Manual No. 002

Business Practices Manual

Energy and Operating Reserve Markets

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Revision History

Doc Number	Description	Author	Effective Date
BPM-002-r19	Annual review completed. This revision contains updates for Coordinated Transaction Scheduling (CTS) between MISO and PJM. It also includes various correction of provisions that are no longer in practice.	P. Addepalle M. Kandukuri A. Hartman	OCT-15-2018
BPM-002-r18	Annual review completed. This revision contains updates from MISO's internal Tariff review and implementation of some Emergency pricing enhancements, Change of RGD references to GBAO per Operation reorganization. It also includes various corrections of provisions that are no longer in practice; Updated Pricing logic; Updated attachment D and corrected typographical errors.	P. Addepalle, A. Hartman, S. Li B. Borissov	SEP-23-2017
BPM-002-r17	Address changes in DA/FRAC Market Timing related to FERC order 809	Y. Jiang	NOV-05-2016
BPM-002-r16	Annual Review completed. Reflect changes associated with Emergency and LMR pricing and Real Time Offer Override Enhancement and expand on Day Ahead market extension and reopening; added details on Ramp Up/Down impact on SCED algorithm; revised Demand Response max contribution to SPIN and off line supplemental; added guidance on registration of Regulation, Spin and Supplemental qualified resources	R. Merring	OCT-01-2016
BPM-002-r15	Annual Review completed. This revision describes changes to accommodate MISO's implementation of Ramp Capability Product, a new Ancillary Service. This update also includes clarifications on Bi-Directional EAR, the transition to webTrans and load modeling procedures.	K. Spontak	MAR-17-2016
BPM-002-r14	Annual Review completed. This revision describes changes to accommodate MISO's implementation of the Extended LMP process, Demand Response Enhancement process, Bi-Direction EAR process, the Sub-Regional Power Balance Constraint, control mode response based on behavior for Real Time ancillary services, behavior for partial generation resources associated with external schedules, the switch in Day Ahead from Nodal Power Balance to Global Power Balance and the update to weighting factors for ARR Zones compared to load zones.	K. Spontak J. Li C. Wang K. Trotter P. Caro-Ochoa S. Duggirala R. Merring	MAR-01-2015
BPM-002-r13	This revision describes changes to accommodate MISO's compliance to FERC Order 755 regarding Regulation Mileage, and changes to accommodate Transmission Constraint Demand Curve Tariff	M. Keyser A. Hartman Y. Ma K. Spontak	FEB-04-2014

	changes. It also includes various corrections and language improvements. Annual review completed.		
BPM-002-r12	This revision describes changes for the Look-Ahead commitment process, changes to accommodate FERC Order 719 and 745 (on Demand Response and Aggregators of Retail Customers), changes for Reg+Spin Demand Curves, and changes to eliminate gaming opportunities from the Day-Ahead market and other forward processes. Also, validations that exist in the Market Portal (MUI) are described, descriptions of how transmission constraint marginal value limits are determined, and various corrections and language improvements are included. Annual review completed.	M. Keyser	FEB-06-2013
BPM-002-r11	This revision describes Reserve Procurement changes, new rules for Resource Supplemental Reserve Testing and Capping, inclusion of notification deadline language, and various corrections and language improvements, including corrections to MCP formulations for the inclusion of Demand Response Resource Type I clearing Spinning Reserves.	M. Keyser	JAN-13--2012
BPM-002-r10	This revision contains changes to accommodate Dispatchable Intermittent Resources. In addition, details about the Real-Time Congestion Management Procedure has been added; various clean-up and grammar edits have been made; MISO rebranding included.	M. Keyser A. Hartman	JUN-29-2011
BPM-002-r9	This revision contains the following changes: timing changes associated with moving the Day-Ahead clearing forward by one hour; references to dispatch bands have been removed; Quick-Start Resource language has been added and clarified; Outage language has been updated for clarity, and to accommodate the new Outage Scheduling application; various clean-up and grammar edits have been made.	M. Keyser A. Hartman	OCT-21-2010
BPM-002-r8	This revision contains constraint details for DA and RAC Ramp Capability Constraints. Several corrections are made to other areas, including DRRI's clearing Spinning Reserves.	M. Keyser	JUL-07-2010
BPM-002-r7	This revision contains changes to accommodate clearing of Spinning Reserves on DRR-Type I Resources	M. Keyser	MAR-11-2010
BPM-002-r6	This revision contains clerical changes only, to reflect the change in identification of this document, from "MO-BPM-001-rxxx" to "BPM-002-rxxx". Also, the Issue Date has been removed from this Revision History.	M. Keyser	JAN-12-2010

BPM-002-r5	This primary reason for this revision is to incorporate Stored Energy Resources, a new resource type. During this revision, other corrections and language improvements were made. Noteworthy changes are to the table of contents and references; all links have been corrected. Also, changes have been made to the language regarding the clearing and deployment of Regulating Reserves, to increase precision. Editing Note: For ease of reading, each Attachment being published along with this r5 revision is being named "r5", even if no changes have been made to that Attachment.	M. Keyser	OCT-27-2009
BPM-002-r4	This revision updates pricing sections to more accurately reflect Market rules. In addition, several other minor corrections have been made as well.	B. Borissov	OCT-02-2009
BPM-002-r3	This revision removes references to the DNR Regulation Must-Offer requirement that existed during the first 180 days of the market. It also describes new rules regarding Interchange Scheduling	M. Keyser	JAN-06-2009
BPM-002-r2	This revision reflects changes to align the document with the final as-built design of the Energy and Operating Reserves Market to the extent possible at the time of edit. Typographical and grammatical corrections have also been made.	M. Keyser	JAN-06-2009
BPM-002-r1	This new Energy and Operating Reserve Market BPM was created by combining the current Energy Markets BPM and Energy Markets Instruments BPM and then revising this combined BPM to reflect the September 14, 2007 filing, subsequent September 19, 2007 Errata filing and March 26, 2008 30-Day Compliance Filing of the Open Access Transmission and Energy Markets Tariff for the MISO, Inc. (EMT) relating to implementation of the Day-Ahead and Real-Time Energy and Ancillary Services Markets and integration of proposed changes to the Balancing Authority Agreement.	M. Tackett	JAN-06-2009

Contents

List of Attachments

Attachment A – Market Optimization Techniques – (provided in separate document)

Attachment B – Day-Ahead Energy and Operating Reserve Market Software Formulations and Business Logic – (provided in separate document)

Attachment C – Reliability Assessment Commitment Software Formulations and Business Logic – (provided in separate document)

Attachment D – Real-Time Energy and Operating Reserve Market Software Formulations and Business Logic – (provided in separate document)

List of Exhibits:

1. Introduction

This introduction to the *Business Practices Manual ("BPM") for Energy and Operating Reserve Markets* includes basic information about this BPM and the other MISO BPMs. The first section (Section 1.1) of this Introduction provides information about the MISO BPMs in general. The second section (Section 1.2) is an introduction to this BPM in particular. The third section (Section 1.30) identifies other documents in addition to the BPMs, which can be used by the reader as references when reading this BPM.

1.1 Purpose of the MISO Business Practices Manuals

The BPMs developed by MISO provide background information, guidelines, business rules, and processes established by MISO for the operation and administration of the MISO markets, provision of transmission reliability services, and compliance with the MISO settlements, billing, and accounting requirements. A complete list of MISO BPMs is available for reference through MISO's website.

1.2 Purpose of this Business Practices Manual

This BPM for *Energy and Operating Reserve Markets* covers the rules, design, and operational elements of MISO's Day-Ahead Energy and Operating Reserve Market and Real-Time Energy and Operating Reserve Market. MISO uses simultaneously co-optimized Security Constrained Unit Commitment ("SCUC"), Security Constrained Economic Dispatch ("SCED") and SCED-Pricing algorithms to clear and dispatch the Energy and Operating Reserve Markets. To understand how these algorithms perform their optimization function, a series of Attachments have been developed to assist in the understanding of some basic optimization concepts and the optimization formulations used within the applicable algorithms as follows:

- Attachment A to the BPM for *Energy and Operating Reserve Markets* outlines some basic optimization concepts and provides a high level description of the SCED and SCUC algorithms that are utilized by MISO to achieve its objectives;
- Attachment B provides additional detail regarding how the Day-Ahead Energy and Operating Reserve Market SCUC, SCED and SCED-Pricing algorithms were formulated and the business logic that is applied to clear the Day-Ahead Energy and Operating Reserve Market;
- Attachment C provides additional detail regarding how the SCUC algorithms were formulated for use in the multi-day RAC, forward RAC and intra-day RAC processes;
- Attachment D provides additional detail regarding how the SCED and SCED-Pricing algorithms were formulated for use in the Real-Time operating hour to calculate Dispatch Targets for Energy and Operating Reserve; and

This BPM conforms and complies with MISO's Tariff, the reliability standards, policies, principles and guidelines of the North American Electric Reliability Corporation ("NERC"), also known as the Electric Reliability Organization ("ERO"), operating policies, and the applicable Regional Entities, and is designed to facilitate administration of efficient Energy and Operating Reserve Markets.

This BPM benefits readers who want answers to the following questions:

- What are the roles of MISO and the Market Participants ("MPs") in the Energy and Operating Reserve Markets?
- What are the basic concepts that one needs to know to interact with the Energy and Operating Reserve Markets?
- What MP activities must be performed to engage in the Energy and Operating Reserve Markets?

1.3 References

Other reference information related to this BPM includes:

- Agreement of Transmission Facilities Owners to Organize the Midcontinent Independent System Operator, Inc., a Delaware Non-Stock Corporation (referred to as "T.O. Agreement" or "TOA")
- BPM-001 Market Registration BPM
- BPM-004 FTR-ARR BPM
- BPM-005 Market Settlements BPM
- BPM-007 Physical Scheduling BPM
- BPM-008 Outage Operations BPM
- BPM-009 Market Monitoring and Mitigation Business Practice Manual
- BPM-010 Network and Commercial Models BPM
- BPM-011 Resource Adequacy BPM
- BPM-025 Forecast Engineering BPM
- BPM-026 Demand Response BPM
- BPM-030 Pseudo-Tie BPM
- Market User Interface – Participant XML Specification
- MS-OP-031 Post Operating Processor Calculation Guide in the Market Settlements BPM
- Tariff for Midcontinent Independent System Operator, Inc.
- Coordination Policy Manual

2. Energy and Operating Reserve Markets Overview

This section presents a high level description of the Day-Ahead and Real-Time Energy and Operating Reserve Markets. The intent is to explain the basics, including the following:

- Energy and Operating Reserve Markets operation and Settlements
- Roles and Responsibilities of the entities that interact with the Energy and Operating Reserve Markets
- Market models and terminology
- Day-Ahead and Real-Time computer system components
- Market operation tools

2.1 Energy and Operating Reserve Markets Operation and Settlements

MISO operates two Energy and Operating Reserve Markets:

- ***Day-Ahead Energy and Operating Reserve Market*** – The Day-Ahead Energy and Operating Reserve Market is a forward market in which Energy and Operating Reserve are cleared on a simultaneously co-optimized basis for each hour of the next Operating Day using Security-Constrained Unit Commitment ("SCUC"), Security-Constrained Economic Dispatch ("SCED") and SCED-Pricing computer programs to satisfy the Energy demand Bids and Operating Reserve requirements of the Day-Ahead Energy and Operating Reserve Market. The results of the Day-Ahead Energy and Operating Reserve Market clearing include hourly Ex Ante and Ex Post LMP values for Energy demand and supply, hourly Ex Ante and Ex Post Market Clearing Price ("MCP") values for Regulating Reserve, Spinning Reserve, Supplemental Reserve supply, Up Ramp Capability and Down Ramp Capability and hourly Energy demand schedules, hourly Energy supply schedules for each Resource, hourly Regulating Reserve, Spinning Reserve and Supplemental Reserve supply, hourly Up Ramp Capability and Down Ramp Capability schedules for each qualified Resource. See Section 7 of this BPM for details of the Day-Ahead Energy and Operating Reserve Market.
- ***Real-Time Energy and Operating Reserve Market*** – The Real-Time Energy and Operating Reserve Market is a market in which Energy and Operating Reserve are cleared on a simultaneously co-optimized basis every five minutes using Security-Constrained Economic Dispatch ("SCED") computer programs to satisfy the forecasted Energy demand and Operating Reserve requirements of the Real-Time Energy and Operating Reserve Market based on actual system operating conditions,

as described by MISO's State Estimator. The results of the Real-Time Energy and Operating Reserve Market clearing include five-minute Ex Ante LMPs for Energy demand and supply, five-minute Ex Ante MCP values for Regulating Reserve, Spinning Reserve, Supplemental Reserve supply, and Up Ramp Capability and Down Ramp Capability, five-minute Dispatch Targets for each Resource for Energy, Regulating Reserve, Spinning Reserve and Supplemental Reserve, and clearing results for Up Ramp Capability and Down Ramp Capability. The Real-Time Energy and Operating Reserve Market dispatch is supported by a Reliability Assessment Commitment ("RAC") process to ensure sufficient capacity is on line to meet Real-Time operating conditions. See Section 6 of this BPM for details of the RAC processes and Section 8 of this BPM for details of the Real-Time Energy and Operating Reserve Market.

