance) * (MW from transaction's marginal segment/ total MW from the marginal segment)*

6.6.3 CTS Common Clearing

Common Clearing is a process that reconciles the results of CTS clearing from the MISO and PJM solutions. For each CTS bid, only those transaction MW cleared by both PJM and MISO will be scheduled to flow. Therefore:

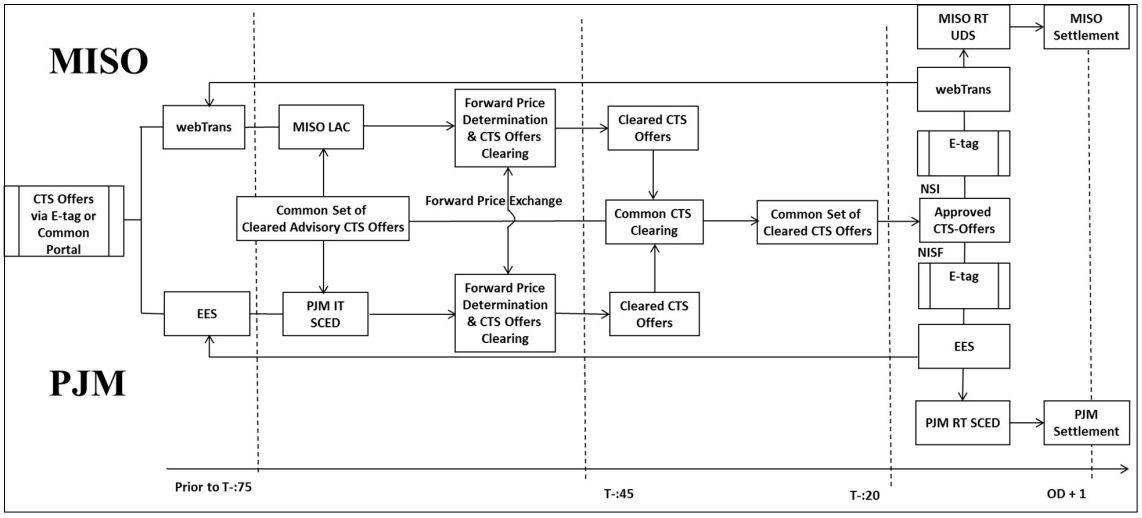
Common Cleared CTS Transaction MW = min (Cleared MISO MW, Cleared PJM MW)

The Common Clearing process executes for each 15 minute scheduling interval (HH:00, HH:15, HH:30, HH:45) at approximately 25 minutes before the start of CTS transaction. For example, the common clearing process for 12:00 runs at approximately 11:35.

The commonly cleared CTS results are posted in the ExSchedule portal and electronic tag (E-Tag) applications following the approval of the common clearing process.

6.6.4 CTS Timing and Data Exchange

The figure below shows the general timing of the various processes that will occur so that CTS transactions will flow at T-0:00. This figure shows the timeline for submittal of CTS bids, data exchanges between MISO and PJM, and common clearing process for each ISO.



Described below is the sequence of events associated with CTS processing:

1. E-Tag and E-Tag adjustments must be submitted at least 75 minutes prior to the listed start time.
2. The MISO advisory prices and schedules will come from the most recent MISO CTS clearing engine run that executes at T- 0:55.
3. At T- 0:40, the ITSCED case will execute for T-0 binding interval and include validated bid data and advisory pricing.
4. At T-25, common clearing case is executed at both ISO's.
5. Prior to T-20, scheduling system issues CTS Tag adjustments on MISO sinking Tags for T-0 intervals based on common cleared results.

6.6.5 CTS Clearing Suspension

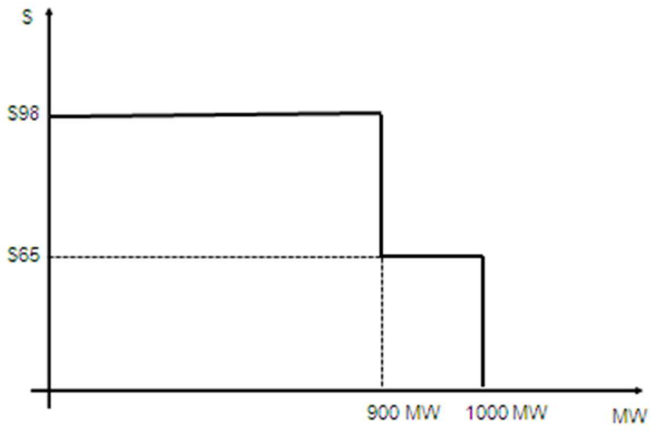
For reliability or system maintenance reasons, either PJM or MISO may suspend the evaluation and clearing of CTS transactions temporarily. During the affected time, all CTS transactions will be cleared to 0 MW. Possible reasons for CTS suspension include but are not limited to:

- Initiation of Maximum Emergency Warning procedures.
- Scheduled system outage / maintenance.
- Inability to send or receive accurate forecast LMP data to/from partner RTO.

A message will be displayed in the ExSchedule system whenever CTS suspension is in effect.

6.6.6 CTS Settlement

MISO and PJM will settle the CTS transactions on each side of the MISO-PJM interface based on actual LMPs, not the projected prices. In other words, although the market clearing process for CTS transactions will use projected prices, the market settlement process for CTS transactions will use actual real-time prices. In MISO, CTS transactions will be settled as Real Time physical schedules, will be treated as generation dispatched up and down and, therefore, will be exempt from uplift charges such as Revenue Sufficiency Guaranty (RSG) and Revenue Neutrality Uplift (RNU) charges in the MISO market. Please refer to the Market Settlements calculation guide for additional details.



7. Day-Ahead Energy and Operating Reserve Market Activities

MPs who wish to participate in the Day-Ahead Energy and Operating Reserve Market must submit Resource Offers, Virtual Supply Offers, Demand Bids, and/or Interchange Schedules for the purchase and sale of Energy and Offers for the sale of Operating Reserve no later than 1030 EPT on the day prior to the Operating Day (OD-1) for use in clearing the Day-Ahead Energy and Operating Reserve Market. Exhibit 7-1 shows the timeline for the principal activities associated with the Day-Ahead Energy and Operating Reserve Market.

Exhibit 7-1: Day-Ahead Energy and Operating Reserve Market Activities Timeline

Beginning Day @ Time	Ending Day @ Time	Description of Processes and Events
Data Required for the Day-Ahead Energy and Operating Reserve Market		
As previously scheduled	OD-1 @ 1030EPT	Scheduled transmission facility outages
As previously scheduled	OD-1 @ 1030 EPT	Scheduled Generation Resource and Stored Energy Resource outages
OD-7 @ 0000 or previous submittal	OD-1 @ 1030 EPT	Resource Offer submittal into the Day-Ahead Energy and Operating Reserve Market for Energy, Regulating Reserve, Spinning Reserve, Supplemental Reserve, Ramp Capability Product, and Short-Term Reserve
OD-7 @ 0000	OD-1 @ 1030 EPT	Fixed Demand Bids and Price-Sensitive Demand Bids into the Day-Ahead Energy and Operating Reserve Market only
OD-7 @ 0000	OD-1 @ 1030 EPT	Virtual Supply Offers and Virtual Demand Bids into the Day-Ahead Energy and Operating Reserve Market only
OD-7 @ 0000	OD-1 @ 1030 EPT	Day-Ahead Fixed Interchange Schedules – not considered binding until OD-1 @ 0900 – roll into Real-Time Energy and Operating Reserve Market, if cleared and not "zeroed" by MP
OD-7 @ 0000	OD-1 @ 1030 EPT	Day-Ahead Dispatchable Interchange Schedules – not considered binding until OD-1@0900 – roll into Real-Time Energy and Operating Reserve Market as Fixed Interchange Schedules, if cleared
OD-7 @ 0000	OD-1 @ 1030 EPT	Up-to-TUC Interchange Schedules (Day-Ahead Energy and Operating Reserve Market only) not considered binding until OD-1@0900 - roll into Real-Time Energy and Operating Reserve Market as Fixed Interchange Schedules, if cleared
OD-7 @ 0000	OD-1 @ 1030 EPT	GFA Schedules (Option B)

Beginning Day @ Time	Ending Day @ Time	Description of Processes and Events
As scheduled by RAC	OD-1 @ 1030 EPT	Long lead time Resource schedules – from RAC
As previously entered	OD-1 @ 1030 EPT	Bid and Offer parameters and Network Model parameters
As previously entered	OD-1 @ 1030 EPT	Updated facility ratings
Day-Ahead Energy and Operating Reserve Market Activities		
	OD-1 @ 1030 EPT	Close the Day-Ahead Energy and Operating Reserve Market and acquire data
OD-1 @ 1030 EPT	OD-1 @ 1330 EPT	Clear the Day-Ahead Energy and Operating Reserve Market
	OD-1 @ 1330 EPT	Post the Day-Ahead Energy and Operating Reserve Market Awards Results and Ex-Ante LMPs and MCPs
OD-1 @ 1330 EPT	OD-1 @ 1630 EPT	Post the Day-Ahead Energy and Operating Reserve Market Ex-Post LMPs and MCPs
OD-7 @ 0000	OD+6 @ 1200	Enter Financial Schedules for the Day-Ahead Energy and Operating Reserve Market (Note: Financial Schedules for Deviations must be submitted by OH-4)

OD = Operating Day
RAC = Reliability Assessment Commitment
SSR = System Support Resource
TUC = Transmission Usage Charge

Note: All times are in EST unless indicated otherwise

MISO may extend or reopen the Day-Ahead Energy and Operating Reserve Market after market close time (1030 EPT) as listed in Exhibit 7-1, based on unanticipated events that:

i) interfere with MISO's ability to receive or process Bid, Offer, or Interchange Schedule data;

ii) render Bid, Offer, or Interchange Schedule data plainly inaccurate in a manner that is likely to significantly impede MISO's ability to deliver a feasible market solution; or

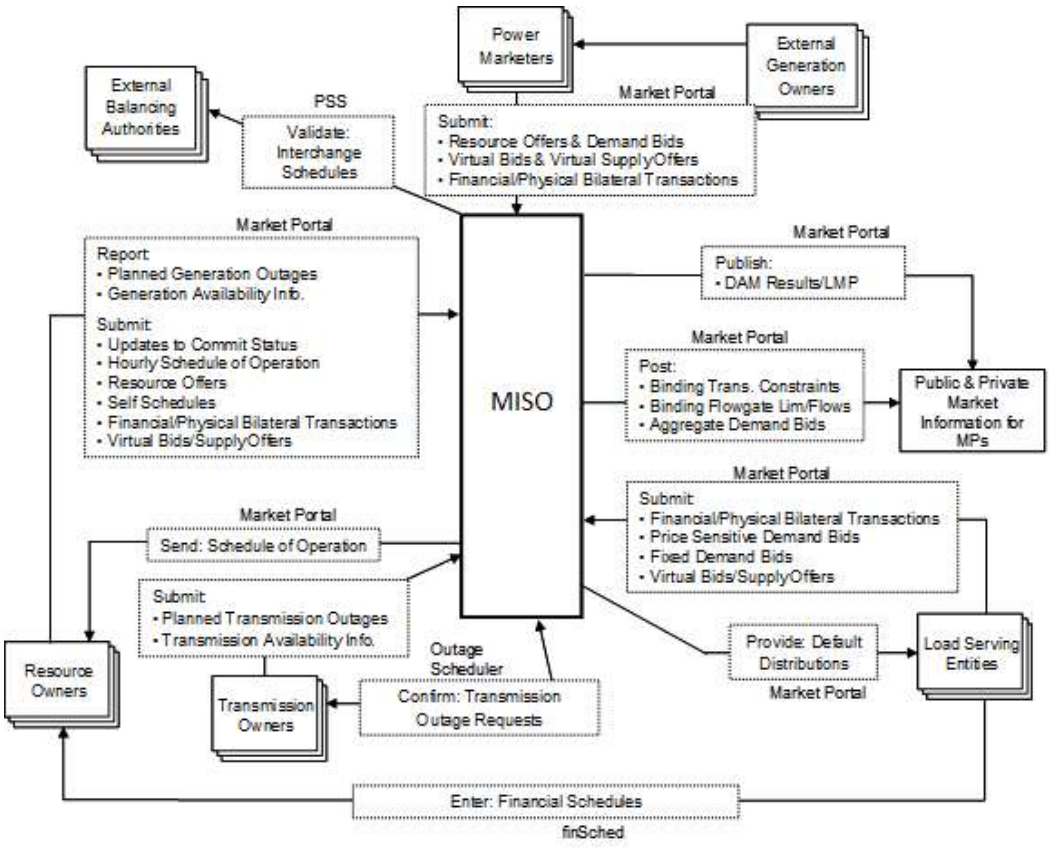
iii) are otherwise likely to have a widespread negative impact on the results of the Day-Ahead Energy and Operating Reserve Market, in a manner that adversely threatens or affects the reliability of market operations or of the Transmission System.