These Energy and Operating Reserve Markets operate in a coordinated sequence as summarized by the process/event overview timeline in Exhibit 2-1.

Separate accounting Settlements are performed for the Day-Ahead and Real-Time Energy and Operating Reserve Markets. See the BPM for *Market Settlements* for a detailed description.

LMP and MCP price calculations are described in detail in Section 5 of this BPM.

Real Time Ex Post Prices are calculated as part of Real Time Market Closure Activities as described in detail in Section 9 of this BPM.

Exhibit 2-1: Energy and Operating Reserve Markets – Timeline Overview

Beginning Day @ Time	Ending Day @ Time	Description of Processes and Events
Real-Time Energy and Operating Reserve Market RAC Pre Day-Ahead (See Section 6)		
OD-7 @ 0000	OD-1 @ 2400	RAC Pre Day-Ahead Time Frame
Day-Ahead Energy and Operating Reserve Market Activities (See Section 7)		
OD-7 @ 0000	OD-1 @ 1030 EPT	Prepare for Day-Ahead Energy and Operating Reserve Market
	OD-1 @ 1030 EPT	Close 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
Real-Time Energy and Operating Reserve Market RAC Post Day-Ahead (See Section 6)		
OD-1 @ 1330EPT	OD-1 @ 1430 EPT	Revise Offers for RAC Post Day-Ahead (with knowledge of Day-Ahead Energy and Operating Reserve Market results)
	OD-1 @ 1800EPT	Perform Post Day-Ahead RAC Process
OD-1 @ 1800 EPT	OD @ 0000	Notify Start-Up/Shut-Downs from Post Day-Ahead RAC Process
Real-Time Energy and Operating Reserve Market RAC Intraday (See Section 6)		
OD-1@ 2000	OD @ 2400	RAC Intraday Time Frame
Real-Time Energy and Operating Reserve Market Activities (See Section 8)		
OD-1 @ 2330	OD @ RT	Real-Time Energy and Operating Reserve Market Time Frame
	OD @ OH-30min	Close Real-Time Energy and Operating Reserve Market 30 minutes Prior to Top of Each OH
	OD @ RT-5min (Every 5 minutes)	Send UDS Dispatch Targets and post results
	OD @ RT-Continuous	Send Setpoint Instructions approximately every 4 seconds.
Energy Markets Closure Activities (See Section 9)		
OD = Operating Day OH = Operating Hour (00 to 23) RT = Real-Time (target time for UDS Dispatch Targets) RAC = Reliability Assessment Commitment		UDS = Unit Dispatch System Note: All times are in EST unless noted otherwise.

2.2 Market Modeling Terminology

This section describes the models and terminology that MISO utilizes to coordinate the electric power system ("Network Model") with the Energy and Operating Reserve Markets ("Commercial Model"). Model coordination is crucial to the Settlement process so that credits and charges are

accurately allocated to the MPs. The following subsections provide an overview of market modeling. See the BPM for *Network and Commercial Models* for a detailed description.

2.2.1 Network Model

The Network Model is a representation of the actual Transmission System within the MISO Balancing Authority Area, including all connection points modeled for generation and Load and including representations of other transmission systems within the Eastern Interconnection. This model has many purposes, including the analysis of the anticipated impact of physical Energy flow across the Transmission System.

2.2.2 Commercial Model

The Commercial Model differs from the Network Model in that it describes the financial market relationships of the MPs and Asset Owners ("AOs"), and the commercial relationships among the elements of the Network Model. The hierarchy of relationships is as follows:

- MP Level
- AO Level
- Commercial Pricing Node ("CPNode") Level
- Elemental Pricing Node ("EPNode") Level

2.2.3 Elemental Pricing Nodes

The EPNode is the finest level of granularity in the Commercial Model. EPNodes represent selected single Buses in the Transmission System Network Model. EPNodes generally include all Buses where Energy is injected and/or withdrawn from the Transmissions System, as well as other commercially significant buses. MISO calculates the Ex Ante and Ex Post LMP of supplying and consuming Energy at each EPNode. Ex Ante and Ex Post MCPs are calculated directly at the CPNode level.

2.2.4 Aggregated Pricing Nodes

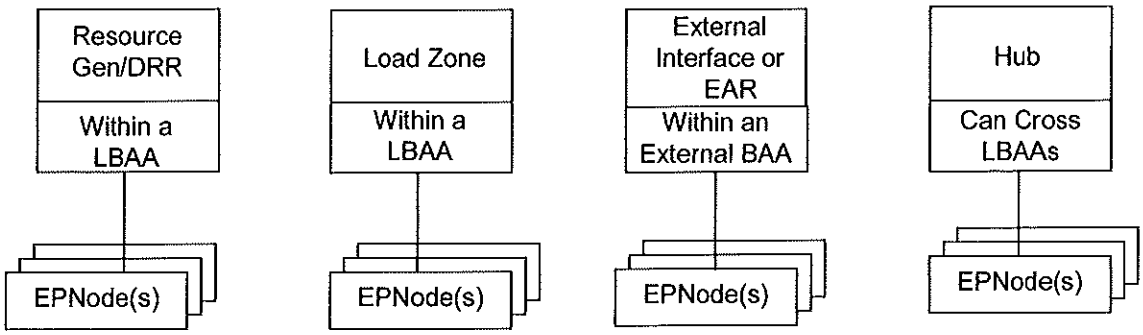
The Aggregated Pricing Node ("APNode") represents an aggregation of two or more EPNodes using predetermined weighting factors. For each APNode, the relationship of EPNodes to APNodes determines how Energy and Operating Reserve at the APNode level are allocated at the EPNode level and/or how prices at the EPNode level are weighted at the APNode level. This nodal relationship is maintained in MISO's Asset Registration System.

2.2.5 Commercial Pricing Nodes

The CPNode represents the next hierarchical level in the Commercial Model and consists of a single EPNode or APNode (i.e., an aggregation of one or more EPNodes). Energy supply and demand is financially settled at the CPNode level based on the appropriate CPNode LMP (Hourly Ex Post Day-Ahead or Hourly Ex Post Real Time) and CPNode energy injection or withdrawal level. Operating Reserve supply is financially settled at the Resource CPNode level based on the appropriate CPNode MCPs (Ex Post Day-Ahead MCPs or Ex Post Real Time MCPs). All LMPs and MCPs will be made available to the public.

There are four types of CPNodes: Resource, Load Zone, Hub, and Interface. Exhibit 2-2 illustrates the relationship between EPNodes and CPNodes.

Exhibit 2-2: CPNode Types



BAA = Balancing Authority Area
LBAA = Local Balancing Authority Area
DRR = Demand Response Resource Types I & II
EAR = External Asynchronous Resource

A Resource CPNode will be based on a single EPNode if the Resource output is injected at a single Bus or an APNode if the Resource output is injected at multiple Buses. For example, a Generation Resource with a single Generator or a Demand Response Resource - Type II hosted by a single Load on the Transmission System would contain a CPNode comprised of the single EPNode where the Generation Resource or Demand Response Resource - Type II injects energy. On the other hand, a Combined Cycle Resource with multiple Generators connected to different electrical Buses or a Demand Response Resource - Type I representing an AC Compressor Control demand-side management program spread across many Loads could be represented by an APNode. Under this situation, the APNode weighting factors would

be determined by the MP when the asset is registered and would need to be based on how the total energy injection from the Resource would be distributed among the multiple injection points to which the Resource connects.

A Load Zone CPNode will be based on a single EPNode if the Load Zone represents Load at a single Bus or an APNode if the Load Zone represents Load at multiple Buses. For Load Zone CPNodes that are APNodes, the weighting factors are generally based on actual Load measurements. For the Day-Ahead and Real-Time Markets, a common set of weighting factors are used for all 24 hours of the operating day and are based on the average of the 24 hourly State Estimator Loads associated with the day seven days prior to the Operating Day. On Quarterly Model updates, State Estimator Loads consistent with the new model may not be available, therefore, the weighting factors may be derived off line and applied for the first seven days after a new model is effective

A Hub CPNode can be based on a single EPNode, but will almost always be based on an APNode. The weighting factors for most Hubs are fixed and determined in advance and are not based on energy injection and/or withdrawal levels at the associated EPNodes.

ARR Zones administered as Hub CPNodes are an exception to this practice. The weighting factors of EPNodes comprising an APNode representing an ARR Zone are calculated in the same manner as those of EPNodes comprising a Load Zone. For ARR Zone CPNodes that are APNodes, the weighting factors are generally based on actual Load measurements. For the Day-Ahead and Real-Time Markets, a common set of weighting factors is used for all 24 hours of the Operating Day and are based on the average of the 24 hourly State Estimator Loads associated with the day seven days prior to the Operating Day.

An Interface CPNode can be based on a single EPNode or an APNode. MISO will determine the weighting factors for an Interface CPNode at the time the Network Model is updated. An Interface CPNode is established for each external Balancing Authority. The EPNodes and associated weighting factors are established to simulate as accurately as possible the sourcing or sinking of an Interchange Schedule within the associated external Balancing Authority based on the physical Resources within such Balancing Authority. In many cases, external Interface Buses represent an aggregation of the Resources within the external Balancing Authority that are most likely to move up or down to accommodate an Interchange Schedule to or from the MISO Balancing Authority.

EPNodes may be allocated by percent of ownership to more than one CPNode, provided that the total allocation equals 100 percent. CPNodes that represent Resources and Loads are referred to as assets and all of these types of Assets must be completely assigned (i.e., 100%) to an AO.

2.2.6 Asset Owners

The AO is the next higher hierarchical level in the Commercial Model and typically, but not necessarily, represents a company. A company may choose to be registered as more than one AO. Within the Commercial Model, AOs can own any combination of generation, Load, and/or FTR assets across any number of Local Balancing Authority Areas ("LBAAs"). All AOs must each be represented by an MP.

MISO calculates charges and produces market Settlements statements for each AO. Each Settlement statement provides the billing determinants for each transaction, along with the AO's total financial obligation resulting from its transactions.

2.2.7 Market Participants

The MP is the highest hierarchical level in the Commercial Model and is the entity in the Commercial Model that is financially obligated to MISO for market Settlements. A single MP represents one or more AOs. A single MP may authorize other entities such as a Scheduling Agent (SA) to act in the MISO Energy and Operating Reserve Markets on its behalf. The MP remains financially responsible for market Settlements. MPs receive Settlement summaries and invoices from MISO for Energy and Operating Reserve Markets activities executed by the MPs' or entities authorized by the MP. See the BPM for *Market Settlements* for detailed information.

2.3 Roles and Responsibilities

Roles and responsibilities are described for the following entities:

- MISO
- MPs
- Transmission Owners/Operators
- Generation Owners/Operators
- Load-Serving Entities ("LSEs")
- Market Support Services Providers
- Local Balancing Authorities ("LBAs")
- Independent Market Monitor ("IMM")

2.3.1 MISO

MISO provides all market services for Energy, Operating Reserve and Transmission Service in accordance with the terms of the Tariff, the BPMs, and related agreements. This includes operation and Settlement of the Day-Ahead Energy and Operating Reserve Market and the Real-Time Energy and Operating Reserve Market.

MISO administers the Energy and Operating Reserve Markets through performance of the following processes:

1) **Reserve Zone Configuration and Operating Reserve Requirements (see Section 3):**
   - Identify and/or modify Reserve Zones on a quarterly basis consistent with updates of the Network Model
   - Calculate minimum Zonal Operating Reserve Requirements on daily basis and post such Requirements 2 days prior to the applicable Operating Day.
   - Calculate Market-Wide Operating Reserve Requirements on daily basis and post such Requirements 2 days prior to the applicable Operating Day.
2) **Multi-Day Reliability Assessment and Commitment ("MDRAC") (see Section 6):**
   - Accumulate information to assess system reliability for the next three to seven days, including gathering data for analyses, identifying potential problems, and determining if sufficient capacity is available to meet Energy and Operating Reserve requirements.
   - Commit, if necessary, Generation Resources, Demand Response Resources – Type II and Demand Response Resources - Type I with Start-Up Notification Time + Start-Up Time greater than 24 hours for a future Operating Day.
3) **Day-Ahead Energy and Operating Reserve Market (see Section 7):**
   - Acquire Day-Ahead data, including transmission outages, generation outages, and Day-Ahead Bids and Offers **(see Section 4)**.
   - Confirm Day-Ahead Interchange Schedules.
   - Clear the Day-Ahead Energy and Operating Reserve Market by committing and dispatching Day-Ahead supply, including consideration of Start-Up, No-Load, Energy Offer, Regulating Reserve Offer, Spinning Reserve Offer (or On-Line Supplemental Reserve Offer if not Spin Qualified), Off-Line Supplemental Reserve Offer (if a Quick-Start Resource) and Ramp Capability for Generation Resources and DRRs-Type II; consideration of Energy Offer,

Regulating Reserve Offer, Spinning Reserve Offer (or On-Line Supplemental Reserve Offer if not Spin Qualified), and Ramp Capability for External Asynchronous Resources ("EARS"); consideration of Shut-Down Offers, Hourly Curtailment Offers, Energy Offers, Spinning Reserve Offers and Supplemental Reserve Offers for DRRs-Type I; and consideration of Regulating Reserve Offer for Stored Energy Resources ("SERs"), against Day-Ahead demand and Operating Reserve requirements.

- Calculate Day Ahead Ex Ante LMPs, Ex Post LMPs, Ex Ante MCPs and Ex Post MCPs **(see Section 5)**
- Review Day-Ahead Energy and Operating Reserve Market results.
- Publish data for Day-Ahead Energy and Operating Reserve Market results (e.g., schedule, commitment, Load, Ex Ante LMP, Ex Post LMP, Ex Ante MCP and Ex Post MCP).
- Perform Day-Ahead Energy and Operating Reserve Market Settlement.

4) **Day-Ahead Reliability Assessment and Commitment (DARAC) (see Section 6):**
   - Following the posting of Day-Ahead Energy and Operating Reserve Market results, accumulate information to assess system reliability for the next Operating Day, including gathering data for analyses, identifying potential problems, and determining if sufficient capacity is available to meet Energy and Operating Reserve requirements.
   - Commit additional Resources not previously committed during the Day-Ahead Energy and Operating Reserve Market process, if necessary, to meet forecast Load and Operating Reserve requirements for the next Operating Day based on Start-Up Offers, No-Load Offers, Energy Offers, Regulating Reserve Offers, Spinning Reserve Offers (or On-Line Supplemental Reserve Offers if not Spin Qualified), Off-Line Supplemental Reserve Offers (if a Quick-Start Resource), and Ramp Capability for Generation Resources and DRRs-Type II; consideration of Energy Offer, Regulating Reserve Offers, Spinning Reserve Offers (or On-Line Supplemental Reserve Offers if not Spin Qualified), and Ramp Capability for External Asynchronous Resources; consideration of Shut-Down Offers, Hourly Curtailment Offers, Spinning Reserve Offers and Supplemental Reserve Offers for DRRs-Type I; and Regulating Reserve Offers for Stored Energy Resources. Both EAR and SER Resources are considered to be committed, if available, during this process.
   - Recommend, if necessary, Resource candidates to supply Regulating Reserve.

- Recommend, if necessary, the release of the emergency high range or emergency low range on specific Resources should it be necessary to ensure power balance and satisfy Operating Reserve requirements.
- Identify Quick-Start Resources selected to supply Supplemental Reserve.

5) Intra-Day Reliability Assessment and Commitment (IRAC) (see Section 6):

- Continue to accumulate information to assess system reliability during the Operating Day, including gathering data for analyses, identifying potential problems, and determining if sufficient capacity is available to meet Energy and Operating Reserve requirements.
- Commit additional Resources not previously committed during the Day-Ahead Energy and Operating Reserve Market process, Day-Ahead RAC process or previous Intra-Day RAC process if necessary, to meet forecast Load and Operating Reserve requirements for the remainder of the Operating Day based on Start-Up Offers, No-Load Offers, Energy Offers, Regulating Reserve Offers, Spinning Reserve Offers (or On-Line Supplemental Reserve Offers if not Spin Qualified), Off-Line Supplemental Reserve Offers (if a Quick Start Resource) and Ramp Capability for Generation Resources and DRRs-Type II and Shut-Down Offers, Hourly Curtailment Offers, Spinning Reserve Offers and Supplemental Reserve Offers for DRRs-Type I. External Asynchronous Resources, if available and not previously selected during the Day-Ahead Energy and Operating Reserve Market process or prior RAC processes, are also considered in this step based on their Energy Offers, Regulating Reserve Offers, Spinning Reserve Offers, Supplemental Reserve Offers and Ramp Capability.[1] SERs, if available and not previously selected during the Day-Ahead Energy and Operating Reserve Market process or prior RAC processes, are also considered in this step based on their Regulating Reserve Offers.
- Recommend, if necessary, Resource candidates to supply Regulating Reserve for the commitment period.
- Recommend, if necessary, the release of the emergency high range or the emergency low range on specific Resources should it be necessary to ensure power balance and satisfy Operating Reserve requirements.

[1] Only if not Spin Qualified

- Identify Quick-Start Resources selected to supply Supplemental Reserve and/or DRRs-Type I selected to supply Contingency Reserve.

6) **Real-Time Energy and Operating Reserve Market (see Section 8):**
   - Update minimum Zonal and Market-Wide Operating Reserve Requirements, if required due to a change in system conditions from Day-Ahead that would adversely impact system reliability.
   - Acquire Real-Time Energy and Operating Reserve Market Offers **(see Section 4)**.
   - Acquire most recent RAC data (e.g. operating plan).
   - Confirm Real-Time Interchange Schedules and Real-Time Resource Offer data.
   - Acquire current system conditions, including: Binding Transmission Constraints (limits, actual flows and sensitivity factors) and actual generation.
   - Calculate 5-minute Load Forecast.
   - Operate and clear the Real-Time Energy and Operating Reserve Market and determine Ex Ante LMPs, Ex Ante MCPs, cleared Energy, cleared Operating Reserve and Dispatch Targets.
   - Send Dispatch Targets to Market Participants with Generation Resources, DRRs-Type II, Stored Energy Resources and External Asynchronous Resources every five minutes.
   - Send Setpoint Instructions to Market Participants with Generation Resources, Demand Response Resources - Type II, Stored Energy Resources and External Asynchronous Resources every four seconds.
   - Calculate and publish preliminary Ex Post LMPs and MCPs.
   - Review Real-Time Energy and Operating Reserve Market results.
   - Schedule and payback Inadvertent Interchange.
   - Initiate Emergency procedures, as needed.
   - Calculate and publish final Hourly Ex Post LMPs and MCPs.
   - Perform Real-Time Energy and Operating Reserve Market Settlement.

2.3.2 Market Participants

MPs are entities that are qualified, pursuant to criteria and procedures established by MISO, to perform the following actions:

1) **Day-Ahead Energy and Operating Reserve Market:**
   - Submit Interchange Schedules to MISO.
   - Submit Demand Bids to purchase Energy and/or submit Offers, including Self-Schedules, to sell Energy and Operating Reserve.
   - Submit Day-Ahead Financial Schedules to MISO by 1200 hours Eastern Standard Time ("EST") up to six days following the Operating Day (OD+6).
   - Submit Virtual Supply Offers and Virtual Demand Bids.
2) **Real-Time Energy and Operating Reserve Market:**
   - Submit Offers for any of the RAC processes (beginning at OD-7).
   - Submit Interchange Schedules to MISO.
   - Submit new or modified Offers, including Self-Schedules, to supply Energy and Operating Reserve no later than 30 minutes prior to the Operating Hour.
   - Submit Real-Time Financial Schedules by 1200 EST up to six days following the Operating Day (OD+6).

2.3.3 Transmission Operators

A Transmission Owner is a member of MISO that has (in whole or in part) transferred functional responsibilities of its transmission facilities classified as transmission and covered under the Tariff and TOA. Those facilities make up MISO's Transmission System. Transmission Operators perform the following actions on behalf of Transmission Owners:

1) **Prior to the Operating Day:**
   - Receive and/or develop transmission maintenance requirements and plans for Transmission Owners.
   - Define operating limits, develop contingency plans, and monitor operations of the transmission facilities under the Transmission Operator's control and as directed by MISO.
   - Provide operating information to MISO.
   - Determine amounts required and arrange for Other Ancillary Services from Generation Owners to ensure reactive supply and voltage control (e.g., from Generation Resources) in coordination with the LBAs and MISO.
   - Update transmission facility ratings.

2) **During the Operating Day:**
   - Operate or direct the operations of the Transmission System within equipment and facility ratings established by the Transmission Owners and Generation Owners, and system ratings established by MISO.
   - Deploy reactive Resources from Transmission Owners and Generation Owners Other Ancillary Services to maintain acceptable voltage profiles and direct Distribution Providers to maintain voltages within limits.
   - Provide Real-Time operations information to MISO.
   - Notify Generation Owners and other affected entities of Transmission System problems (e.g., voltage limitations or equipment overloads that may affect Generator operations).
   - Request MISO actions to mitigate equipment overloads for facilities not monitored by MISO.
   - Coordinate Load Shedding with, or as directed by, MISO and direct Distribution Providers to shed Load.

2.3.4 Generation Owners/Operators

A Generation Owner is an entity that owns, or leases with rights equivalent to ownership, facilities for generation of Energy and provision of Operating Reserve that are located within or are used to supply Energy and Operating Reserve in the MISO market footprint. Generation Resources within the Market Footprint must be represented by an MP. Generator Operators perform the following actions:

1) **Prior to the Operating Day:**
   - Submit maintenance schedules.
   - Submit operational parameters and facility limitations (e.g., long lead time units).
2) **During the Operating Day:**
   - Respond to dispatch and control directives or signals.
   - Respond to reactive supply and voltage control directives.
   - Respond to Start-Up and Shut-Down directives.

2.3.5 Load-Serving Entities

LSEs are any parties taking Transmission Service on behalf of wholesale or retail power customers, that have undertaken an obligation to provide or obtain Energy and/or Operating Reserves for end-use customers by statute, franchise, regulatory requirement or contract for Load located within or attached to the Transmission System.

An LSE must either qualify as an MP, or arrange with an MP to be served through the Energy and Operating Reserve Markets. LSEs perform the following actions:

1) **Prior to the Operating Day:**
   - Coordinate with their LBA in the development of Load Forecasts (hourly for 7 days out) that the LBA submits to MISO.
2) **During the Operating Day:**
   - Respond to MISO interruptible Load and Load Shedding directives either directly or through their LBA.

2.3.6 Aggregators of Retail Customers ("ARCs")

ARCs are any parties that have contracted to provide load interruption services or behind the meter generation to the Energy and Operating Reserve Markets with one or more retail or wholesale customers whose load they have not undertaken an obligation to provide or obtain Energy and/or Operating Reserves for end-use customers by statute, franchise, regulatory requirement or contract for Load located within or attached to the Transmission System.

An ARC must either qualify as an MP, or arrange with an MP to be served through the Energy and Operating Reserve Markets. ARCs perform the following actions:

1) **Prior to the Operating Day:**
   - Submit Maintenance Schedules
   - Submit operational parameters and facility limitations (e.g., long lead time Resources)
2) **During the Operating Day:**
   - Respond to dispatch and control directives or signals
   - Respond to Start-Up and Shut-Down directives

2.3.7 Market Support Services Providers

There are three types of market support services providers:

- ***Scheduling Agent ("SA")*** – an agent designated by an MP to physically exchange market information, such as submitting Bilateral Transactions, Bids, and Offers or receiving market data and notifications from MISO on the MP's behalf.
- ***Meter Data and Management Agent ("MDMA")*** – an entity that is designated by an MP to manage and conduct the metering function.
- ***Billing Agent*** – an entity that may be designated by an MP to receive bills and/or make payments on behalf of the MP.