MISO will post a notice of any extension or reopening of the market. The notice will state each extension or reopening's circumstances, rationale, duration, and whether such action enabled MISO to successfully address or minimize the issue that necessitated the extension or reopening.

Similarly, though MISO will strive to post the Day-Ahead Energy and Operating Reserve Market clearing results before 1330 EPT as listed in Exhibit 7-1, additional time may be needed for such posting from time to time due to unanticipated events.

The interactions and data flows between the entities that participate in the Day-Ahead Energy and Operating Reserve Market are shown in Exhibit 7-2.

Exhibit 7-2: Data Flow for Day-Ahead Energy and Operating Reserve Market



7.1 Market Participant Activities

MPs submit Offers and Interchange Schedules for use in the Day-Ahead Energy and Operating Reserve Market clearing process as follows.

7.1.1 Submitting Resource Offers

MPs may submit Resource Offers up to Day-Ahead Energy and Operating Reserve Market close time 1030 EPT on the day prior to the Operating Day for use in the Day-Ahead Energy and Operating Reserve Market clearing process. See Section 4. of this BPM for a description of the valid Offer parameters. The following rules apply to all Resources:

- ***Resources designated as Capacity Resources for Module E Purposes*** – If not on a forced or maintenance outage, such Resources must offer into the Day-Ahead

Energy and Operating Reserve Market any designated capacity, including Energy, Contingency Reserve and Short-Term Reserve if qualified except to the extent that the Resource is unable to provide Energy, Contingency Reserve or Short-Term Reserve due to a forced or planned outage or other physical operating restrictions.

- ***Other Resources*** – These Resources can, but are not obligated to, offer any available capacity into the Day-Ahead Energy and Operating Reserve Market.

DRR-Type I Offers should be accompanied by a Fixed Demand Bid for the associated host load zone equal to the expected Targeted Demand Reduction Level; otherwise, a Load deviation will be created in the Real-Time host load one settlement equal to the Targeted Demand Reduction Level if the DRR-Type I is committed.

Resources selected and committed as part of the Day-Ahead Energy and Operating Reserve Market clearing must adhere to MISO's instructions, including start times. These Resources must also submit an Energy Offer (except for Stored Energy Resources) for their full range of Operable Capacity, from Hourly Emergency Minimum Limit to Hourly Emergency Maximum Limit, regardless of Module E capacity designation status for use in the RAC Processes and in the Real-Time Energy and Operating Reserve Market. Generation Resources and DRRs-Type II committed by MISO are guaranteed recovery of Start-Up Offers, No-Load Offers, Energy Offers (at actual output), Regulating Reserve Offers, Spinning Reserve Offers and On-Line Supplemental Reserve Offers (if applicable) net the value of Day-Ahead Energy and Operating Reserve Market revenues earned based upon the Day-Ahead Schedule for Energy and Operating Reserve, and subject to restrictions on Self-Scheduling. DRRs-Type I committed by MISO are guaranteed recovery of Shut-Down Offers and Hourly Curtailment net the value of Day-Ahead Energy and Operating Reserve Market revenues earned based upon the Day-Ahead Schedule for Energy. Further detailed Settlement information can be found in the BPM for *Market Settlements*.

The availability of Generation Resources, DRRs-Type I, DRRs-Type II and Stored Energy Resources is also determined in the Day-Ahead Energy and Operating Reserve Market clearing by incorporating the status of the Resource in Outage Scheduler. Under normal operating conditions, if a Generation Resource, DRR-Type I or DRR-Type II is listed in Outage Scheduler with an outage type of "Maintenance", "Construction", "Urgent", "Emergency", or "Forced", the Resource will be considered unavailable in the Day-Ahead Energy and Operating Reserve Market

Clearing. Generation Resources listed in Outage Scheduler with an outage type of "Economy" or "Deration" will be considered available. Further detailed Outage Scheduler information can be found in the BPM for *Outage Operations*.

7.1.2 Submitting Bids and Virtual Supply Offers

MPs may submit Virtual Supply Offers, Demand Bids and Virtual Demand Bids up to Day-Ahead Energy and Operating Reserve Market close time (1030 EPT) on the day prior to the Operating Day for use in the Day-Ahead Energy and Operating Reserve Market clearing process. As stated in Section 7.1.17.1.1 above, Fixed Demand Bids must be submitted in conjunction with DRR-Type I and DRR-Type II Offers. See Section 4. of this BPM for a description of the valid Offer parameters.

7.1.3 Submitting Interchange Schedules

The following rules apply to submitting Interchange Schedules in the Day-Ahead Energy and Operating Reserve Market. See Section 4. of this BPM for detail relating to the types of Interchange Schedules that may be submitted.

- Interchange Schedules must start on the top, quarter-past, half-past, or quarter till the hour.
- MPs must submit all Interchange Schedules for the Day-Ahead Energy and Operating Reserve Market, via NERC E-Tag, prior to 1030 EPT of the day prior to the Operating Day (OD-1).
- Day Ahead Interchange Schedules must be fully approved and implemented prior to 1030 EPT in order to be considered as a DA Market submission.
- Should a Day Ahead Interchange Schedule be implemented after1030 EPT, the schedule will be rejected from the Day Ahead market, and an adjustment request will be sent to the corresponding E-Tag.
- If that Market Adjustment is denied by an external Balancing Authority or Transmission Provider; the Market Result remains unchanged. Any MWs that flow in Real Time will be settled at the Real-Time Ex Post LMP.
- On multi-day tags the pricing information must be the same.
- If an External Asynchronous Resource ("EAR") Offer is submitted, an associated Fixed Dynamic Interchange Schedule must also be submitted. The estimate of the maximum schedule amount for Imports and/or Exports into MISO should be less than or equal to the EAR's Hourly Emergency Maximum Limit. The estimate of the maximum

schedule amount for Exports out of MISO should be less than or equal to the EAR's Hourly Emergency Minimum Limit.

For further information on Interchange Schedules, please refer to the BPM for *Physical Scheduling (BPM-007)*.

7.2 MISO Activities

MISO operates the Day-Ahead Energy and Operating Reserve Market via Security Constrained Unit Commitment ("SCUC"), Security Constrained Economic Dispatch ("SCED") and SCED-Pricing algorithms to develop commitment schedules and Day-Ahead Schedules of operation for each MP. The Day-Ahead Energy and Operating Reserve Market is a forward market in which hourly Ex Ante and Ex Post LMP values and hourly Ex Ante and Ex Post MCP values are calculated on a simultaneously co-optimized basis for each hour of the next Operating Day based on MP Offers and Bids for Energy and Offers for the sale of Operating Reserve and other reserve products. MPs purchase Energy and sell Energy, Operating Reserve and other reserve products in the Day-Ahead Energy and Operating Reserve Market at financially binding Day-Ahead Ex Post LMPs and Day-Ahead Ex Post MCPs.

The Day-Ahead unit commitment utilizes a simultaneously co-optimized Security-Constrained Unit Commitment algorithm ("SCUC") to commit sufficient Resources to meet the Fixed Demand Bids, cleared Price Sensitive Demand Bids, Fixed Interchange Schedule Exports, cleared Dispatchable Interchange Schedule Exports, cleared Virtual Demand Bids, forecasted Zonal and Market-Wide Regulating Reserve Requirements and forecasted Co-Optimized Zonal, Market-Wide Contingency Reserve Requirements, Ramp Capability Requirements, and Short-Term Reserve Requirements on an hourly basis. The objective of the SCUC is to minimize total costs over the entire commitment period while simultaneously enforcing physical constraints and reliability requirements.

The day-ahead economic dispatch utilizes a simultaneously co-optimized Security-Constrained Economic Dispatch algorithm ("SCED") and SCED-Pricing algorithm to dispatch Resources to meet the Fixed Demand Bids, cleared Price Sensitive Demand Bids, Fixed Interchange Schedule Exports, cleared Dispatchable Interchange Schedule Exports, cleared Virtual Demand Bids, forecasted Co-Optimized Zonal and Market-Wide Regulating Reserve Requirements and forecasted Co-Optimized Zonal, Market-Wide Contingency Reserve Requirements, Ramp

Capability Requirements, and Short-Term Reserve Requirements on an hourly basis. The objective of the security-constrained economic dispatch is to minimize total hourly costs while simultaneously enforcing physical constraints and reliability requirements. The SCED algorithm produces DA Ex Ante LMPs and Ex Ante MCPs. The SCED-Pricing algorithm produces DA Ex Post LMPs and Ex Post MCPs.

MISO performs the Day-Ahead Energy and Operating Reserve Market Settlement based on the hourly Day-Ahead Schedules, hourly Day-Ahead Ex Post LMPs and hourly Day-Ahead Ex Post MCPs.

7.2.1 Energy and Operating Reserve Markets Requirements

Prior to the operation of the Energy and Operating Reserve Markets, MISO identifies Reserve Zones, calculates Co-Optimized Zonal and Market-Wide Operating Reserve and other reserve Requirements and develops Demand Curves for Operating Reserve, Regulating and Spinning Reserve, Regulating Reserve and other reserve products which are required inputs into the Energy and Operating Reserve Markets clearing process. Calculation of Co-Optimized Zonal and Market-Wide Operating Reserve Requirements is described under Section 3. this BPM. Demand Curve development is described under Section 5. of this BPM.

7.2.2 Interchange Schedules

MISO applies the following rules and actions relating to MP-submitted Interchange Schedules for use in the Day-Ahead Energy and Operating Reserve Market. See Section 4. of this BPM for detail relating to the types of Interchange Schedules that may be submitted.

- MISO confirms the validated and compliant Interchange Schedule requests with appropriate neighboring external BAs.
- If the transaction clears the Day-Ahead Energy and Operating Reserve Market, the MP is settled at the Day-Ahead Ex Post LMP for the cleared MW amount.
- If cleared Day-Ahead Interchange Schedules are adjusted after the market clearing but before 20 minutes prior to the Operating Hour, the original schedule will be used in the Day-Ahead Energy and Operating Reserve Market and the adjusted MW schedule will be used in the Real-Time Energy and Operating Reserve Market.
- Partial hour pricing is not permitted.
- Interchange Schedule implementation is subject to ramping availability (see the BPM for *Physical Scheduling, BPM-007*).

- Interchange Schedules not adhering to the webTrans data requirements are denied. The MP is notified of the reason for denial via transaction denial and the MP may then submit another Interchange Schedule via a NERC E-Tag, if there is sufficient time prior to the submission deadlines.
- MISO submits a 'Market Adjust' to the NERC E-Tag when a Day-Ahead Energy and Operating Reserve Market Interchange Schedule is not cleared or is partially cleared. Entities with approval rights, as defined by NERC, must take approval actions.
- If a Market Adjust is denied by a non-MISO entity, the PSE will be responsible to provide the Energy in the Real-Time Energy and Operating Reserve Market or PSE adjusts the schedule to the market adjusted value.
- After the Day-Ahead Energy Market closes and prior to Day-Ahead Energy Market clearing, changes will not be permitted to Day-Ahead Schedules running the next day. MISO will deny such changes. Changes are allowed after Day-Ahead Energy Market clearing.