Market support services providers do not need to be qualified as MPs as long as the MPs they represent remain financially liable to MISO for all the activities that the market support services providers perform. The market support services providers are required to act in accordance with the provisions of the Tariff. However, the MP's responsibilities and liabilities to MISO cannot be transferred to market support service providers.

2.3.8 Local Balancing Authorities

Local Balancing Authority responsibilities are specified in the Amended Balancing Authority Agreement.

2.3.9 Independent Market Monitor

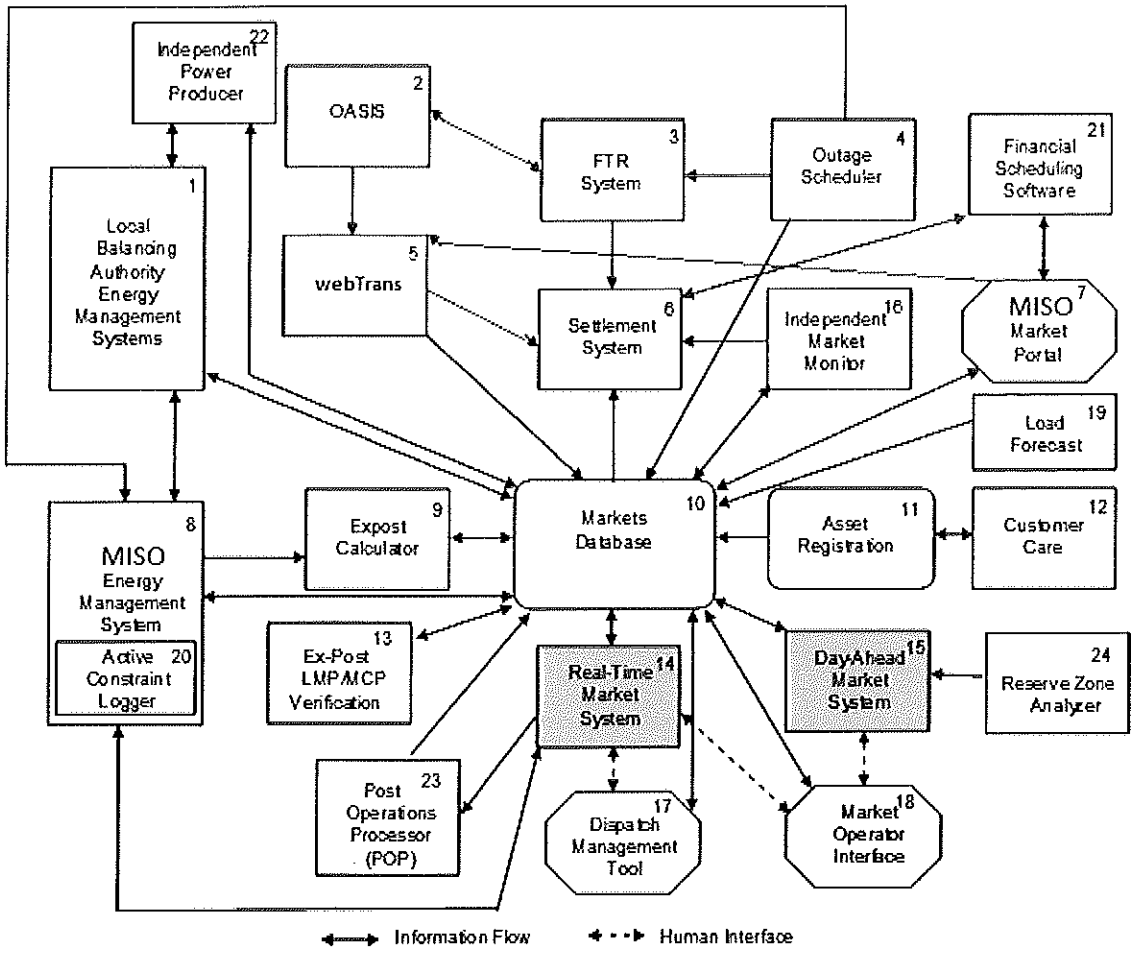
MISO uses the services of its IMM to provide for the independent, impartial, and effective monitoring and reporting on the MISO Energy and Operating Reserve Markets as a whole. In addition, the IMM provides the means for MISO to mitigate the market effects of any conduct that would distort competitive outcomes in the Energy and Operating Reserve Markets. For further information on the IMM, please see the BPM for *Market Monitoring and Mitigation*.

2.4 Energy and Operating Reserve Markets System Components

The Day-Ahead and Real-Time Energy and Operating Reserve Markets ("DART") system consists of software, servers, and related applications used to support the operation of the Day-Ahead and Real-Time Energy and Operating Reserve Markets.

Exhibit 2-3 depicts the major components of this system.

Exhibit 2-3: DART Components Overview



The following components are shown in

Exhibit 2-3:

1) ***LBA/MP Energy Management Systems*** – The LBA and MP EMSs that are within the Market Footprint provide SCADA via ICCP, and the MISO EMS and MP EMSs that are within the Market Footprint provide Dispatch Targets, to Resources that are dispatched by MISO. MISO also sends Resource Dispatch Targets to LBAs.
2) ***Open Access Same-Time Information System ("OASIS")*** – Used to manage Transmission Service reservations that may be used to schedule Interchange Transactions. Reservations for Firm Transmission Service may also be accompanied by an FTR request via the OASIS.
3) ***FTR System*** – Maintains records of FTR Holders, allocates new FTRs, and conducts auctions.

4) ***Outage Scheduler*** – The system that tracks the status of transmission and generation outages and their expected return to service.
5) **webTrans** – The system for entering and disseminating Interchange Schedule information. Interchange Schedules are submitted to webTrans via NERC E-Tag.
6) ***Settlement System*** – Calculates the MP charges and credits for the Day-Ahead Energy and Operating Reserve Market, the Real-Time Energy and Operating Reserve Market, and the FTR Market.
7) ***MISO Market User Interface ("MUI"), also known as the Market Portal*** – The internet portal by which MP information is entered via input/output displays and data templates[2].
8) ***MISO Energy Management System*** ("EMS") – consists of the power system network analysis functions (including the State Estimator and Contingency Analysis) that are used by MISO Operators to maintain reliable power system operations and the AGC system.
9) ***Real Time Ex-Post Calculator*** – Calculates five-minute Ex-Post LMPs and MCPs based on the same input data and SCED-Pricing algorithm used to clear the Real-Time Energy and Operating Reserve Market.
10) ***Markets Database*** – The Markets Database is the central repository of all market-related data and coordinates market component communications.
11) ***Asset Registration*** – The system for the storing of authorized MP information relevant to participation in the MISO markets.
12) ***Customer Care*** – Customer services and the MISO response to market inquiries.
13) ***Ex- Post LMP/MCP Verification*** – Verification and correction of Ex-Post Calculator results.
14) ***Real-Time Market System*** – Provides Dispatch Targets for a near-term forecast of operating conditions for the Real-Time Energy and Operating Reserve Market, using a simultaneously co-optimized SCED algorithm. For the Real-Time Energy and Operating Reserve Market, the SCED algorithm is executed on a five-minute periodic basis to produce a security constrained co-optimized economic dispatch and Operating Reserve clearing and determines Ex-Ante LMPs and Ex-Ante MCPs based on the current system conditions, the actively managed transmission

[2] For more information regarding querying and submitting Market data to the MUI, please see the *Market User Interface – Participant XML Specification*

constraints, the Sub-Regional Power Balance Constraint and the forecast system conditions. The SCED algorithm is not used in RAC.

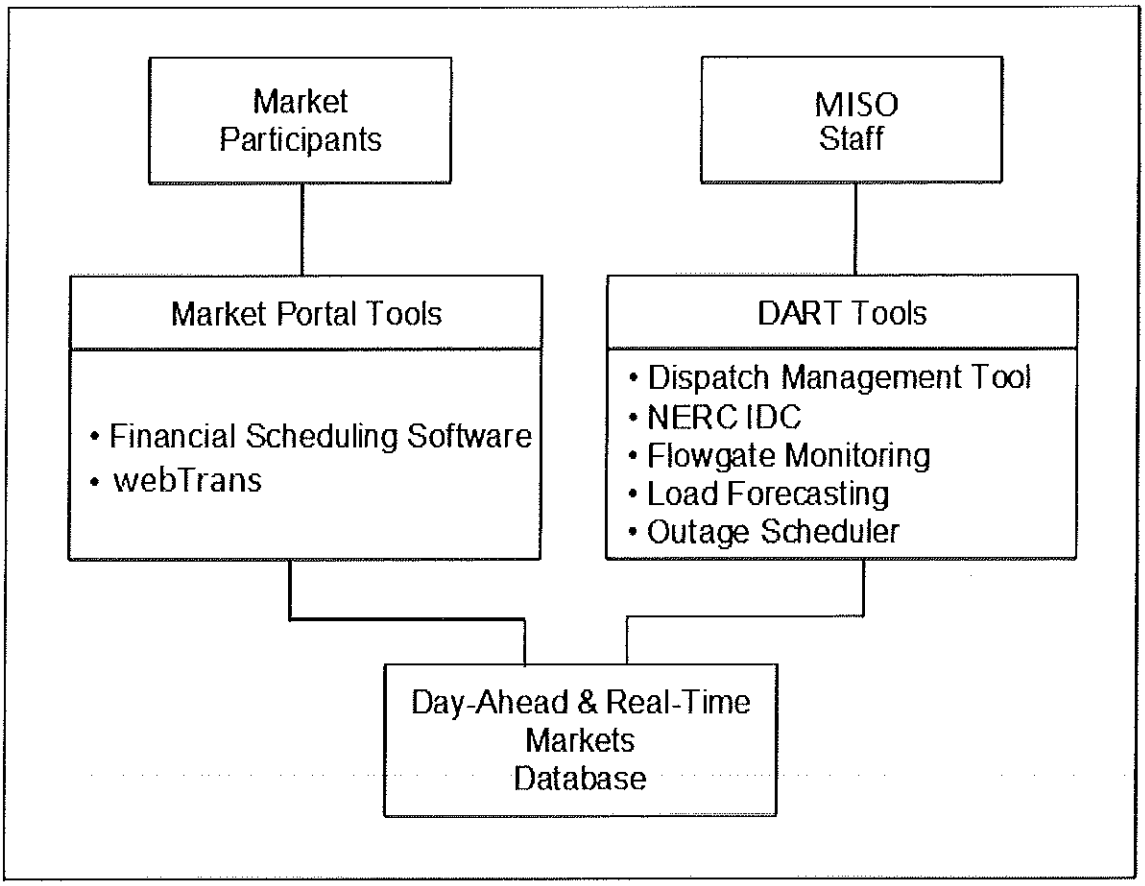
15) ***Day-Ahead Market System*** – Provides SCUC commitments, SCED schedules and SCED-Pricing prices, based on MP submitted Offers and Bids and forecast Operating Reserve requirements. The following applications are executed for each hour:
    - ***Resource Scheduling and Commitment ("RSC")*** – A SCUC which performs generation commitment for the 24-hour period.
    - ***Scheduling, Pricing and Dispatch ("SPD")*** – A SCED that uses the Network Model to perform dispatch for 24 hours and determines Ex Ante LMPs and Ex Ante MCPs.
    - ***Simultaneous Feasibility Test ("SFT")*** – Performs contingency analysis for each hour to evaluate network security of a set of injections and withdrawals under a range of contingent scenarios.
    - ***Day Ahead Locational Marginal Price ("DALMP")*** – A SCED, specifically SCED-Pricing, that uses the Network Model to perform dispatch for 24 hours and determines Ex Post LMPs and Ex Post MCPs.
16) ***Independent Market Monitor ("IMM")*** – Provides the independent observation of market activities to detect market rule violations and the influence of market power.
17) ***Energy Market Displays ("EMD")*** – Allows the Operator to make changes to the planned operation of specific Resources,
18) to view the inputs and outputs of the market system, and to make input parameter adjustments.
19) ***Load Forecast*** – Provides short-term Load forecast over the next hour for the Real-Time Energy and Operating Reserve Market dispatch and provides 24 hour Load forecast values for rolling seven days for use in the RAC for the Real-Time Energy and Operating Reserve Market.
20) ***Active Constraint Logger*** – Records and logs transmission constraints that are "actively" being controlled and impacting the dispatch solution produced by UDS in the Real-Time Energy and Operating Reserve Market.
21) ***Financial Scheduling Software ("finSched")*** – Used by MPs to enter Financial Schedules.
22) ***Independent Power Producer ("IPP")*** – A Generation Resource that operates within an LBA and that submits MW/Price Offers into the Energy and Operating Reserve Markets, independently of any other Generation Resource(s) within the LBA.

23) ***Post Operation Processor ("POP")*** – Calculates hourly MCPs and cleared Operating Reserve MW for use in the hourly Settlements in the Real-Time Energy and Operating Reserve Market.

2.5 Market Operations Tools

Many software tools are required for the operation of the Day-Ahead and Real-Time Energy and Operating Reserve Markets. These tools, listed as part of the system components described under Section 2.4, can be categorized as illustrated by Exhibit 2-4, which distinguishes between those tools designed for MP interaction and those tools designed primarily for MISO staff interaction.

Exhibit 2-4: Market Operations Tools



The following software tools are available to assist MISO with the management of the Energy and Operating Reserve Markets and interactions with MPs, and are described in this subsection:

- Financial Scheduling Software ("finSched")
- Physical Scheduling Software ("webTrans")
- MISO Market Portal

2.5.1 Financial Scheduling Software

The finSched MUI application provides MPs with the ability to create Financial Schedules that transfer the financial responsibility for Energy, but not the physical flow of Energy. A Financial Schedule identifies the parties, Source Point, Delivery Point, Sink Point, and Energy schedules. The Source/Delivery/Sink Points can be any CPNode. The following MP capabilities and functionalities are incorporated in finSched:

- Define contracts between two parties who are each MPs in the Energy and Operating Reserve Markets. The contracts permit parties to create schedules, which transfer financial responsibility between parties.
- Define MW schedules for periods of time consistent with the contracts that are defined between the parties.
- Define financial transfers within and across MISO's Market Footprint.
- Acknowledge/accept the contracts and schedules entered by the counterparty.
- Provide the MPs with web and XML methods to schedule Financial Schedules. Those MPs with a programmatic interface receive notification from finSched of schedules that are pending their approval.
- Provide financial schedule reports to MPs via web browser and XML programmatic interface.
- Enter and confirm Financial Schedules (by both parties to the agreement) by 1200 EST on the sixth day after the Operating Day (OD+6).

See Section 4.1.3 of this BPM for a description of Financial Schedules.

2.5.2 Physical Scheduling Software (webTrans)

OATI's webTrans processes and tracks the Interchange Schedules that enter, exit, pass through or exist within MISO's market footprint. In general, webTrans is used to process Interchange Schedules with external entities and validate transactions against rules explained in BPM-007.

2.5.3 MISO Market Portal

MPs may submit Bilateral Transactions, Resource Offers, Demand Bids, and Virtual Transactions into the Energy and Operating Reserve Markets through MISO's Market Portal. The Market Portal also serves as the focal point for posting unrestricted (public) information and private information to authorized MPs.

3. Energy and Operating Reserve Market Requirements and Product Description

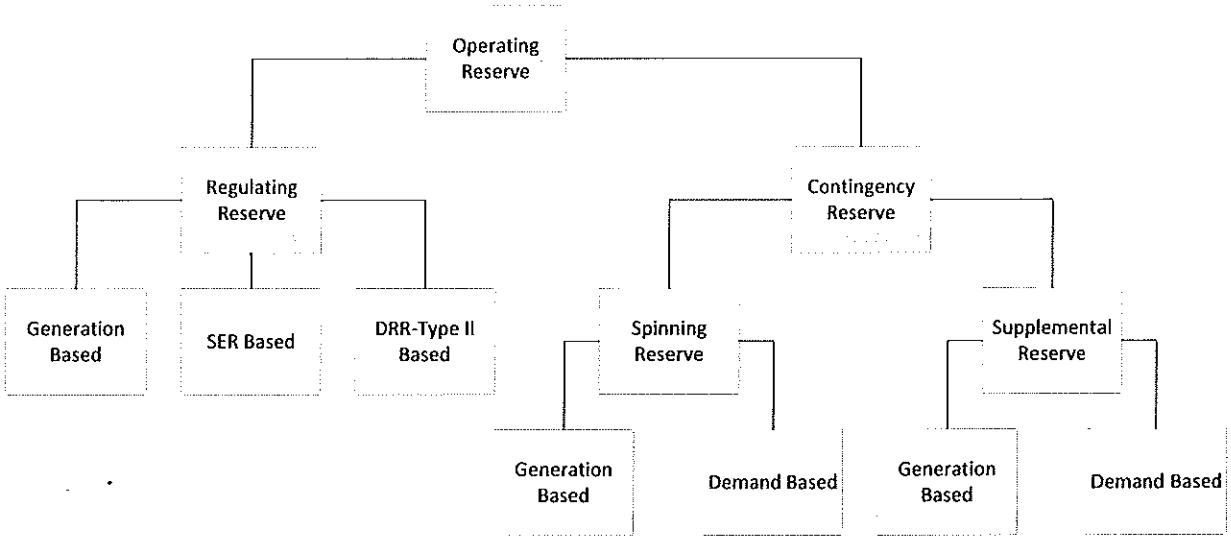
The following five products are traded in both the Day-Ahead and Real-Time Energy and Operating Reserve Markets to meet the MISO Energy and Operating Reserve Market requirements:

- Locational Energy;
- Regulating Reserve;
- Spinning Reserve;
- Supplemental Reserve;
- Ramp Capability.

Locational Energy is a commodity that is both purchased and sold by MPs to meet Energy requirements. Day-Ahead Energy requirements are based upon Demand Bids, Virtual Demand Bids and Export Schedules. Real-Time Energy requirements are based upon actual real-time metered deviations from Day-Ahead Energy requirements. Regulating Reserve, Spinning Reserve and Supplemental Reserve represent Ancillary Services procured to meet MISO Operating Reserve requirements to ensure reliable operation of the MISO Balancing Authority. The three Operating Reserve products are related through the Operating Reserve Hierarchy (See

Exhibit 2-5). Ramp Capability is used to reduce the occurrence of energy and reserve scarcity by reserving ramping capacity for future load variations and uncertainty. Ramp Capability does not fit within the hierarchy of Operating Reserves for the purpose of product substitution.

Exhibit 2-5: Operating Reserve Product Hierarchy



Based on the Operating Reserve Hierarchy, Operating Reserve is comprised of Regulating Reserve and Contingency Reserve; Regulating Reserve is comprised of Generation-based, DRR-Type II based and SER-based Regulating Reserve; Contingency Reserve is comprised of Generation-based and Demand-based Spinning Reserve and Generation-based and Demand-based Supplemental Reserve. This Section describes the Operating Reserve products and the methods used by MISO to calculate the Market-Wide and Zonal Regulating Reserve Requirements. The Market-Wide Operating Reserve Requirement is always equal to the sum of the Market-Wide Regulating Reserve Requirement and the Market-Wide Contingency Reserve Requirement.

3.1 Regulating Reserve Product and Requirements

The Regulating Reserve product and the methods used by MISO to set the Market-Wide and Zonal Regulating Reserve Requirements are described in the following subsections.

3.1.1 Regulating Reserve Product Description

Regulating Reserve products cleared in either the Day-Ahead or Real-Time Energy and Operating Reserve Market to meet either the Zonal or Market-Wide Regulating Reserve Requirements must meet the following criteria:

- All cleared Regulating Reserve products must be fully deployable in both the regulation-up and regulation-down directions within the Regulation Response Time. MISO will determine automatically the maximum amount of Regulating Reserve that

is fully deployable from a specific Resource within the Regulation Response Time based on active ramp rates and/or the clearing of other products on the Resource.

- The Regulation Response Time may be reviewed and adjusted if it is determined by MISO that the current setting is not providing acceptable reliability compliance at a reasonable cost.
- All Regulating Reserve products must be supplied by Regulation Qualified Resources, where Regulation Qualified Resources are Resources that are registered as such, meet the requirements outlined in Section 4.2 of this BPM for Regulation Qualified Resources and have their hourly Regulation Qualified Flag set to "True" for the Operating Hour in question.
- The amount of Regulating Reserve product that can be economically cleared on Stored Energy Resources is limited to be less than or equal to the Market-Wide Regulating Reserve Requirement. This could result in price separation between the SER-based Regulating Reserve product and the non-SER-based Regulating Reserve product. If an amount of Regulating Reserve greater than the Market-Wide Regulating Reserve Requirement is Self-Scheduled or offered with price zero by SERs, then the amount of Regulating Reserve cleared on SERs will be greater than the Market-Wide Regulating Reserve Requirement; however, this Regulating Reserve will not be eligible to substitute for other Operating Reserve products.

3.1.2 Market-Wide Regulating Reserve Requirements

MISO sets the Market-Wide Regulating Reserve Requirements based upon the follow criteria:

- The MISO Market-Wide Regulating Reserve Requirement will be established and posted for each hour of the Operating Day no later than 48 hours prior to the Operating Day. These hourly requirements will apply to both the Day-Ahead and Real-Time Energy and Operating Reserve Markets. The MISO Market-Wide Regulating Reserve Requirement may be adjusted for the Real-Time Energy and Operating Reserve Market if necessary due to an Emergency operating condition.
- The hourly Market-Wide Regulating Reserve Requirements will be reviewed daily to ensure acceptable compliance levels with Electric Reliability Organization standards and applicable Regional Entity standards related to control performance. Acceptable compliance levels are performance levels that meet reliability standards at a reasonable cost. Market-Wide Regulating Reserve Requirements will be set to comply with Electric Reliability Organization Standards related to control performance. Should these standards be modified, replaced or terminated, or should additional standards related to control performance be adopted, the method used to

set the hourly Market-Wide Regulating Reserve Requirements will be updated accordingly.

3.2 Contingency Reserve Product and Requirements

The Contingency Reserve product and the methods used by MISO to set the Market-Wide and Zonal Contingency Reserve Requirements are described in the following subsections.

3.2.1 Contingency Reserve Product Requirements

Contingency Reserve products cleared in either the Day-Ahead or Real-Time Energy and Operating Reserve Market to meet either the Zonal or Market-Wide Contingency Reserve Requirements must meet the following criteria:

- All cleared Contingency Reserve must be fully deployable within the Contingency Reserve Deployment Period. MISO will determine automatically the maximum amount of Contingency Reserve that is fully deployable from a specific Resource within the Contingency Reserve Deployment Period based on active ramp rates and/or the clearing of other products on the Resource.
- The Contingency Reserve Deployment Period will be governed by Reliability standards, but in no case will be set greater than 10.0 minutes. Based on Electric Reliability Organization ("ERO") Standard BAL 002-0, a Balancing Authority has 15.0 minutes (the Disturbance Recovery Period) to return its Area Control Error to the lesser of zero or the pre-disturbance Area Control Error level. MISO currently allows five minutes to notify Resources to deploy Contingency Reserve after the occurrence of a disturbance which requires a Contingency Reserve Deployment Instruction. Therefore, MISO will set the Contingency Reserve Deployment Period at 10.0 minutes, which is the difference between the Disturbance Recovery Period (15.0 minutes) and the notification time (5.0 minutes).
- Contingency Reserve will be comprised of Spinning Reserve and Supplemental Reserve. Spinning Reserve is Contingency Reserve supplied from Spin Qualified Resources whereas Supplemental Reserve is Contingency Reserve supplied from Supplemental Qualified Resources that are not Spin Qualified Resources. However, it is important to note that Spin Qualified Resources may supply Supplemental Reserve through product substitution.