For further information on Interchange Schedules, please refer to the BPM for *Physical Scheduling (BPM-007).*

7.2.3 Day-Ahead Energy and Operating Reserve Market Clearing

The Day-Ahead Energy and Operating Reserve Market clears for each hour of the upcoming Operating Day. A simultaneous co-optimization methodology, utilizing the SCUC, SCED and SCED-Pricing algorithms, is employed to simultaneously perform the following tasks:

- Commit offered Resources at least-Offer price using the SCUC algorithm to meet the Energy, Operating Reserve, other reserve products, transmission constraint and Sub-Regional Power Balance Constraint requirements throughout the projected upcoming Operating Day while respecting Resource operating constraints, including minimum run-times and minimum down-times, considering any carryovers from the previous day; and
- Clear Offers and Import Schedules to meet Demand Bids and Operating Reserve and other reserve requirements for each hour of the upcoming Operating Day using the SCED and SCED-Pricing algorithm to yield Day-Ahead Schedules, Day-Ahead Ex Ante and Ex Post LMPs and Day-Ahead Ex Ante and Ex Post MCPs, respectively.

The objective in clearing the Day-Ahead Energy and Operating Reserve Market is to minimize the costs of Energy and Operating Reserve procurement over the 24-hour dispatch horizon, subject to network constraints and Resource operating constraints. The overall procurement costs include:

- Start-Up Offers and No-Load Offers for Generation Resources and DRRs-Type II committed by SCUC;
- Shut-Down Offers and Hourly Curtailment Offers for DRRs-Type I committed by SCUC;
- Energy Offers, Regulating Reserve Offers, Spinning Reserve Offers and Supplemental Reserve Offers of all Generation Resources, DRRs-Type II and External Asynchronous Resources selected by SCED for Day-Ahead Schedules;
- Regulating Reserve Offers of all Stored Energy Resources selected by SCED for Day-Ahead Schedules;
- Dispatchable Import Daily Offers selected by SCED for Day-Ahead Schedules;
- Spinning Reserve Offers, Supplemental Reserve Offers, or Off-Line Short-Term Reserve Offers for DRRs-Type I selected by SCED for Day-Ahead Schedules that were not committed for Energy by SCUC;
- Off-Line Short-Term Reserve Offers for all Generation Resources, DRRs-Type II selected by SCED for Day-Ahead Schedules;
- Price adjustments for the cost of committing Fast Start Resources, the Energy cost of Fast Start Resources dispatched at limits, Up Ramp Capability and Down Ramp Capability by SCED-Pricing, Short-Term Reserve by SCED-Pricing; and
- Virtual Supply Offers.

The rules applying to the Day-Ahead Energy and Operating Reserve Market clearing of Energy, Regulating Reserve and Contingency Reserve on specific Resources are as follows:

- If a Resource has been scheduled to potentially provide Regulating Reserve, the cleared sum of Energy, Regulating Reserve, Contingency Reserve, and Ramp Capability is constrained by the Hourly Regulation Maximum Limit.
- If a Resource has been scheduled to potentially provide Regulating Reserve, the cleared sum of Energy, Regulating Reserve and Short-Term Reserve is constrained by the Hourly Regulation Maximum Limit.

- If a Resource has been scheduled to potentially provide Regulating Reserve, cleared Energy less cleared Regulating Reserve less cleared Down Ramp Capability is constrained by the Hourly Regulation Minimum Limit.
- If a Resource has not been scheduled to potentially provide Regulating Reserve, the cleared sum of Energy, Contingency Reserve, and Up Ramp Capability is constrained by the Hourly Economic Maximum Limit.
- If a Resource has not been scheduled to potentially provide Regulating Reserve, the cleared sum of Energy and Short-Term Reserve is constrained by the Hourly Economic Maximum Limit.
- If a Resource has not been scheduled to potentially provide Regulating Reserve, Energy less cleared Down Ramp Capability is constrained by the Hourly Economic Minimum Limit.
- The cleared Energy is constrained by the applicable ramp rates.
- The cleared Regulating Reserve is constrained by the applicable ramp rates.
- The cleared Contingency Reserve is constrained by the applicable ramp rates.
- The cleared Short-Term Reserve is constrained by the applicable ramp rates.
- The amount of Regulating Reserve that may clear on a Resource is limited to a configurable percentage of the Market-Wide Regulating Reserve Requirement. This limit is required to ensure reliable dispersion of Regulating Reserve and may be modified by MISO based upon observed historical Regulating Reserve dispersion. To the extent that this limit causes Regulating Reserve or Operating Reserve Scarcity, clearing above this amount on a single Resource will be allowed.
- The amount of Contingency Reserve that may clear on a Resource is limited to a configurable percentage of the Market-Wide Contingency Reserve Requirement. This limit is required to ensure reliable dispersion of Contingency Reserve and may be modified by MISO based upon observed historical Contingency Reserve dispersion. To the extent that this limit causes Operating Reserve Scarcity, clearing above this amount on a single Resource will be allowed.
- The amount of Ramp Capability that may clear on a Resource is limited to a configurable percentage of the Market-Wide Ramp Capability Requirement. This limit is required to ensure reliable dispersion of Contingency Reserve and may be modified by MISO based upon observed historical Contingency Reserve dispersion. To the extent that this limit causes Operating Reserve Scarcity, clearing above this amount on a single Resource will be allowed.

- The amount of Short-Term Reserve that may clear on a Resource is limited to a configurable percentage of the Market-Wide Short-Term Reserve Requirement. This limit is required to ensure reliable dispersion of Short-Term Reserve and may be modified by MISO based upon observed historical Short-Term Reserve dispersion. To the extent that this limit causes Operating Reserve Scarcity, clearing above this amount on a single Resource will be allowed.

MISO clears the Day-Ahead Energy and Operating Reserve Market, calculates the Day-Ahead Ex-Ante LMPs and MCPs and posts the results on MISO's Market Portal at 1330 EPT. MISO also calculates Ex-Post LMPs and MCPs and posts the results on MISO's Market Portal between 1330 and 1630 EPT. Posting of results may be delayed due to unanticipated events. The following Day-Ahead Energy and Operating Reserve Market results are posted:

- The 24 hourly injections for each Resource of each MP whose Offers are accepted in the Day-Ahead Energy and Operating Reserve Market, including all Self-Scheduled Resources, all cleared Resource Offers, all cleared Virtual Supply Offers, and all cleared Import Schedules.
- The 24 hourly withdrawals of each MP whose Bids are accepted in the Day-Ahead Energy and Operating Reserve Market, including all Fixed Demand Bids, cleared Price-Sensitive Demand Bids, cleared Virtual Demand Bids, and all cleared Export Schedules.
- The Day-Ahead Ex Ante and Ex Post LMPs and Day-Ahead Ex Ante and Ex Post MCPs are determined as described under Section 5. of this BPM.

7.2.3.1 Clearing Under Shortage Conditions

If, while clearing the Day-Ahead Energy and Operating Reserve Market, the sum of the Day-Ahead Fixed Demand Bids, Fixed Export Schedules and Operating Reserve requirements, either on a system-wide or zonal basis, cannot be satisfied with all available non-Emergency Offers (Generation Offers, DRR-Type I Offers, DRR-Type II Offers, Stored Energy Resource Offers, External Asynchronous Resource Offers, Import Schedules, and Virtual Supply Offers), shortage conditions occur, MISO will attempt to meet fixed demands by utilizing offered Emergency Resources, and Emergency ranges of available resources. In order to appropriately value the Emergency resources such as and released Emergency range, Proxy Offers will be utilized in the ex post Emergency pricing as the maximum of the Emergency Offer Floor and the resource's offer for the applicable capacity block. The Emergency Offer Floor is calculated as the as the

maximum of $500 or the highest available economic energy offer or dispatchable import transaction existing prior to the release of the Emergency Resources and Emergency ranges.

MISO will implement the following steps to clear the Day-Ahead Energy and Operating Reserve Market:

- ***Step One*** – Market Participant Offers submitted for each Resource up to the Hourly Emergency Maximum Limit and Generation Resources, DRRs-Type I and DRRs-Type II that are designated as available only for use in Emergency conditions are made available to the SCUC algorithms.
  - Ex Ante. If use of this Emergency Capacity is sufficient to relieve an anticipated Operating Reserve shortage condition in a capacity Emergency, the Day-Ahead Energy and Operating Reserve Market will clear by incorporating the Emergency Resource, and Resource Emergency limit Offers as part of the co-optimized Day-Ahead Energy and Operating Reserve Market clearing results and the Ex Ante LMPs and Ex Ante MCPs produced by the SCED algorithm will not reflect any Scarcity Prices but will reflect the Emergency Offers associated with the Emergency ranges of those Resources.
  - Ex Post. Similarly, if use of this Emergency Capacity is sufficient to relieve an anticipated Operating Reserve shortage condition in a capacity Emergency, the Day-Ahead Energy and Operating Reserve Market will clear by incorporating the Emergency Resource, and Resource Emergency limit Proxy Offers as part of the co-optimized Day-Ahead Energy and Operating Reserve Market clearing results. The Ex Post LMPs and Ex Post MCPs produced by the SCED-Pricing algorithm will not reflect any Scarcity Prices but will reflect the emergency pricing Proxy Offer for all Emergency Resources, external resources qualified as Planning Resources and Emergency range deployment.
  - If inclusion of the Emergency Capacity is sufficient to meet bid-in demand requirements but is not sufficient to relieve an anticipated Operating Reserve shortage in a capacity Emergency, the Day-Ahead Ex Ante and Ex Post MCPs for Operating Reserve will reflect Scarcity Prices set by the Demand Curves based upon the level of the shortage.
- ***Step Two*** –If inclusion of this Emergency Capacity is not sufficient to meet bid-in demand requirements, the bid-in demand requirements, including fixed Export Schedules, are reduced pro-rata to match the available Capacity and all Day-Ahead

Ex Ante and Ex Post LMPs and Ex Ante and Ex Post MCPs are set at the VOLL and Day-Ahead Schedules for demand are based upon the reduced pro-rata amount.

7.2.3.2 Clearing Under Surplus Conditions

If, while clearing the Day-Ahead Energy and Operating Reserve Market, either on a market-wide or zonal basis, the sum of: (1) Self-Scheduled Generation levels; (2) Self-Scheduled DRR-Type I Targeted Demand Reduction levels; (3) Self-Scheduled DRR-Type II levels; (4) Hourly Economic Minimum Limits (or Hourly Regulation Minimum Limits if cleared for Regulating Reserves) for Must Run Generation Resources; (5) Hourly Regulation Minimum Limits for any other Resources committed to provide Regulating Reserve; (6) Fixed Import Schedules; and (7) the applicable Regulating Reserve Requirement (either market-wide or zonal) exceeds the sum of: (1) Fixed Demand Bids; (2) cleared Price Sensitive Demand Bids; (3) cleared Export Schedules and (4) cleared Virtual Demand Bids, MISO will perform the following steps to clear the Day-Ahead Energy and Operating Reserve Market:

- ***Step One*** – For each Resource that is not providing Regulating Reserve, MP Offers submitted down to the Hourly Emergency Minimum Limit are made available to the SCUC algorithm. If use of this Emergency Capacity is sufficient to relieve the anticipated supply surplus condition, the Day-Ahead Energy and Operating Reserve Market will clear by incorporating the Resource Hourly Emergency Minimum Limit Offers as part of the co-optimized Day-Ahead Energy and Operating Reserve Market clearing results and the Ex Ante and Ex Post LMPs and Ex Ante and Ex Post MCPs will not reflect any Scarcity Prices but will reflect the Emergency Offers associated with the Hourly Emergency Minimum Limits of those Resources.
- ***Step Two*** – If inclusion of the Hourly Emergency Minimum Limits in Step One is not sufficient to relieve the supply surplus condition, MP Offers submitted down to the Hourly Emergency Minimum Limit are made available to the SCUC,SCED and SCED-Pricing algorithms for each Resource that had been providing Regulating Reserve. Use of these Hourly Emergency Minimum Limits will create a Regulating Reserve shortage and Ex Ante and Ex Post LMPs will contain negative Regulating Reserve Scarcity Prices and Regulating Reserve Ex Ante and Ex Post MCPs will include positive Regulating Reserve Scarcity Prices based upon the applicable (market-wide) Regulating Reserve Demand Curves.
- ***Step Three*** – If the Energy balance is not achieved after Step Two, MISO reduces supply proportionately until Energy balance is achieved and the Day-Ahead Energy

and Operating Reserve Market is cleared. Ex Ante and Ex Post LMPs and Regulating Reserve Ex Ante and Ex Post MCPs will continue to be set based upon the Regulating Reserve Demand Curves.