3.2.2 Market-Wide Contingency Reserve Requirements

MISO sets the Market-Wide Contingency Reserve Requirements based upon the following criteria:

- The MISO Market-Wide Contingency Reserve requirement will be established and posted for each hour of the Operating Day no later than 48 hours prior to the Operating Day and will generally be the same value in each hour[3]. These hourly requirements will apply to both the Day-Ahead and Real-Time Energy and Operating Reserve Markets. The MISO Market-Wide Contingency Reserve Requirement may be adjusted anytime following the posting of the requirements 48 hours prior to the Operating Day if necessary due to changing reliability requirements, such as loss of most severe system contingency and MISO, in such cases, will post the revised requirements as quickly as possible.
- The hourly MISO Market-Wide Contingency Reserve Requirement will be set equal to the most restrictive requirement mandated by Electric Reliability Organization standards, applicable Regional Entity standards or applicable Contingency Reserve Sharing Agreement requirement allocations. In no case will the hourly MISO Market-Wide Contingency Reserve Requirement be set less than the largest single supply contingency (Resource or transmission). Currently, Electric Reliability Organization Standard BAL-002 indicates that, *"Each Responsible Entity shall develop, review and maintain annually, and implement an Operating Process as part of its Operating Plan to determine its Most Severe Single Contingency and make preparations to have Contingency Reserve equal to, or greater than the Responsible Entity's Most Severe Single Contingency available for maintaining system reliability".* The MISO Market-Wide Contingency Reserve requirement may be adjusted after the close of the Day-Ahead Energy and Operating Reserve Market for the Real-Time Energy and Operating Reserve Market if one or more events result in a different requirement level.
- The hourly Market-Wide Spinning Reserve requirement will be equal to the greater of i) the most restrictive frequency responsive Contingency Reserve requirement, expressed in MW or as a percent of Contingency Reserve, specified by Electric Reliability Organization standards, applicable Regional Reliability Organization standards and/or applicable Contingency Reserve Sharing Agreements or ii) the

[3] The Market-Wide Contingency Reserve Requirement may change in some hours during the Operating Day based upon changes to the most severe system contingency.

most restrictive spinning reserve requirement, expressed in MW or as a percent of Contingency Reserve, specified by Electric Reliability Organization standards, applicable Regional Reliability Organization standards and/or applicable Contingency Reserve Sharing Group agreements.

- Electric Reliability Organization Standard BAL-002 indicates that, following a supply contingency, a Balancing Authority or Reserve Sharing Group must restore their Contingency Reserve within the Contingency Reserve Restoration Period, which is defined in the standard as the 90 minute period following the end of the Disturbance Recovery Period. After the Contingency Reserve Restoration Period expires, the Real-Time Energy and Operating Reserve Market will restore the Market-Wide Contingency Reserve Requirement back to its pre-disturbance level. However, should there be capacity available to clear additional Market-Wide Contingency Reserve, the Real-Time Energy and Operating Reserve Market will clear additional Market-Wide Contingency Reserve up to the pre-disturbance Market-Wide Contingency Reserve requirement prior to the end of the Contingency Reserve Restoration Period.

3.3 Reserve Zone Establishment and Zonal Operating Reserve Requirements

MISO establishes and reconfigures Reserve Zone boundaries and sets the minimum Operating Reserve requirements for each Reserve Zone based upon the follow methodology:

3.3.1 Method to Establish Reserve Zones

One or more Reserve Zones will be established to ensure Regulating Reserve and Contingency Reserve are dispersed in a manner that prevents adverse operating conditions that affect the reliability of the Transmission System. Reserve Zone Configuration Studies will be performed, as described below, on a quarterly basis, in conjunction with the update of the Network Model, except as provided for under Section 3.3.1.1. Reserve Zone Configuration Studies establish the number of Reserve Zones and the assignment of Resource, Load and/or Interface Elemental Pricing Nodes to specific Reserve Zones concurrent with the update of the Network Model until the next scheduled update of the Network Model and results will be available to Market Participants electronically through downloadable files no less than seven (7) days prior to the date on which the new or reconfigured Resource Zones take effect, except as provided for under Section 3.3.1.1. It is important to note that due to the physical characteristics of Stored Energy Resources, the Regulating Reserve cleared on Stored Energy Resources is ineligible to satisfy Zonal Regulating Reserve Requirements.

In performing Reserve Zone Configuration Studies, MISO applies the following process to establish the Reserve Zones and assign Resource, Load and/or Interface Elemental Pricing Nodes to specific Reserve Zones:

- Utilizing a Network Model representation within the Reserve Zone study software for the target study period, identify all transmission constraints that could occur through Resource re-dispatch. Transmission constraint identification will include consideration of projected system demands and planned generation and transmission outages for the period;
- This list of transmission constraints is then screened to limit the applicable transmission constraints to only those that will have a significant impact on the Reserve Zone determination based on projected system demands and planned generation and transmission outages for the period;
- Once a final set of transmission constraints is identified, Resource, Load, and/or Interface Elemental Pricing Nodes are grouped based on similar impact on all of the remaining transmission constraints. The groups of Resource, Load and Interface Elemental Pricing Nodes represent the Reserve Zones. Multiple Resources and/or Loads normally connected at the same Elemental Pricing Nodes will all be included within a single Reserve Zone.
- Lastly, all remaining Resource, Load and Interface Elemental Pricing Nodes not assigned specifically through the Reserve Zone Configuration Study are assigned to a separate Reserve Zone that represents the remaining part of the system and the minimum Contingency Reserve requirement of this Reserve Zone is always equal to zero (0) MW. The minimum Regulating Reserve requirement for this Reserve Zone may be greater than zero as determined under Section 3.3.2.

3.3.1.1 Reserve Zone Reconfiguration

MISO may adjust the number of Reserve Zones and/or the assignment of Resource, Load and/or Interface Elemental Pricing Nodes to specific Reserve Zones as required if:

- A condition or event occurs, including, but not limited to, an unplanned transmission facility outage, a Generator Forced Outage, or an event of Force Majeure, as defined in Section 10.1 of the Tariff;
- Such condition or event results in an adverse reliability condition that cannot be resolved through operating procedures;
- Such condition or event has a projected duration of two or more Operating Days and;

- MISO determines such adjustment is necessary to ensure the reliability of the Transmission System.

The duration of any Reserve Zone adjustment will coincide with the duration of the condition or event, or until the next quarterly Reserve Zone Configuration Study update, whichever is less. MISO will publish a notice on OASIS identifying the reasons for any such Reserve Zone adjustment, and the expected duration. MISO will not implement an adjustment to a Reserve Zone without a minimum of a forty-eight (48) hour notice prior to the Operating Day for which the Reserve Zone adjustment will apply.

3.3.2 Method to Establish Minimum Zonal Operating Reserve Requirements

MISO identifies the minimum Zonal Operating Reserve Requirements through Reserve Zone Requirements Studies performed on a daily basis, the results of which are posted no later than 48 hours prior to each Operating Day. Reserve Zone Requirements Studies determine (i) the hourly Zonal Regulating Reserve Requirements for each Reserve Zone, (ii) the hourly Zonal Contingency Reserve Requirements for each Reserve Zone, and (iii) the hourly Zonal Spinning Reserve Requirements for each Reserve Zone.

In performing Reserve Zone Requirements Studies, MISO applies the following process to establish the minimum Operating Reserve requirements for each Reserve Zone:

- MISO tests each Reserve Zone established or reconfigured through the Reserve Zone Configuration Study by simulating the loss of each Resource inside the Reserve Zone and importing from the Resources with the highest impact on the transmission constraints identified in the Reserve Zone Configuration Study until a constraint limit is reached or the lost Resource is fully replaced. This step is repeated for each Resource in each Reserve Zone;
- The minimum Operating Reserve requirement is the largest difference between the Resource MW lost and the resulting import capability, but not less than the minimum Regulating Reserve requirements set forth below if applicable, and not greater than the total available Operating Reserve within the Reserve Zone following the loss of the largest Resource within the Reserve Zone;
- The minimum Regulating Reserve requirement for a Reserve Zone is equal to twenty-five (25) percent of the product of the Market-Wide Regulating Reserve Requirement and the ratio of the sum of the Maximum Regulation Capability of Resources within the Reserve Zone to the sum of the Maximum Regulation Capability of all Regulation Qualified Resources. If the resulting Regulating Reserve

Requirement for a Reserve Zone is less than ten (10) MW, the Regulating Reserve Requirement for that Reserve Zone is equal to zero (0) MW;

- The minimum Contingency Reserve requirement for a Reserve Zone is equal to the minimum Operating Reserve requirement of the Reserve Zone less the Regulating Reserve requirement of the Reserve Zone but not less than zero (0) MW. If the minimum Contingency Reserve requirement for a Reserve Zone is calculated to be less than ten (10) MW, the Contingency Reserve requirement for that Reserve Zone is equal to zero (0) MW;
- The minimum Spinning Reserve Requirement for a specific Reserve Zone is equal to twenty-five (25) percent of the product of the minimum Contingency Reserve requirement for that Reserve Zone and the ratio of the Market-Wide Spinning Reserve Requirement to the Market-Wide Contingency Reserve Requirement. If the resulting Spinning Reserve Requirement for a Reserve Zone be less than ten (10) MW, the Spinning Reserve Requirement for that Reserve Zone is equal to zero (0) MW; and
- The minimum Supplemental Reserve requirement for a specific Reserve Zone is equal to the minimum Contingency Reserve Requirement for the Reserve Zone less the minimum Spinning Reserve Requirement for the Reserve Zone.

3.4 Ramp Capability Product

The Ramp Capability product is described in the following subsections.

3.4.1 Ramp Capability Product Description

The Ramp Capability Product is cleared in the Day-Ahead or Real-Time Energy and Operating Reserve Markets to reserve ramp capability to respond to net load variations and includes the following features:

- The Up Ramp Capability and Down Ramp Capability requirements are designed to model both the expected net energy demand change and additional uncertain variation across all market processes and across different system operational conditions at a system level (zonal values will be calculated).
- The contribution of a resource to the ramp capability constraint is limited by its operating limits and its ramp rate over the modeled deployment time. No MP offer price is needed. MPs will be able to indicate their offered dispatch status as either "Economic" or "Not Participating".
- Ramp capability is not explicitly "deployed." Rather Ramp Capability prepositions resources so that adequate ramp is available in subsequent dispatch intervals. Ramp

Capability Requirement Demand Curve will enforce this constraint as a soft constraint. Cleared amounts will be reduced if the cost of violation is lower than the cost of economically dispatching energy to meet the Ramp Capability Requirement. The ramp capability product demand curves allow for relaxation for the ramp requirements at a relatively low cost when the resource ramping capability needs to be used in the current interval dispatch.

- Zonal ramp capability requirements are not required since post-deployment constraints ensure that the cleared ramp capability is deliverable to the load without violating transmission constraints after deployments. Although zonal requirements are not decided by the market clearing process and not a direct input, there may be pricing differences as determined by the post-deployment transmission constraints.
- Demand curves for the Up Ramp Capability and Down Ramp Capability products are defined which represent the value for the ramp capability service and provide a mechanism for limiting the clearing of ramp capability and the associated impact on prices when ramp capability is in short supply, e.g., when maintaining the ramp capability is infeasible or unduly expensive. Refer to the MISO Tariff Schedule 28 for more information about the ramp capability demand curve.
- The ramp capability constraints are added to the simultaneous co-optimization of the existing energy and Ancillary Services. The modeled costs include the re-dispatch opportunity cost associated with providing the ramp capability and the existing products and the demand curves for Up and Down Ramp Capabilities. When the ramp capability is "deployed" as energy dispatch during a subsequent Real-Time Dispatch, the simultaneous co-optimization of all products will select the most economical resources to respond with changes in energy output and to fulfill operating reserve and ramp capability requirements.

3.4.2 Ramp Capability Requirements

MISO sets the System-Wide Up and Down Ramp Capability Requirements based upon the following components:

- Net Load Uncertainty is a calculated value based on load forecast error, wind generation forecast errors and dispatchable resources not following set points. This calculated value is fixed for the up and down directions and applies to all case types for all intervals in the Day Ahead and Real Time Markets.
- Net Load Change is a calculated value based on load forecast change, wind generation change and NSI change. The Real-Time Market uses a deploy time

window of 10 minutes. The Day-Ahead Market and other forward processes scale the 10 minute window used in real-time to a deploy time window of one hour.