Note: Fast Start Resources shall not be partially committed in SCED-Pricing in Steps one, two or three

7.3 Monitoring and Mitigating Day-Ahead Energy and Operating Reserve Market

Any Offer, or change in availability submitted to MISO by MPs is subject to market monitoring and mitigation measures. The complete process is described in the BPM for *Market Monitoring and Mitigation*.

8. Real-Time Energy and Operating Reserve Market Activities

MPs that participate in the Real-Time Energy and Operating Reserve Market must submit new or revised Offers and/or new or revised Interchange Schedules for the purchase and sale of Energy and new or revised Offers for the sale of Operating Reserve no later than 30 minutes prior to the Operating Hour (OH-30) for use in clearing the Real-Time Energy and Operating Reserve Market. Exhibit 8-1: shows the timeline for the principal activities associated with the Real-Time Energy and Operating Reserve Market.

Exhibit 8-1: Real-Time Energy and Operating Reserve Market Activities Timeline

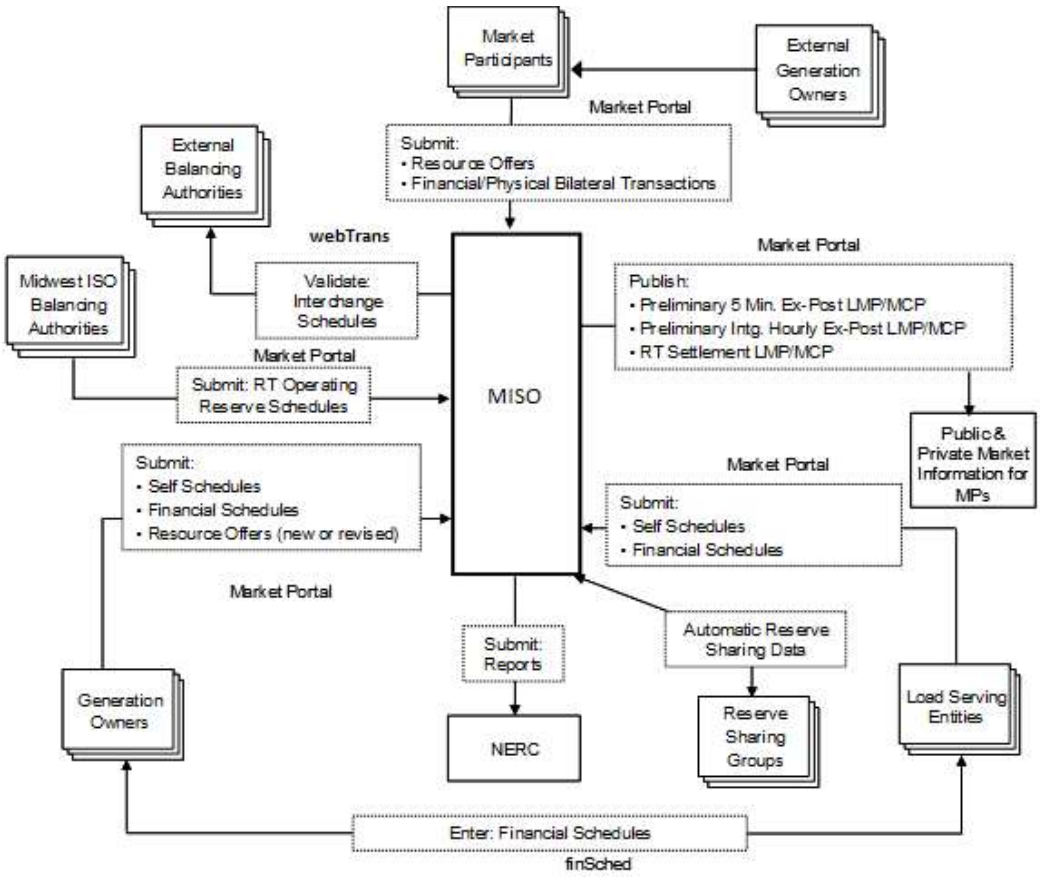
Beginning Day @ Time	Ending Day @ Time	Description of Processes and Events
Data Required for Real-Time Energy and Operating Reserve Market		
OD-7 @ 0000	OD @ OH-30	Fixed Interchange Schedules into the Real-Time Energy and Operating Reserve Market
OD-7 @ 0000	OD @ OH-30	Dynamic Interchange Schedules (dispatchable and import only) into the Real-Time Energy and Operating Reserve Market
OD-7 @ 0000	OD+6 @ 1200	Financial Schedules for the Real-Time Energy and Operating Reserve Markets
OD-7 @ 0000	OD @ OH-30	Generation Resource Offers into the Real-Time Energy and Operating Reserve Market
OD-7 @ 0000	OD @ OH-30	DRR-Type I, DRR-Type II, Stored Energy Resource and External Asynchronous Resource Offers into the Real-Time Energy and Operating Reserve Market
OD @ OH-60	OD@RT	DIR Forecast Maximum Limit submitted into the Real-Time Energy and Operating Reserve Market via MUI
Ongoing	OD @ RT-10 min.	Constraint limits applied and removed based on MISO's power system security analyses
	OD @ RT-10 min.	Contingency Reserve deployment
Real-Time Energy and Operating Reserve Market Activities		
OD-1 @ 1800 EPT	OD-1 @ 2300	Review Load Forecasts and Reports
	OD @ 0000	Open/Close Operator's Log
	OD @ OH-30	Close the Real-Time Energy and Operating Reserve Market 30 minutes prior to the top of each Operating Hour

Beginning Day @ Time	Ending Day @ Time	Description of Processes and Events
OD @ RT-10 Starts every 5 minutes	OD @ RT-5 Ends within 5 min. of start	Execute UDS
	OD @ RT-5	Send Resource Dispatch Targets to Resource operators
OD Continuous	OD Continuous	Send Setpoint Instructions to Resource operators on a 4 second periodicity that consists of Dispatch Target for Energy adjusted for Regulating Reserve deployment and Contingency Reserve deployment

OD = Operating Day
OH = Operating Hour (00 to 23)
RT = Real-Time (target time for UDS base points)
UDS = Unit Dispatch System Note: All times are in EST unless indicated otherwise

The interactions and data flows between the entities that participate in the Real-Time Energy and Operating Reserve Market are shown in Exhibit 8-1, excluding RAC.

Exhibit 8-1: Data Flow for Real-Time Energy and Operating Reserve Market (Excluding RAC)



8.1 Market Participant Activities

MPs submit Offers and Interchange Schedules for use in the Real-Time Energy and Operating Reserve Market clearing process as follows.

8.1.1 Notification Deadline

The Notification Deadline is the cut-off time, four hours prior to the beginning of each operating hour, by which schedule changes must be reported to the Transmission Provider to enable it to reflect such changes in the RAC process. For certain assets, schedule changes are automatically gathered from existing offers at the Notification Deadline; for others, specific Notification Deadline

offer submittals are required. The following list describes the process that MISO uses to gather Notification Deadline information for each impacted schedule, asset, etc.:

- For Load Zones, a Real-Time Load Zone Demand Forecast may be submitted prior to the Notification Deadline, via the "Real-Time Demand Forecast submittal in the MUI. For Load Zones, positive values represent load. If a value is not submitted prior to the Notification Deadline, it will be deemed to be equal to the Day-Ahead Schedule.
- For Interchange Transactions, the MW quantity of each scheduled transaction that has an "Implemented" status in webTrans is automatically gathered.
- For Financial Schedules, the MW quantity of each Fin Sched that is an RSG Deviations Contract is automatically gathered.
- For Generation Resources (including DIRs and Intermittent Resources), and DRRs Type - II, the as-offered Economic Minimum Limit is automatically gathered.
- For Generation Resources (other than DIRs and Intermittent Resources), and DRRs Type - II, the as-offered Economic Maximum Limit is automatically gathered.
- For DIRs and Intermittent Resources, a Notification Deadline DIR Forecast may be submitted prior to the Notification Deadline, via the "Real-Time Demand Forecast" submittal in the MUI. For a DIR or Intermittent Resource, positive values represent generation. If a value is not submitted prior to the Notification Deadline, it will be deemed to be equal to the Day-Ahead Schedule. The as-offered Economic Minimum Limit for DIRs is automatically gathered.
- For Stored Energy Resources, the as-offered Regulation Minimum Limit and Regulation Maximum Limit are automatically gathered.
- For External Asynchronous Resources, the as-offered Economic Maximum Limit for imports into MISO and as-offered Economic Minimum Limit for exports out of MISO is automatically gathered.

For more information regarding the implications of Notification Deadline information, please see the BPM for *Market Settlements.*

8.1.2 Submitting Real-Time Resource Offers

In the Real-Time Energy and Operating Reserve Market, Resource Offers can be submitted that differ from the Day-Ahead Resource Offers. An MP with Resources that are scheduled in the Day-Ahead Energy and Operating Reserve Market or committed in the RAC process must promptly notify MISO's Real-Time Operators of any changes to the availability or operating plan of its

Resource(s) for the Operating Day but no later than 30 minutes after the changes have occurred. MPs with Generation Resources can modify Energy Offers for the capacity that has not yet been dispatched, but is available during the Operating Day.

Resources within the Market Footprint can participate in the Real-Time Energy and Operating Reserve Market by submitting Resource Offers provided they can respond to 5-minute Dispatch Setpoint Instructions. These Resources are termed "dispatchable". A Resource that is considered dispatchable but does not consistently follow Setpoint Instructions may be reclassified as non-dispatchable. Such considerations are made on a case-by-case basis considering severity, number of occurrences, and reasons for deviations from Setpoint Instructions.

All other Resources (not able to respond to a 5-minute dispatch signal) except DRRs-Type I must Self-Schedule their Resource output.

8.1.2.1 Real-Time Resource Offer Rules

Resource Offers may be submitted in the Real-Time Energy and Operating Reserve Markets only at the registered location of that Resource. These Offers must be submitted at least 30 minutes prior to the Operating Hour[65].

- For Generation Resources and DRRs-Type II, the non-price related Offer parameters must reflect the actual known physical capabilities and characteristics of the Resource except that the Hourly Emergency Maximum Limit, Hourly Economic Maximum Limit, or Forecast Maximum Limit may, at the discretion of the MP, be reduced by an amount equal to any Capacity associated with the Resource that is i) not designated as a Capacity Resource, ii) not being used to provide Energy and/or Operating Reserve to the Day-Ahead Energy and Operating Reserve Market, iii) not being used to provide Capacity in any RAC process, iv) not being used to provide Energy and/or Operating Reserve or other reserve products to the Real-Time Energy and Operating Reserve Market and v) not being used to provide Energy and/or Operating Reserve to any other party or entity.
- An MP whose Resources are scheduled in the Day-Ahead Energy and Operating Reserve Market, committed in the RAC process, and/or have offered into the Real-Time Energy and Operating Reserve Market must promptly notify MISO's Real-Time

[65] The DIR Forecast Maximum Limit is not subject to this requirement

Operators of any changes to the availability of its Resource(s) as soon as possible, but no later than 30 minutes after the changes have occurred.

- If a change has occurred that affects the Resource later in the day (e.g., loss of a coal mill that results in a derating from the Hourly Economic Maximum Limit of the unit) but that does not immediately affect the unit, the MP must update their Real-Time Schedule Offer to reflect the change in unit conditions. These changes can be submitted up to 30 minutes prior to the hour for a new or existing Real-Time Schedule Offer or 30 minutes prior to the hour for an existing Real-Time Schedule Offer.
- If the change in conditions affects Resource operations within the next 30 minutes, the MP must notify MISO's Real-Time Operators of the change by voice communications or by submitting a Real-Time Offer Override request via the Market Portal. MPs are urged to use Portal submitted override requests rather than voice requests. Override requests submitted via the portal are subject to same rules as real time offers (e.g., Emergency Max > Economic Max > Regulation Max etc.). Override requests must be submitted in complete sets and should be accompanied by a valid reason. Override requests can be accompanied with a reason "Other" along with a free form text description. Override requests are organized into eight sets as listed in the table below. Real-Time Offer Override requests submitted via the Market Portal are effective for the current hour and expire at the end of the next market hour to allow the Market Participants sufficient time to update their hourly offers. Portal submitted override requests are organized in sets. In general, a complete set must be submitted with an override request for a particular parameter. Sets are listed in Exhibit 8-2below.

Exhibit 8-2: Offer Override Sets

Set	Gen/DRR2 Override Parameters	SER Parameters	DRR1 Parameters	EAR Override Parameters
Run Times	Notification Time		Notification Time	Notification Time
Operating Limits	Economic Min, Eco Max, Regulation Min, Reg Max, Emergency Min, Emer Max	Reg Min, Reg Max	Target Demand Reduction MW	Economic Min, Eco Max, Regulation Min, Reg Max, Emergency Min, Emer Max
Offline Response	OfflineRespMax OfflineSTRMax			OfflineRespMax
Ramp Rates	RR Up, RR Down, Reg RR (bi-directional)	Ramp Rate Bidirectional		RR Up, RR Down, Reg RR (bi-directional)
Self Schedules	SelfMWEnergy, SelfMWSpin, SelfMWOnlineSupp, SelfMWReg, SelfMWOfflineSupp	SelfMWReg	SelfMWSpin, SelfMWOnlineSupp	SelfMWEnergy, SelfMWSpin, SelfMWOnlineSupp, SelfMWReg,
Dispatch Status	Energy Dispatch Status, Reg Status, Spinning Reserve Status, Online Supp Status, Offline Supp Status, Ramp Capability Status Online STR Dispatch Status Offline STR Dispatch Status	Reg Status	Online Supp Status, Spin Status Offline STR Dispatch Status	Energy Dispatch Status, Reg Status, Spinning Reserve Status, Online Supp Status, Ramp Capability Status Online STR Dispatch Status

Commit Status	Energy Commit Status	Commit Status	Energy Commit Status	Energy Commit Status
Off Control, EEE Flag	OffControlFlag, EEE Flag	OffControlFlag, EEE Flag	OffControlFlag, EEE Flag	OffControlFlag, EEE Flag
Fast Ramp	Fast Ramp Resource Flag	Fast Ramp Resource Flag	Fast Ramp Resource Flag	Fast Ramp Resource Flag

Set	ESR Override Parameters
Run Times	Notification Time
ESR Operating Limits	Minimum and Maximum Discharge Limit, Minimum and Maximum Charge Limit, Minimum and Maximum Regulation Discharge Limit, Minimum and Maximum Regulation Charge Limit, Minimum and Maximum Emergency Discharge Limit, Minimum and Maximum Emergency Charge Limit
Offline Response	OfflineRespMax
ESR Ramp Rates	Charge Ramp Rate and Discharge Ramp Rate for ESR
Self Schedules	SelfMWEnergy, SelfMWSpin, SelfMWOnlineSupp, SelfMWReg, SelfMWOfflineSupp
Dispatch Status	Energy Dispatch Status, Reg Status, Spinning Reserve Status, Online Supp Status, Offline Supp Status, Ramp Capability Status Online STR Dispatch Status
ESR Commitment Status	Charge, Discharge, Continuous , Available , Not Participating ,Outage , Emergency Charge, Emergency Discharge
ESR Storage Level	Minimum Energy Storage Level, Maximum Energy Storage Level, Emergency Minimum Energy Storage Level, Emergency Maximum Energy Storage Level
Off Control, EEE Flag	OffControlFlag, EEE Flag

Fast Ramp	Fast Ramp Resource Flag

- To commit a Generation Resource or DRR-Type II in the Real-Time Energy and Operating Reserve Market that does not have a current commitment or is outside of its Day-Ahead Energy and Operating Reserve Market schedule, the MP must submit the status of "Must-Run" for the desired run period. Any Resource that operates without a commitment from the Day-Ahead or Real-Time Energy and Operating Reserve Markets will be considered to be "Must-Run" during the period of time for which no commitment is present. An Electric Storage Resource must provide an ESR Commitment Status for each market interval.
- To decommit a Generation Resource or DRR-Type II in the Real-Time Energy and Operating Reserve Market that is not scheduled in the Day-Ahead Energy and Operating Reserve Market or the RAC, the MP must submit a status update of "Unavailable" or notify MISO's Real-Time Operators if the Real-Time Energy and Operating Reserve Market is closed for that hour or submit the override request for the commit status via Market Portal if the Real-Time Energy and Operating Reserve Market is closed for that hour.

If a Resource is scheduled in the Day-Ahead Energy and Operating Reserve Market or the RAC and wishes to deviate from that schedule (i.e., not run or run at a reduced output level) for economic reasons, the MP must contact MISO's Real-Time Operators to determine if this course of action is acceptable. MISO will determine one of the following:

- That the Resource is not needed for reliability purposes for the Operating Day; if so, then the Market Participant can decide not to run the Resource on an economic basis. The MP is still responsible for Settlement of the deviation between its Day-Ahead Schedule and Real-Time output.
- That the Resource is needed for reliability purposes and informs the MP that the Resource must remain committed to its schedule.

The guideline for notifying MISO of deviations for Generation Resources or DRRs-Type II is the sum of the unit's notification time plus the time to start. The minimum notification time is 90 minutes prior to the start time required for the operation of the Resource. This allows adequate time for determining if the unit is needed for reliability.

8.1.3 Submitting Real-Time Interchange Schedules

The following general rules apply to submitting any Interchange Schedules in the Real-Time Energy and Operating Reserve Market:

- All Interchange Schedules must begin on the top, quarter past, half, or quarter till the hour.
- MPs must submit all Interchange Schedules for the Real-Time Energy and Operating Reserve Market, via NERC E-Tag, at least 20 minutes prior to the start of the Interchange Schedule; however, Interchange Schedules may not be submitted during the operating hour except for reliability purposes as determined by MISO. MISO confirms the validated and compliant Interchange Schedule requests with appropriate external BAs.
- Real-time PSE adjustments to Interchange Schedules must also be submitted no later than 20 minutes before the start of the schedule change or the start of the operating hour. Adjustments due to Transmission Loading Relief Procedures ("TLRs") or loss of generation will be permitted after this timeframe as specified by MISO.

8.2 MISO Activities

The Real-Time Energy and Operating Reserve Market provides a continuous process for least cost balancing of supply and demand while recognizing current operating conditions. MISO uses a Network Model to accurately dispatch Resources to match the short-term demand forecast, Operating Reserve, and other reserve product requirements and manage congestion in Real-Time.

The Real-Time Energy and Operating Reserve Market clearing produces Resource Dispatch Targets for Energy, Regulating Reserve, Spinning Reserve and Supplemental Reserve and provides Ex Ante Real-Time LMPs for injections and withdrawals within MISO's Market Footprint and Ex Ante Real-Time MCPs for cleared Operating Reserve. MISO uses a Real-Time Security-Constrained Economic Dispatch ("SCED") algorithm to balance injections and withdrawals, meet Operating Reserve requirements, manage congestion, and produce LMPs and MCPs on a simultaneously co-optimized basis. The Real-Time Energy and Operating Reserve Market clearing operates continuously on a five-minute basis. The SCED runs every five minutes to develop Resource Dispatch Targets for the end of the next dispatch interval.

The objective of the security-constrained economic dispatch will be to minimize total costs for the dispatch interval while simultaneously enforcing physical constraints and reliability requirements. Total costs to be minimized include energy costs, reserve availability costs and reserve scarcity costs.

8.2.1 Checkout of Interchange Schedules

All MISO-adjacent external Balancing Authorities that are parties to Interchange Schedules with MISO are contacted and NSI is confirmed. Individual Interchange Schedules are not verified unless necessary to resolve any discrepancy.

Verification starts prior to the Operating Hour and is only performed if the NSI has not already been verified at a previous time.

See the BPM for *Physical Scheduling* for a detailed description of Checkouts (BPM-007*)*.

8.2.2 Operating Reserve Requirements

The Market-wide and Co-Optimized Zonal Regulating Reserve, Contingency Reserve, and other reserve product requirements for the Real-Time Energy and Operating Reserve Market will generally be the same as those requirements developed for use in the Day-Ahead Energy and Operating Reserve Market. MISO may increase these requirements if necessary to address system condition changes following the clearing of the Day-Ahead Energy and Operating Reserve Market and/or Emergency conditions in Real-Time.

8.2.3 Real-Time Energy and Operating Reserve Market Clearing

MISO clears the Real-Time Energy and Operating Reserve Market by determining the security-constrained dispatch that is the least costly means of balancing generation and Load (supply/demand) while meeting Operating Reserve and other reserve product requirements within the Market Footprint based on actual conditions, forecasted conditions, and on submitted Offers. The inputs to the SCED are identified and described below:

- ***Load Forecast*** – MISO forecasts Real-Time demand for use in the Real-Time Energy and Operating Reserve Market. The forecast is distributed to individual Load Buses using the most recent State Estimator results.
- ***Network Model*** – The Real-Time Energy and Operating Reserve Markets Network Model is populated with the most recent State Estimator results before starting the Real-Time Energy and Operating Reserve Market clearing process. This includes the current on-line status and output of Generation Resources, DRRs-Type II, Stored Energy Resources and External Asynchronous Resources. In addition, the current set of active constraints is obtained from the Constraint Logger (CLOGGER).

- ***Interchange Schedules*** – The expected values of Interchange Schedules for the following five-minute period, including any Transmission Loading Relief ("TLR"), are obtained from the webTrans.
- ***Resource Status –*** The Resource Status consists of a Regulation Flag and an Off-Control Flag. If the Off-Control Flag is set, the Resource is treated as having a fixed dispatch equal to the output from the most recent State Estimator result (or with fixed dispatch at zero output, if a SER). If the Off-Control Flag is not set and the Regulation Flag is set, the Resource is considered to be scheduled to potentially provide Regulating Reserve. Otherwise, the Resource will be considered to be a "Load Following" Resource. The ICCP-telemetered Resource Control-Mode is not an input to the SCED algorithm.
- ***Resource Information*** – The Real-Time Energy and Operating Reserve Market clears based upon the Generation Resource, DRR-Type-I, DRR-Type-II, Stored Energy Resource and External Asynchronous Resource Offers received 30 minutes prior to the operating hour for the next five-minute period. For Regulating Reserve, only Offers associated with Resources that have been scheduled to potentially provide Regulating Reserve are considered.
- ***SER - Specific Information*** – The ICCP-telemetered Energy Storage Level for each Stored Energy Resource is used, along with Stored Energy Resource Offers, to pre-determine the Energy Dispatch Target for the Stored Energy Resource in such a way as to maximize the Regulating Reserve capability available to the SCED co-optimization. For more information on the methodology for determining the Energy Dispatch Target pre-processing for Stored Energy Resources, see Attachment D of this BPM.