3.5 Load Forecasting

This subsection describes how MISO develops Load Forecasts for use in the Real-Time Energy and Operating Reserve Market.

3.5.1 High Level Description of Load

MISO needs a forecast of Load for the following purposes:

- The RAC process performed each day for the next several days and also for any RAC process performed current day for future hours of that day
- The LAC process performed for the rolling future hours
- The Real-Time 5-minute dispatch

The values that the Load Forecast represents for each of these purposes are the same and conceptually can be defined as follows:

- ***MISO Forecast Load:*** The Load (including losses) within the telemetered boundary of the MISO LBA members. This includes any Load served "Behind-the-Meter" where the Load and Generation Resources are explicitly modeled in the Network Model for reliability purposes. Load served by generation that MISO has not explicitly modeled in the Network Model is excluded[4].

MISO needs this Load to be at LBA granularity. The definition for the LBA forecast Load is as follows:

- ***Local Balancing Authority Forecast Load:*** The Load (including losses) within the telemetered boundary of a MISO LBA member. This includes any Load served Behind-the-Meter where the Load and generation are explicitly modeled in the Network Model for reliability purposes. Load served by generation that MISO has not explicitly modeled in the Network Model is excluded.

[4] Note that MISO uses ICCP Load data from its members to assist in producing the 5-minute Load Forecast. To be consistent with this definition, the ICCP Load value received from the LBAs should include Load served by generation behind the meter where the generation is included in the MISO Network Model. The forecast Load received from LBAs should also include this Load served by generation behind the meter where the generation is included in the Network Model. Load associated with a DRR-Type I should be submitted on a net basis (i.e., a host DRR-Type I Load of 50 MW that has a DRR-Type I Targeted Demand Reduction Level of 20 MW, should submit a 30 MW Load Forecast for hours in which the DRR-Type I is committed, assuming the load reduction actually occurs).

In addition, note that it is the telemetered boundary of the LBA, as determined by the real-time values included in the LBA's Actual Net Interchange that determines the LBA forecast Load.
For market Settlement purposes, MISO market Load is similar to MISO forecast load with the exception that Load served by Behind-the-Meter Generation Resources but explicitly modeled in the Network Model is excluded (i.e. Load is settled on a net metered basis) and the output of DRRs-Type I and DRRs-Type II is included as part of market Load. The definition of MISO market Load is as follows:

- ***MISO Market Load:*** The Load (including actual losses) within the telemetered boundary of the MISO LBA members. Load served by Generation Resources that MISO has not explicitly modeled in the Network Model or is explicitly modeled for reliability but commercially considered as Behind-the-Meter is not included in this Load. MISO market Load is the sum of the LBA market Load values at any point in time.

Hence, the definition for the LBA market Load is as follows:

- ***Local Balancing Authority Market Load:*** The Load (including actual losses) within the telemetered boundary of a MISO LBA member. Load served by Generation Resources that MISO has not explicitly modeled in the Network Model, or is explicitly modeled for reliability but commercially considered as Behind-the-Meter, is not included in this Load

3.5.2 Use of Load Forecast

3.5.2.1 Reliability Assessment Commitment

The goal of the RAC processes is to ensure that enough generation capacity is scheduled on-line to meet the Load and Operating Reserve requirements in the MISO BA. It is very important that this Load Forecast is as accurate as possible. A low Load Forecast has the potential of resulting in a capacity insufficiency, resulting in the need for Emergency procedures. On the other hand, a high Load Forecast could result in too much generation being committed by MISO, with the potential for uplift of commitment costs.

3.5.2.2 MP Estimation of Operating Reserve Obligations

The hourly mid-term MISO Balancing Authority Area Load Forecast developed for use in RAC is available to MPs through the MUI. Additionally, MISO provides percent of Load values for each Reserve Zone that represent the percentage of the MISO Balancing Authority Area Load Forecast that resides within each Reserve Zone (the sum of all Reserve Zone percentages will

be 100%). MPs can use this Load Forecast and Reserve Zone percentage data to estimate their Operating Reserve obligation on both a market-wide and zonal basis. A Market Participant will only need to estimate obligations on a zonal basis if the MP believes that a particular minimum Reserve Zone requirement will bind as illustrated in the following example.

Assume MISO posts the MISO BA Spinning Reserve requirement and Supplemental Reserve requirement, which is equal to 640 MW and 960 MW respectively, and a MISO Balancing Authority Load Forecast for Hour 15 of 70,000 MWh, 48 hours prior to the Operating Day to which the Contingency Reserve requirement applies. There are three Reserve Zones defined and Reserve Zone 4 is the remaining system Zone and Reserve Zone assumptions are defined in Exhibit 2-6 as follows:

Exhibit 2-6: Contingency Reserve Obligation Example

Reserve Zone	Minimum Contingency Reserve Requirement[5]	Minimum Spinning Reserve Requirement[6]	Minimum Supplemental Reserve Requirement[7]	Reserve Zone System Load Percentage	Reserve Zone Load[8] (Hour 15)
Zone 1	150	15	135	15%	10,500
Zone 2	250	25	225	10%	7,000
Zone 3	200	20	180	10%	7,000
Zone 4 (Remaining system)	0	0	0	65%	45,500

Further assume that MP1 has 2,500 MWh of Load located within Reserve Zone 1. If no Reserve Zones are binding (i.e., the amount of Contingency Reserve cleared within each Reserve Zone

[5] Determined by the Reserve Zone Requirements Study.

[6] The Spinning Reserve minimum requirement is equal to 25% of the minimum Contingency Reserve requirement multiplied by (640 / (640 +960)).

[7] The minimum Supplemental Reserve requirement is equal to the minimum Contingency Reserve requirement minus the minimum Spinning Reserve requirement.

[8] Reserve Zone Load Forecast equals Reserve Zone percentage multiplied by MISO BA Load Forecast of 70000 MWh.

exceeds the minimum requirement, thus causing no MCP separation), then MP1's Spinning Reserve and Supplemental Reserve obligations could be estimated as follows:

- MP1 Spinning Reserve obligation estimate = 640 MW * (2,500 MWh / 70,000 MWh) = 23 MW
- MP1 Supplemental Reserve obligation estimate = 960 MW * (2,500 MWh / 70,000 MWh) = 34 MW

MP1 would then have the option of Self-Scheduling 23 MW of Spinning Reserve and 34 MW of Supplemental Reserve from qualified Resources located anywhere within the MISO Balancing Authority Area to meet these obligations, as opposed to purchasing these obligations directly from the Energy and Operating Reserve Markets. In this case, if MP1 Self-Scheduled its entire obligation, a perfect hedge would be created since there is no MCP separation between Reserve Zones, assuming that the actual Load consumption in real-time was exactly equal to the forecast amounts in Hour 15.

If Reserve Zone 1 is binding (i.e., the amount of Contingency Reserve cleared in Reserve Zone 1 is exactly equal to minimum Contingency Reserve requirement and the Spinning Reserve and Supplemental Reserve MCP is greater than the minimum of remaining Reserve Zone MCPs), then MP1's Spinning Reserve and Supplemental Reserve obligations could be estimated as follows:

- MP1 Spinning Reserve obligation estimate = 15 MW * (2,500 MWh / 10,500 MWh) = 4 MW
- MP1 Supplemental Reserve obligation estimate = 135 MW * (2500 MWh / 10,500 MWh) = 32 MW

Again, MP1 would then have the option of Self-Scheduling 4 MW of Spinning Reserve and 32 MW of Supplemental Reserve from qualified Resources located anywhere within the MISO Balancing Authority Area to meet these obligations, as opposed to purchasing these obligations directly from the Energy and Operating Reserve Markets. In this case, however, if MP1 Self-Scheduled its entire obligation, a perfect hedge would not be created since there will be MCP separation between Reserve Zone 1 and the remaining Reserve Zone. MP1 will need to consider that if these obligations are Self-Scheduled on qualified Resources located outside of Reserve Zone 1, that these Self-Schedules may receive an MCP that is less than the MCP that Load located within Reserve Zone 1 will pay and adjust its Self-Schedules accordingly. MP1 would also have the option of purchasing these obligations directly from the Energy and Operating Reserve Markets.

3.5.2.3 Real-Time 5-Minute Dispatch

During the Real-Time 5-minute dispatch process, a MISO developed Load Forecast is developed and used on a 5-minute basis. The SCED will have as inputs this forecast Load for a 5-minute target period and all Interchange Schedules into or out of MISO at that same point in time[9].

To the extent that the actual MISO BA Load in Real-Time is different than the MISO BA 5-minute Load Forecast target, Regulation Capability in the MISO BA will make up for the difference, in response to AGC.

3.5.3 Source of Load Forecast

3.5.3.1 Reliability Assessment Commitment

For the RAC process, MISO requests that the LBA(s) provide a Load Forecast consistent with the above LBA Load Forecast definition at an hourly granularity for the next 7 days to MISO by the Day-Ahead Energy and Operating Reserve Market Offer deadline. MISO also produces a 7-day hourly forecast for the MISO BA. MISO requires MPs serving Load in an LBA to supply a forecast of their Load values to the LBA for the Load served by the MP if the LBA needs the data to develop the LBA forecast.

MISO will continuously evaluate which of these two sources of input produce the most accurate result and will utilize the most accurate source of this data for its RAC processes.

3.5.3.2 Look-Ahead Commitment and Real-Time 5-Minute Dispatch

MISO produces a Short Term Load Forecast ("STLF") for the MISO BA at a 5-minute granularity for multiple hours into the future, on a rolling basis. LBAs do not provide a forecast for this Real-Time dispatch process. The SCED, as well as the Look-Ahead Commitment ("LAC") process, utilize these 5-minute forecast Load targets during the dispatch process.[10] The STLF algorithm utilizes the real-time ICCP Load submitted by MISO LBAs and regression modeling.
See the *BPM-025 for Forecast Engineering* for a detailed description of STLF.

3.5.3.3 Pumped Storage Load

[9] For schedules that have been tagged as Dynamic Schedules, the estimated value submitted is used in the dispatch algorithm.

[10] The one exception to this is for non-conforming Loads, which is discussed in more detail below.

Load at a pumped storage facility when operating in pumping mode should be included in the Load Forecast supplied by the LBA for the RAC processes. ICCP values for the load and Generator should be sent to MISO. The Load measurement would be a positive value and the Generator measurement would be "zero" when pumping and vice versa when generating. During Real-Time, Load served by the pumped storage facility can be handled in the same manner as described below under non-conforming Loads. Although not required, it may provide more accuracy for submitting demand Bids in the Day-Ahead Energy and Operating Reserve Market if the pumped storage "Loads" are separated from larger Load Zones of conforming Loads. That will provide more control to Bid in zero Load at that location for expected generating times and specific Load amounts at expected pumping times. Load at pumping facilities may also qualify as a DRR-Type I or a DRR-Type II.

MPs may use all or any combination of the following options to participate in the Energy and Operating Reserve Markets:

- ***Bilateral Transactions*** – For both physical and financial agreements.
- ***Resource Offers*** – For the sale of Energy and Operating Reserve from Generation Resources, Demand Response Resources-Type I ("DRRs-Type I"), Demand Response Resources-Type II ("DRRs-Type II") and External Asynchronous Resources ("EAR"), or for the sale of Regulating Reserve from Stored Energy Resources, as price takers (via Self-Schedules, up to Self-Schedule MW level) or at variable prices.
- ***Demand Bids*** – For the purchase of Energy in the Day-Ahead Energy Market only, at market prices or at "not-to-exceed" prices at Load Zone Commercial Pricing Nodes ("CPNodes").
- ***Virtual Transactions*** – Offers to supply Energy or Bids to purchase Energy at any CPNode in the Day-Ahead Energy and Operating Market only and that are not related to any physical Resource or Load asset.

Exhibit 0-1 provides an overall summary of these options, which market they are applicable to and which software tools are used by MPs to initiate Offer and Bid submittal.