MISO economically dispatches, subject to ramp rate and other Resource constraints, Generation Resources, DRRs -Type II, Stored Energy Resources and External Asynchronous Resources that effectively meet forecast Load, Operating Reserve and other reserve product requirements, and Interchange Schedules, subject to activated network constraints. The objective of the SCED algorithm is to minimize the as-offered Energy, Operating Reserve and other reserve product prices of Real-Time Energy, Operating Reserve and other reserve product procurement over the next dispatch interval, on a simultaneously co-optimized basis, subject to network constraints and Resource operating constraints, with the exception that Stored Energy Resource energy dispatch is not a component of this objective. Dispatch Target information is communicated directly to

Generation Resources, Stored Energy Resources, External Asynchronous Resources, and DRRs Type-II via Setpoint Instructions.

The rules applying to the Real-Time Energy and Operating Reserve Market clearing of Energy, Regulating Reserve, Contingency Reserve and other reserves on specific Resources are as follows:

- If a Resource has been scheduled to potentially provide Regulating Reserve the cleared sum of Energy, Regulating Reserve, Contingency Reserve, and Ramp Capability is constrained by the Hourly Regulation Maximum Limit.
- If a Resource has been scheduled to potentially provide Regulating Reserve, the cleared sum of Energy, Regulating Reserve, and Short-Term Reserve is constrained by the Hourly Regulation Maximum Limit.
- If a Resource has been scheduled to potentially provide Regulating Reserve, the cleared quantity of Energy less Regulating Reserve less Down Ramp Capability is constrained by the Hourly Regulation Minimum Limit.
- If a Resource has not been scheduled to potentially provide Regulating Reserve, the cleared sum of Energy, Contingency Reserve, and Up Ramp Capability is constrained by the Hourly Economic Maximum Limit.
- If a Resource has not been scheduled to potentially provide Regulating Reserve, the cleared sum of Energy, and Short-Term Reserve is constrained by the Hourly Economic Maximum Limit.
- If a Resource has not been scheduled to potentially provide Regulating Reserve, Energy less Down Ramp Capability is constrained by the Hourly Economic Minimum Limit.
- The cleared Energy is constrained by the applicable ramp rates.
- The cleared Regulating Reserve is constrained by the applicable ramp rates.
- The cleared Contingency Reserve is constrained by the applicable ramp rates.
- The cleared Short-Term Reserve is constrained by the applicable ramp rates.
- The amount of Regulating Reserve that may clear on a Resource is limited to a configurable percentage of the Market-Wide Regulating Reserve Requirement. This limit is required to ensure reliable dispersion of Regulating Reserve and may be modified by MISO based upon observed historical Regulating Reserve dispersion. To the extent that this limit causes Regulating Reserve Scarcity, clearing above this amount on a single Resource will be allowed.

- The amount of Contingency Reserve that may clear on a Resource is limited to a configurable percentage of the Market-Wide Contingency Reserve Requirement. This limit is required to ensure reliable dispersion of Contingency Reserve and may be modified by MISO based upon observed historical Contingency Reserve dispersion. To the extent that this limit causes Operating Reserve Scarcity, clearing above this amount on a single Resource will be allowed.
- The amount of Ramp Capability that may clear on a Resource is limited to a configurable percentage of the Market-Wide Ramp Capability Requirement. This limit is required to ensure reliable dispersion of Contingency Reserve and may be modified by MISO based upon observed historical Contingency Reserve dispersion. To the extent that this limit causes Operating Reserve Scarcity, clearing above this amount on a single Resource will be allowed.
- The amount of Short-Term Reserve that may clear on a Resource is limited to a configurable percentage of the Market-Wide Short-Term Reserve Requirement. This limit is required to ensure reliable dispersion of Short-Term Reserve and may be modified by MISO based upon observed historical Short-Term Reserve dispersion. To the extent that this limit causes Operating Reserve Scarcity, clearing above this amount on a single Resource will be allowed.

The SCED program produces the following outputs:

- ***Dispatch Targets*** – The Real-Time Energy and Operating Reserve Market clearing process develops the Dispatch Targets for Energy, Regulating Reserve, Spinning Reserve and On-Line Supplemental Reserve (if applicable), Ramp Capability Product and On-Line Short-Term Reserves for each offered Generation Resource, DRR-Type II and External Asynchronous Resource, Dispatch Targets for Energy, Spinning Reserve or Supplemental Reserve and Off-Line Short-Term Reserve for each offered DRR-Type I, and Dispatch Targets for Energy and Regulating Reserve (if applicable) for each offered Stored Energy Resource for the five-minute period. MISO communicates the desired Energy, Regulating Reserve, Spinning Reserve and/or On-Line Supplemental Reserve deployment to each Resource selected via Setpoint Instructions approximately every four seconds and communicates the Dispatch Targets for Energy, Regulating Reserve, Spinning Reserve, On-Line Supplemental Reserve (if applicable), offline Supplemental Reserve (DRR-Type I), Ramp Capability Product and Short-Term Reserve to each applicable Resource on a five-minute basis.

Deviation from Setpoint Instructions may result in Excessive/Deficient Energy Deployment Charges, Contingency Reserve Deployment Failure Charges and/or Real-Time RSG Charges. MISO communicates Dispatch Targets (via Backup Dispatch Notification and ICCP) and Setpoint Instructions (via ICCP) to the MP responsible for scheduling and dispatching the Resource. All MPs responsible for responding to Setpoint Instructions must have the ability to receive electronic Dispatch Targets and Setpoint Instructions from MISO. MISO also sends Dispatch Target Notifications and Start/Stop Notifications, via Market User Interface API, to the Local Balancing Authority of each Resource. The Dispatch Targets for Energy are for the end of the five-minute period. All Generation Resources and DRRs-Type II that are on-line and External Asynchronous Resources and Stored Energy Resources that are available receive a Setpoint Instruction, regardless of whether they have submitted Self-Schedules and/or Offers.

- ***Ex-Ante LMPs*** – The Real-Time Energy and Operating Reserve Market clearing process also develops ex-ante LMPs for the five-minute period. These values are posted and are developed for informational purposes only.
- ***Ex-Ante MCPs*** – The Real-Time Energy and Operating Reserve Market clearing process also develops ex-ante MCPs for SER-based and generation based Regulating Reserve, demand-based and generation-based Spinning Reserve, demand-based and generation-based Supplemental Reserve, Ramp Capability Product and Short-Term Reserve on a Reserve Zone and Market-Wide basis for the five-minute period. These values are posted and are developed for informational purposes only.

The SCED-Pricing program produces the following outputs:

- ***Real-Time Ex Post LMPs*** – The Real-Time Energy and Operating Reserve Market clearing process also develops Real-Time Ex-Post LMPs for the five-minute period. These values are posted and developed utilizing the SCED-Pricing algorithm which includes the Extended LMP formation. The Real-Time Ex-Post formulation allows Fast Start Resources, Emergency Operations Resources, Emergency Demand Response, Load Modifying Resources, Emergency Energy purchases as well as Emergency Resources and Emergency ranges to set prices. The Real-Time Ex-Post LMPs are used by MISO to settle the Real Time Energy and Operating Reserve Market.

- ***Real-Time Ex Post MCPs*** – The Real-Time Energy and Operating Reserve Market clearing process also develops Real-Time Ex-Post MCPs for SER-based and generation based Regulating Reserve, demand-based and generation-based Spinning Reserve. demand-based and generation-based Supplemental Reserve, Ramp Capability Product and Short-Term Reserve on a Reserve Zone and Market-Wide basis for the five-minute period. The Real-Time Ex-Post MCPs are used by MISO to settle the Real Time energy and Operating Market.

Real-time ex post and ex ante prices are expected to be identical majority of the time but could differ. There are specific circumstances that could result in Real-time ex ante and ex post price differences. Typically, Real-Time Ex Post LMPs will be higher than Real-Time Ex Ante LMPs when online Fast Start Resources or Emergency Operations Resources are available to set real-time ex post prices. Because the online Fast Start Resource's or Emergency Operations Resource's no load and start up portion of the Offer is included in the price setting, the Real-Time Ex-Post LMPs could be higher compared to the Real-Time Ex Ante LMPs. On the other hand, Real-Time Ex Post LMPs can be lower when there is transmission scarcity or Operating Reserve scarcity in the ex-ante phase. In the latter case, Real-Time Ex Post LMPs can be lower due to the availability of Offline Fast Start Resources that are eligible to participate in price setting in Real-Time Ex Post LMP calculation and could result in the alleviation of the scarcity conditions,

The Real-Time Energy and Operating Reserve Market utilizes the same Network Model that is used in the Day-Ahead Energy and Operating Reserve Market, with all real-time network configurations and constraints as determined from the most recent State Estimator results.

8.2.3.1 Clearing Under Shortage Conditions

8.2.3.1.1 Real-Time Ex Ante

The Ex Ante SCED algorithm will utilize MP Offers for all Resource Capacity used in the RAC process immediately preceding the real-time operating Hour, including selected Hourly Emergency Maximum Limit segments, Emergency-only Resources and Emergency Energy purchases, in clearing the Real-Time Energy and Operating Reserve Market for each Dispatch Interval. If there is an actual Operating Reserve shortage during any Dispatch Interval, the Ex Ante MCPs for Operating Reserve and other reserve products will reflect Scarcity Prices set by the Demand Curves based upon the level of the shortage. As a last resort, if there is a shortage

of available Capacity to meet demand requirements within the Operating Hour, MISO will issue an EEA Level 3 and begin Load Shedding procedures as described in the Tariff, and all Real-Time Ex Ante LMPs and Ex Ante MCPs will be set at the VOLL.

8.2.3.1.2 Real-Time Ex Post

The Ex-Post SCED-Pricing Algorithm will additionally utilize a Proxy Offer for all Emergency-Only Resources, External Resources qualified as Planning Resources, Emergency range of available on-line Resources, Emergency Energy Purchases, Load Modifying Resources, and Emergency Demand Response resources dispatched in the Real-Time Market. The Proxy Offer is described in section 5.2.3 (Market Clearing under Emergency Shortage Conditions) of this BPM.

8.2.3.2 Clearing Under Surplus Conditions

Within the real-time operating Hour, the SCED algorithm will utilize MP Offers for all Resource Capacity used in the RAC process immediately preceding the real-time operating Hour, including selected Hourly Emergency Minimum Limit segments, in clearing the Real-Time Energy and Operating Reserve Market for each Dispatch Interval. If use of Hourly Emergency Minimum Limits creates a Regulating Reserve shortage during any Dispatch Interval, the Ex Ante MCPs for Regulating Reserve will reflect Scarcity Prices and Ex Ante LMPs will reflect negative Scarcity Prices as set by the Regulating Reserve Demand Curve.

8.2.4 Regulating Reserve Deployment

Regulating Reserve Deployment in the up or down direction is limited to Resources that have cleared Regulating Reserve. The set of Resources available to regulate during a Dispatch Interval is limited to the set of Resources that cleared Regulating Reserve during the Dispatch Interval and that submit an ICCP-telemetered Control Mode equal to 2, and the amount of Regulating Reserve that can be deployed on these Resources during the Dispatch Interval is limited to the amount of Regulating Reserve that cleared on these Resources during the Dispatch Interval. The AGC system deploys Regulating Reserve with both a regular Regulating Reserve Deployment signal and a fast Regulating Reserve Deployment signal to meet the system balancing needs.

8.2.4.1 Regulating Reserve Deployment on non-Fast Ramping Resources

Resources which have cleared Regulating Reserve and do not meet Fast Ramping Resource criteria, will receive the regular Regulating Reserve Deployment signal to address the system

balancing needs. Regulating Reserve is deployed on specific non-fast ramping Resources via Setpoint Instructions via the AGC system on a graduated pro-rata basis, based on the ramp available to each Resource providing Regulating Reserve; that is, the ramp rate of each Resource over five minutes less the change in Dispatch Target for that Resource during the Dispatch Interval. Resources are allocated into five groups, with Group 1 containing the Resources with the greatest ramp available and Group 5 containing the set of Resources with the least Ramp Available. Resources in Group 1 will be deployed on a pro-rata basis first, and Resources in Group 5 will be deployed on a pro-rata basis last. Resource undeployments occur in reverse order.

A Resource that has Control Mode equal to 1 or 2 but does not consistently follow Setpoint Instructions may be reclassified as Control Mode equal to 3, Off Control, per Section 3.13 of RTO-OP-010-r20 Generator Operator Communication with MISO including EEE Procedure. Such considerations are made, including input from the Market Participant, on a case-by-case basis considering severity, number of occurrences, and reasons for deviations from Setpoint Instructions.

Exhibit 8-3 shows the various ICCP-telemetered Resource Control Modes that may be selected by Market Participants and the corresponding AGC system treatment.

Exhibit 8-3: AGC System Resource Control Modes

Resource Control Mode	MISO AGC System Treatment
0	Offline (indicates Resource is NOT available to the market)
1	Online, NOT capable of Regulating (indicates Resource is available for Dispatch Target for Energy and/or Contingency Reserve deployment)
2	Online, capable of Regulating (indicates Resource is available for Regulating Reserve Deployment, Dispatch Target for Energy, and/or Contingency Reserve deployment)
3	Off Control (indicates Resource is online but off control) – Setpoint Instruction is an echo of the current MW reading)

For example, assume 20 Resources each cleared 30 MW of Regulating Reserve. Assume the change in the Energy Dispatch Target for 3 Resources is 0 MW, for 5 Resources is + 10 MW, and for the remaining 12 Resources is +15 MW. There will be five groups, each containing four Resources: Group 1 will contain the three Resources with a change in Energy Dispatch Target of 0 MW and one Resource with a change in Energy Dispatch Target of 10 MW; Group 2 will contain the remaining four Resources with a change in Energy Dispatch Target of 10 MW; and Groups 3, 4 and 5 will each contain four Resources with a change in Energy Dispatch Target of 15 MW. Assume the AGC system requires a system-wide regulation deployment of 120 MW in the upward direction. The AGC system would deploy + 30 MW on each of the four Resources in Group 1. No Regulating Reserve would be deployed from the remaining Groups, but should the system-wide regulation deployment signal increase, Regulating Reserve could be deployed on the other Resources within the remaining Groups as well.

8.2.4.2 Regulating Reserve Deployment on Fast Ramping Resources

Resources which have cleared Regulating Reserve and meet Fast Ramping Resource criteria, will receive fast Regulating Reserve Deployment signals to address the fast-changing system balancing needs. As defined in the Tariff, a Fast Ramping Resource is a Generation Resource that: (1) meets the qualification criteria of having a: (i) ramp rate greater than eighty (80) MW per minute; (ii) Fast Ramping Resource Performance Score that meets or exceeds the Fast Ramping

Resource Performance Threshold when responding to regulation signals in Fast Ramping Resource Performance Tests; and (iii) duration greater than 20 minutes or more for Use Limited Resources; and (2) as such, will receive a fast changing regulation signal for a market interval for which it has been offered.

In order to help energy limited Fast Ramping Resources to stay in a neutral position with respect to their State of Charge, a dynamic priority ranking and distribution factors via the AGC system are calculated for Fast Ramping Resources in each AGC cycle. The dynamic priority calculated for the Fast Ramping Resources is grouped into 5 priority groups, Groups 1 to 5, as shown in Exhibit 8-4:

Exhibit 8-4: Fast Ramping Resource Regulating Reserve Deployment Priority Group

State of Charge	Desired MW (Energy)	Priority Group	
		Reg Deployment < 0	Reg Deployment > 0
SOC below Neutral Zone	Base Point >= 0	1	5
SOC below Neutral Zone	Base Point < 0	2	4
SOC in Neutral Zone / **Non-Stored resources**		3	3
SOC above Neutral Zone	Base Point >= 0	4	2
SOC above Neutral Zone	Base Point < 0	5	1

- Priority Group 1 & 5: The Fast Ramping Resources that have States of Charge below their Hourly Neutral Zone Lower Limit (row 1) and are currently providing positive Regulating Reserves (that is, moving further away from their Hourly Neutral Zone Lower Limit), will have priority 1 if the current cycle need is to reduce positive Regulating Reserves deployment; and will have priority 5 if the current cycle need is to increase positive Regulating Reserves deployment. Similarly, the Fast Ramping Resources that

have States of Charge above their Hourly Neutral Zone Upper Limit (row 5) and are currently providing negative Regulating Reserves (that is, moving further away from their Hourly Neutral Zone Upper Limit), will have priority 5 if the current cycle need is to reduce negative Regulating Reserves, and will have priority 1 if the current cycle need is to increase negative Regulating Reserves deployment.

- Priority Group 2 & 4: The Fast Ramping Resources that have States of Charge below their Hourly Neutral Zone Lower Limit (row 2) and are currently providing negative Regulating Reserves (that is, moving towards their Hourly Neutral Zone Lower Limit), will have priority 2 if the current cycle need is to increase negative Regulating Reserves deployment; and will have priority 4 if the current cycle need is to reduce negative Regulating Reserves deployment. Similarly, the Fast Ramping Resources that have States of Charge above their Hourly Neutral Zone Upper Limit (row 4) and are currently providing positive Regulating Reserves (that is, moving towards the Hourly Neutral Zone Upper Limit), will have priority 4 if the current cycle need is to reduce positive Regulating Reserves deployment; and will have priority 2 if the current cycle need is to increase positive Regulating Reserves deployment.
- Priority Group 3: The Fast Ramping Resources that do not have any energy duration limitation or the Stored Energy Resources which are within the neutral zone limits will be assigned to the priority group 3 (row 3).

Further, within each priority group a distribution factor is calculated for each Fast Ramping Resource based on the current State of Charge and the distance from the Hourly Neutral Zone Upper/Lower Limits. The Regulating Reserve MW amount distributed using this distribution factor will help the Fast Ramping Resource to get back to, or slow down the movement further away from, the Hourly Neutral Zone Upper/Lower Limits

8.2.4.3 Performance Test on Resource offered as Fast Ramping Resources

In all Dispatch Intervals during each Hour, MISO will conduct performance tests on every Regulating Reserve Qualified Resource which is offered in the Real-Time Energy and Operating Reserve Market ("Real-Time Market") as a Fast Ramping Resource for the particular Hour. At the beginning of each Hour, the Resource will be assigned an initial score that is the higher of the Fast Ramping Resource Historical Performance Score reached at the end of the preceding hourly interval and the Fast Ramping Resource Performance Threshold (which is 70%). Within each

Hour, at the end of each UDS Dispatch Interval, the initial performance score will be adjusted by calculating the ratio of the Resource's Fast Ramping Resource Passed 4-second AGC Intervals to its Fast Ramping Resource Valid 4-second AGC Intervals. If the adjusted score falls below the Fast Ramping Resource Performance Threshold, then for the next UDS Dispatch Interval the Resource is placed in the pool of normal Regulation Qualified Resources, and will not receive a fast Regulating Reserve Deployment signal in the subsequent Dispatch Intervals within that Hour. If the adjusted performance score meets or exceeds the Fast Ramping Resource Performance Threshold, the Resource will regain its qualification to receive, and will start receiving, fast Regulating Reserve Deployment signals again, in the next Dispatch Interval. At the end of each Hour, the hourly performance metrics will be rolled into a historical score, which will be used for the new Dispatch Intervals that start at the top of the next Hour.

The adjusted performance score is calculated as follows:

Initial Score = max (Fast Ramping Resource Historical Performance Score, Fast Ramping Resource Performance Threshold)
Passed ratio = sum $_{\text{of each dispatch interval}}$ (Fast Ramping Resource Passed Intervals) / sum $_{\text{of each dispatch interval}}$ (Fast Ramping Resource Valid Intervals)
factor = Initial Score / Fast Ramping Resource Performance Threshold
Adjusted Score = min (Initial Score, passed ratio * factor * 100)

A 4-second AGC interval when a regulation signal is sent to a Regulation Qualified Resource shall be considered a valid interval for testing the Resource's response, if the AGC system is sending Setpoint Instructions to the Resource that changes by 0.1 MW in comparison to the previous Setpoint Instruction sent to the same Resource.

The response of a Regulation Qualified Resource is considered sufficient for it to be considered a Fast Ramping Resource if for a Fast Ramping Resource Valid Interval the delay adjusted MW response of the Resource for the Setpoint Instruction is within a desired tolerance of +/- 0.25MW if the delta change is 0.8 MW or less and +/- 30% if the delta MW change is greater than 0.8 MW.

8.2.5 Ensuring Bulk Electric System Reliability

The MISO Reliability Coordinator has ultimate responsibility for the reliability of MISO's Reliability Coordination footprint. As such, the RC must have the authority to take the actions deemed necessary to ensure a reliable system. MISO develops congestion management procedures in conjunction with its stakeholder groups that give the Reliability Coordinator guidance on appropriate mitigation strategies and actions available. These procedures may indicate a

preferred order of mitigating actions while recognizing the Reliability Coordinator has the authority to take the actions in the order deemed necessary to protect the Bulk Electric System. The available mitigation options may include, but are not limited to:

- Implementation of Operating Guides
- System Reconfiguration
- Security Constrained Economic Dispatch
- Use of TLR
- Curtailment of Intermittent Resources
- Commitment/Decommitment of Resources
- Manual Dispatch of Resources
- Declaration of System or Local Emergencies and implementation of Emergency Procedures

8.2.6 Congestion Management and Transmission Constraint Demand Curves

In order to solve the Security Constrained Economic Dispatch, each Transmission Constraint must have a marginal value limit (or MVL, also known as shadow price limit), expressed in $/MW, assigned to it. The MVL is the maximum marginal benefit that the SCED will consider when evaluating resource dispatches to meet the constraint. During any Dispatch Interval in which a transmission constraint cannot be managed within its limit, the marginal value (also known as the shadow price) of the constraint will be set to the MVL for the constraint. The following procedure is used to determine MVLs. For a more in-depth understanding of how MVLsare used in the co-optimization, please see Attachment A to this BPM, which provides an overview on optimization problems and constraint formulation.

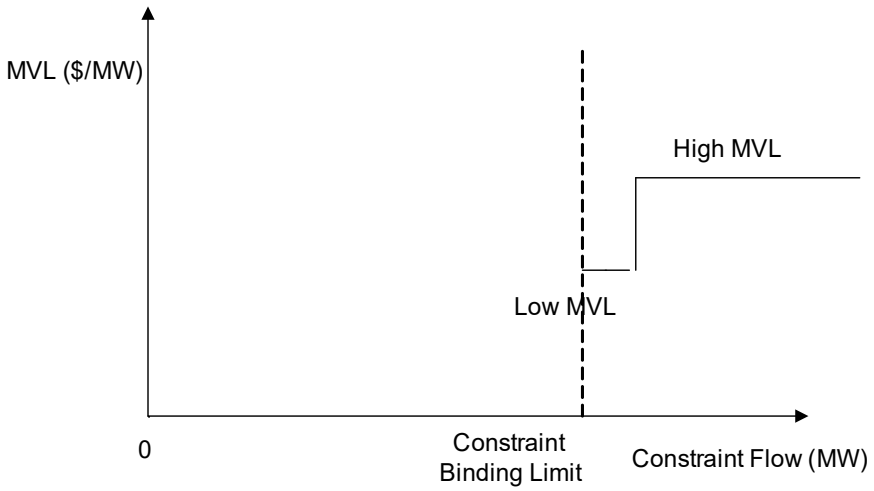
MISO utilizes Transmission Constraint Demand Curves (“TCDC”) in both the Day-Ahead and Real-Time Energy and Operating Reserve Markets to determine the MVL of each transmission constraint. The TCDC assigns a $/MW MVL according to the quantity flow across the constraint. The TCDC in use for each binding constraint will be published for each Dispatch Interval in Real-Time, regardless of what type of TCDC is used for that constraint.

8.2.6.1 TCDC Development

In the MISO Real-Time and Day-Ahead market, each MISO transmission constraint is assigned a TCDC which includes two pairs of Marginal Value Limits (in $/MW) and constraint flow (in MW

or percentage of binding limit). The two block MVLs may be equal as in the case of IROLs. The TCDC is utilized to determine the MVL(s) that is used for commitment and dispatch of Resources.

Exhibit 8-5: Example of Transmission Constraint Demand Curve



There are three methods that MISO utilizes to assign a transmission constraint to a TCDC and determine the associated MVL.

- Group 1
- Group 2
- Temporary Override

Detailed TCDCs for Group 1 and 2 are available in Tariff Schedule 28A.

8.2.6.2 Assign Transmission Constraints with Group 1 TCDCs

MISO assigns a TCDC to each transmission Constraint based on its voltage level or impact (e.g., IROL). Most constraints will be assigned to default TCDC based on voltage level, TLR or IROL status. For simplicity, a two-step TCDC is currently used. The lower portion of the TCDC is used for flows just at or exceeding limits up to the higher block breakpoint. The higher TCDC will be used for larger exceedances of the transmission constraint limit.

8.2.6.3 Assign Transmission constraints with Group 2 TCDCs

There are a small number of constraints that do not respond well to Group 1 TCDCs. These constraints may be impacted by broad regional flows or may need different MVLs to achieve control. An example of this type of exception is a transmission constraint that is highly impacted by wind generation such that increasing wind output adversely impacts the constraint. Assuming a very low production cost, a very low LMP is necessary to provide incentive for downward dispatch to the wind Resource(s).

When an exception is identified that is not managed well to the Group 1 TCDCs, MISO will add this constraint to Group 2.

Updates to the contents of Group 2 will be posted within two business days after a transmission constraint has been assigned to or removed from Group 2. This posting will identify the monitored element and the assigned TCDC for each constraint in Group 2.

8.2.6.4 Assign Transmission constraints with TCDC Temporary Overrides

To maintain reliable operation, MISO operators can temporarily override the MVL associated with Group 1 or 2 TCDC based on operating conditions for particular constraints in both the Day-Ahead and Real-Time markets. The MVL is returned to the Group 1 or 2 TCDC value as soon as system conditions and congestion management no longer require an overridden MVL. There are various circumstances that require the MISO operator to temporarily override the default TCDC. Any Operator Overrides to a Group 1 or Group 2 TCDC will be posted within two business days.

If MISO identifies that a TCDC does not allow for reliable constraint management, MISO Real-Time Operations personnel will assess the current costs and capabilities (shift factors) of available resources that impact the transmission constraint, and identify appropriate modifications to the TCDC to capture the benefits of further economic re-dispatch, in order to maintain both the reliability of constrained transmission elements and the economic efficiency of the market. This assessment will determine the shape and magnitudes of an override TCDC that allows MISO to achieve the required relief for the transmission constraint. The magnitude of the required TCDC change can be impacted by, but is not limited to impact by, the following:

- Economic and Physical characteristics of resources that impact the constraint.
- Local and system-wide product pricing.

- Changing system conditions (current and projected flows across the constrained element as well as nearby transmission element).

The following examples demonstrate the situations that operators need to temporarily override TCDC for particular constraints.

8.2.6.4.1 Temporary Overrides-Increasing the MVL

If a system operating limit (SOL) condition is expected to persist and the condition raises reliability concerns, the MVL values of the TCDC may be raised to reflect the heightened reliability concerns and mitigate the condition. Conditions that may lead to MVL increases include, but are not limited to: conflicting constraints, and high system-wide LMPs. Conflicting constraints refers to system conditions where congestion management of one transmission constraint adversely impacts the reliable management of one or more other transmission constraints. High system-wide marginal energy costs may require an increase to the MVLs because resources with negative impacts on a constraint tend to be dispatched upward during periods in which the MEC is high. The adjustment in the TCDC for a particular constraint required for congestion management is dependent on a number of factors, including the relief required, the ramp rates and limits of impacting resources, associated sensitivities of resources, and the MEC.

8.2.6.4.2 Temporary Overrides-Lowering the MVL

It may also be necessary to lower the MVL values of a TCDC for a particular constraint from the default values. The most common reason for doing so is to avoid conflicting constraints. In other situations, temporary operating guides or other action plans, which rely on post-contingency action to avoid SOL events, may provide the basis for lowering the MVLs of a transmission constraint.

8.2.7 Sub-Regional Power Balance Constraint Curves

In order to manage dispatched intra-regional flows, all constraints relating to applicable seams agreements, coordination agreements or operating procedures (Sub-Regional Power Balance Constraints) have a Marginal Value Limit (or MVL, also known as shadow price limit) assigned to them. The MVL is the maximum marginal benefit that the SCED will consider when evaluating resource dispatches to meet the Sub-Regional Power Balance Constraint. For any Dispatch Interval where a Sub-Regional Power Balance Constraint cannot be managed within its limit, the Marginal Value (also known as shadow price) will be set to the Marginal Value Limit.

8.2.7.1 Sub-Regional Power Balance Constraint Curve Development

In both the MISO Real-Time and Day-Ahead markets, each Sub-Regional Power Balance Constraint is assigned a curve that includes predefined levels of exceedance percentages and their corresponding prices. The curve is utilized to determine the MVL(s) used for commitment and dispatch of Resources. The curve can be found in Schedule 28B of the Tariff.

8.2.7.2 Assign Sub-Regional Power Balance Constraints with Appropriate Sub-Regional Power Balance Constraint Curve

MISO uses a tiered system to control Sub-Regional Power Balance Constraints. When the dispatch flow rises over the predefined percentage of exceedance, the price rises proportionally to allow the SCED to exert additional control.

8.2.7.3 Temporary Overrides of Sub-Regional Power Balance Constraint Curve

When the dispatch flow is expected to be greater than the limit for two or more consecutive Dispatch Intervals, MISO may temporarily override the Sub-Regional Power Balance Constraint Curve to more effectively manage flows. Constraint exceedance will be returned to the limit as soon as MISO determines system conditions and/or reliability no longer need the override. For any period where MISO overrides a limit, MISO will make a public posting on its website with:

1) The circumstances in which the temporary override was executed,
2) The Dispatch Intervals the temporary overrides were in place,
3) The values applied during the temporary override, and

8.2.8 Excessive/Deficient Energy Deployment Charges

The Excessive/Deficient Energy Deployment Charge is an hourly charge that is applied to any Resource that has Excessive Energy and/or Deficient Energy in four or more consecutive Dispatch Intervals in the same clock hour. The Excessive/Deficient Energy Deployment Charge consists of two components: (1) the Excessive/Deficient Charge Rate multiplied by the Resource's Actual Energy Injection; and (2) a recapture of net Regulating Reserve credits paid to the Resource. The first portion of the charge applies equally to all applicable Resources for causing an increased Regulating Reserve burden. The second portion of the charge applies only to Resources with Dispatch Targets for Regulating Reserve and is equivalent to non-payment of any net credits for cleared Regulating Reserve for failure to provide the Regulation Service. If a MP has elected to use the Common Bus option, the output of Resources identified at the Common Bus location will be considered in aggregate for the purposes of determining whether or not an

Excessive/Deficient Energy Deployment Charge will apply, as described below. See the BPM for *Market Settlements* for additional details.

8.2.8.1 Excessive/Deficient Energy Deployment Charge Waiver

A MP is exempted from the Excessive/Deficient Energy Deployment Charge under certain conditions where the MP would otherwise be subject to the charge due to events beyond its control and without the fault or negligence of the MP. Such conditions include but are not limited to:

- Emergencies;
- A Resource in test mode;
- A Resource in start-up or shut-down mode;
- The Hour in which a Resource trips and goes offline;
- During a Contingency Reserve Deployment event, if the Resource has cleared Contingency Reserves; and/or
- Extremely high wind or other weather-related conditions materially impacting a Dispatchable Intermittent Resource's ability to provide Energy and resulting in a substantial reduction or cessation of wind generation activities.

A MP may request the Generation Balancing Authority Operator to waive the Excessive/Deficient Energy Deployment Charge for conditions other than those listed above, and the Generation Balancing Authority Operator shall grant such request subject to the Regional Generation Dispatcher's determination that the reason for the request is due to events beyond the MPs control that were not caused by the fault or negligence of the MP. A MP can also request to waive the Excessive/Deficient Energy Deployment Charge by submitting a real time override request via the Market Portal, stating valid reasons. Please see section 8.1.2 for details.

8.2.9 Contingency Reserve Deployment

Contingency Reserve procured in Real-Time will be deployed through a Contingency Reserve Deployment Instruction, via both ICCP and Backup Dispatch Notification, following a system event, normally following the sudden loss of a supply Resource. The amount of Contingency Reserve deployed will depend upon the MW size of the Resource loss or other extreme condition, and the anticipated response capability of the MISO Contingency Reserve Resources. Contingency Reserves will be deployed only on Resources with cleared Contingency Reserve. On-line Contingency Reserve (i.e., Spinning Reserve and Supplemental Reserve cleared on on-line Generation Resources, on-line DRRs – Type II, DRRs – Type I with Contingency Reserve

Status set to “online”, and/or on-line External Asynchronous Resources) will be prioritized ahead of off-line Contingency Reserve (i.e., Supplemental Reserve cleared on off-line Quick-Start Resources and DRRs - Type I with Contingency Reserve Status set to “offline”). If the amount of undeployed Contingency Reserve carried on on-line Resources is greater than or equal to the Contingency Reserve Deployment Instruction, no off-line Contingency Reserve will be deployed. In the first pass, the Contingency Reserve deployed amount which can be fulfilled by online Resources is split between total online Generation Resources and total DRRs – Type 1 with Contingency Reserve status set to “online” pro rata based on the Contingency Reserve cleared. The total amount allocated to online Generation Resources will be deployed in proportion to the amount of Contingency Reserve cleared on each Generation Resource. The total amount allocated to DRRs - Type 1 with Contingency Reserve status set to “online” will be deployed on a cost-based merit order list. Should it be necessary to deploy Contingency Reserve on off-line Resources as well, off-line Quick-Start Resources and DRRs – Type I with Contingency Reserve Status set to “offline” will be deployed in merit order, subject to Reserve Zone import limits, based on economics. Offline merit order prices will be calculated as follows:

For an off-line Quick-Start Resource:

$$CRD\_CallonCost = SU_i + \sum_{i=start\_hour}^{End\_hour} [(NL_i + \int_0^{Off-Line\_Deployed\_MW} IncEnergy_i) * Minutes\_run_i / 60]$$

$$MeritOrder = CRD\_CallonCost / (eventduration * Off-Line\_Deployed\_MW)$$

For a DRR Type-1:

$$CRD\_CallonCost = Shut\_Down\_Offer + \sum_{i=start\_hour}^{Endhour} HourlyCurtailmentOffer_i * Minutes\_run_i / 60$$

$$MeritOrder = CRD\_CallonCost / (eventduration * Fixed\ \text{Re}ductionMW)$$

Where

- *CRD_CallonCost* is the Total Production cost for the Resource commitment for the commitment period