Exhibit 0-1: Market Participation Options

Options	Day-Ahead Energy and Operating Reserve Market Interface	Real-Time Energy and Operating Reserve Market Interface
Interchange Schedules ▪ Fixed (Normal / Dynamic) ▪ Up to TUC (Normal) (Day-Ahead Energy and Operating Reserve Market Only) ▪ Dispatchable (Normal) (Day-Ahead Energy and Operating Reserve Market Only)	/ E-Tag	/ E-Tag
Financial Schedules ▪ Fixed ▪ Pseudo-Tie ▪ Grandfathered Agreement	Market Portal ▪ finSched ▪ N/A ▪ finSched	Market Portal ▪ finSched ▪ finSched ▪ N/A
Generation Resource Offer	Market Portal	Market Portal
External Asynchronous Resource Offer	Market Portal	Market Portal
Demand Response Resource Type I ("DRR-Type I") Offer	Market Portal	Market Portal
Demand Response Resource Type II ("DRR-Type II") Offer	Market Portal	Market Portal
Stored Energy Resource Offer	Market Portal	Market Portal
Demand Bid	Market Portal	N/A
Virtual Supply Offer	Market Portal	N/A
Virtual Demand Bid	Market Portal	N/A
TUC = Transmission Usage Charge N/A = Not allowed finSched = Financial Scheduling Software		

The following subsections describe each of these four options in more detail.

4.1 Bilateral Transactions

Bilateral Transactions are contracts between parties for the transfer of Energy and financial responsibility for Energy from suppliers to consumers.

See the *BPM-007 for Physical Scheduling* for a detailed description of Bilateral Transactions.

4.1.1 Interchange Schedules

4.1.1.1 Interchange Schedule

An Interchange Schedule is submitted via a NERC E-Tag by an MP representing withdrawals and injections at specified locations. See the BPM-007 for Physical Scheduling for a detailed description of Interchange Schedules.

4.1.1.2 Import Schedule

If the Source Point is external to the MISO market footprint and the Sink Point is not, the Interchange Schedule is an Import Schedule.

See the *BPM-007 for Physical Scheduling* for a detailed description of the Spot In Market Product.

4.1.1.3 Export Schedule

If the Sink Point is external to the MISO market footprint and the Source Point is not, the Interchange Schedule is an Export Schedule.

See the *BPM-007 for Physical Scheduling* for a detailed description of the Spot In Market Product.

4.1.1.4 Through Schedule

If the Source Point and Sink Point are both external to the MISO Market Footprint, the Interchange Schedule is a Through Schedule.

See the *BPM-007 for Physical Scheduling* for a detailed description of the Spot In Market Product.

4.1.1.5 Within Schedule

If the Source Point and Sink Point are internal to the MISO market footprint, the Interchange Schedule is a Within Schedule.

See the *BPM-007 for Physical Scheduling* for a detailed description of the Spot In Market Product.

4.1.1.6 GFA Schedule

If the Source Point and Sink Point are internal to the MISO Market Footprint, the schedule is a GFA Schedule. GFA Schedules do not require confirmed reservations of Network Integration Transmission Service because the Transmission Service is provided according to the terms of a Grandfathered Agreement. Grandfathered Carve Outs will be physically scheduled within the Market Footprint GFA Schedule

4.1.2 Interchange Schedule Types

When creating an E-Tag for Interchange Schedules, each MP must select an Energy type, a transaction type, and a market type.

See the *BPM-007 for Physical Scheduling* for a detailed description of the Interchange Schedule Types.

4.1.2.1 Fixed Interchange Schedules

Fixed Interchange Schedules are physical transactions that do not specify a Bid or Offer ($/MWh).

See the *BPM-007 for Physical Scheduling* for a detailed description of the Interchange Schedule Types.

4.1.2.2 Dispatchable Interchange Schedules

Dispatchable Interchange Schedules are physical transactions that specify a Bid or Offer ($/MWh).

See the *BPM-007 for Physical Scheduling* for a detailed description of the Interchange Schedule Types.

4.1.2.3 Up-to-TUC Interchange Schedules

Up-to-TUC Interchange Schedules are physical transactions created via NERC E-Tag that specify a willingness to pay the TUC (in $/MWh) represented by a maximum amount beyond which the MP agrees to be curtailed.

See the *BPM-007 for Physical Scheduling* for a detailed description of the Interchange Schedule Types.

4.1.2.4 Dynamic Interchange Schedules Associated with External Asynchronous Resources ("EARs")

Fixed Dynamic Interchange Schedules associated with External Asynchronous Resources (EAR) are special types of schedules that are submitted at an EAR Resource CPNode (the Source Point).

See the *BPM-007 for Physical Scheduling* for a detailed description of the Interchange Schedule Types.

4.1.2.5 Grandfathered Carve Out Transactions

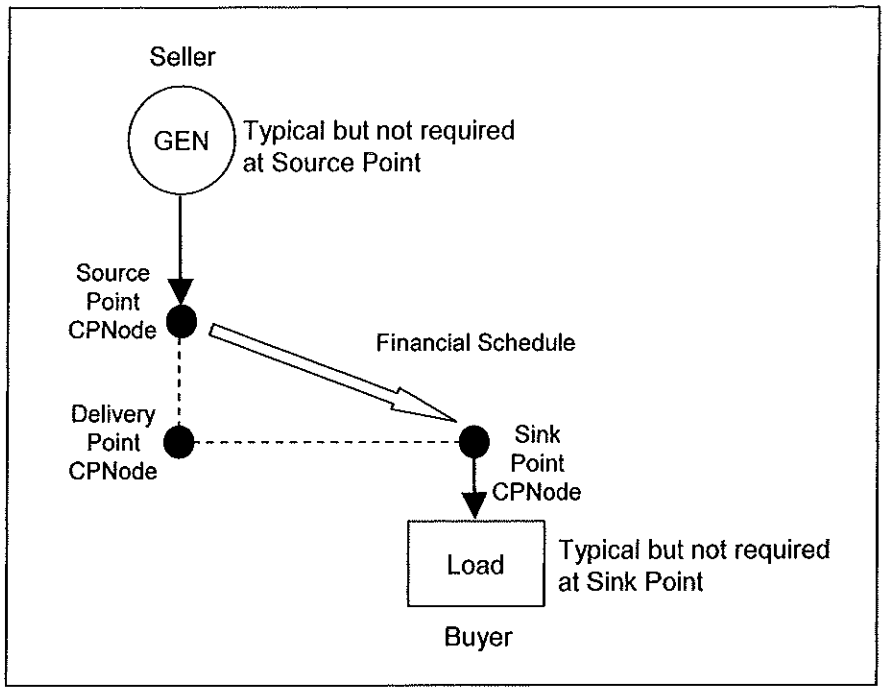
The Federal Energy Regulatory Commission determined that certain Grandfathered transactions would be carved out of the MISO market.

See the *BPM-007 for Physical Scheduling* for a detailed description of the Interchange Schedule Types.

4.1.3 Financial Schedules

Financial Schedules, also known as Financial Bilateral Transactions ("FBTs"), provide MPs with the ability to transfer the financial responsibility for Energy (not the physical flow of Energy) between buyers and sellers for the transfer of Energy within and across the Market Footprint. OASIS reservations are not required for Financial Schedules. Financial Schedules are defined in terms of three points in the Commercial Model as illustrated in Exhibit 0-2.

Exhibit 0-2: Financial Schedule – Definition



4.1.3.1 Rules for Financial Schedules

A Financial Schedule is a financial transaction in which the Source Point, the Sink Point, and the Delivery Point are any CPNodes within the Commercial Model, including Hubs and External Interfaces. Financial Schedules must be submitted through the finSched and may be submitted up to seven days prior to the Operating Day (OD-7), and must be submitted and approved prior to 1200 EST of the sixth day after the Operating Day (OD+6). FBTs must include the following information:

- The Contract Name for the Financial Schedule.
- Identification of the AOs included in the Financial Schedule.
- The CPNodes identified as the Source Point, the Sink Point, and the Delivery Point.
  - The Day-Ahead or Real-Time Energy and Operating Reserve Market for which the Financial Schedule is to be settled, using either the Day-Ahead Ex Post LMPs or Ex Post Real-Time LMPs.
- The scheduled volume in MWh for each hour of the Financial Schedule, using a granularity of tenths of MWh.
- Whether the Financial Schedule is a Financial Schedule for Deviations (by use of the "RSG Deviations Contract" checkbox) Financial Schedules for Deviations must be

submitted at least four hours prior to a given Market Hour (OH-4); submittals made less than four hours prior to a market hour will be rejected.

4.1.3.2 Types of Financial Bilateral Transactions

There are three types of Financial Schedules:

- ***Fixed*** – Fixed Financial Schedules are for a fixed number of MW and may be submitted in either the Day-Ahead or Real-Time Energy and Operating Reserve Markets. These transactions do not roll over from the Day-Ahead to the Real-Time Energy and Operating Reserve Markets.
- ***Pseudo-Tie*** – These Financial Schedules apply to the Real-Time Energy and Operating Reserve Market only as described by Exhibit 1-3.
- ***Grandfathered Agreement*** – These Financial Schedules apply to the Day-Ahead Energy Market only as described by Exhibit 1-4.

Exhibit 1-3: Pseudo-Ties (Real-Time Financial Schedules)

Attaining BA/LBA →	**External BA**	**MISO LBA**	**MISO LBA**
Native BA/LBA →	**MISO LBA**	**External BA**	**MISO LBA**
Load Pseudo-Tie	**Load in Native LBA:** Attaining BA is registered only for Congestion and Loss charges in MISO.	**Load in Native BA:** Pseudo-tie is assigned to Load Zone in Attaining LBA. Attaining LBA must have appropriate transmission service arrangements with Native BA.	**Load in Native LBA:** Pseudo-tie is assigned to Load Zone in Attaining LBA.
Generation Pseudo Tie: (Note: Resource partial Pseudo Tie is represented as two units in the Network Model)	**Generation in Native LBA:** All pseudo-tie units inside MISO must be registered and claimed by AOs. Pseudo-tie units transferred out of MISO are responsible for Congestion and Loss charges in MISO.	**Generation in Native BA:** Pseudo-tie unit transferred into MISO must be claimed by an AO. Pseudo-tie units not transferred into MISO do not need to be registered.	**Generation in Native LBA:** Both pseudo-tie units must be claimed by AOs.
Default AO	Attaining BA/LBA	Attaining BA/LBA	Attaining BA/LBA
Commercial Pricing Node for Pseudo Tie	External Interface CPNode and Pseudo Gen/Load CPNode for Congestion and Loss Charges	Internal Gen/Load CPNode	Attaining LBA's designated CPNode
Financial Schedule: via finSched	Financially Responsible AO is Buyer and Seller.	Financially Responsible AO is Buyer and Seller.	Financially Responsible AO is Buyer and Seller.

Note 1: Native BA means the BA within which the "pseudo" Load or generation is physically located.

Note 2: Attaining BA means the BA that is "sending" MW to the "pseudo" Load or is "receiving" MW from the "pseudo" generation.

Note 3: Pseudo-Tie MW values are calculated by the State Estimator and can be updated up until 1200 EST (OD+1).

Note 4: See Attachments A, B, and C of the *BPM for Network and Commercial Models* for further information.

Exhibit 1-4: Grandfathered Agreements (Day-Ahead Financial Schedules)

GFA Options →	Tariff Option A	Tariff Option B	Tariff Option C
Financial Transmission Right ("FTR")	FTR is held by GFA Responsible Entity	No FTR	No FTR
Cost of Congestion	GFA Responsible Entity is charged	GFA Responsible Entity is credited/charged	GFA Responsible Entity is charged
Cost of Losses	GFA Responsible Entity is charged	GFA Responsible Entity is credited/charged based on difference between Marginal Losses and System Losses	GFA Responsible Entity is charged
Excess Marginal Losses Pool Revenue	GFA Responsible Entity receives share	No share	GFA Responsible Entity receives share
FTR Administrative Costs	GFA Responsible Entity is charged	GFA Responsible Entity is charged	No Charge
Source Point	Any CPNode	Any CPNode	Any CPNode
Delivery Point	Any CPNode	Any CPNode	Any CPNode
Sink Point	Any CPNode	Any CPNode	Any CPNode
Note 1: DRRs are not valid CPNodes for GFA finScheds.			

4.1.3.3 Day-Ahead Transmission Usage Charges for Financial Schedules

MISO collects a Transmission Usage Charge ("TUC") (separated into congestion and loss components for surplus distribution) for all Day-Ahead Financial Schedules. The TUCs for the seller are calculated as the product of (i) the amount of Energy scheduled, in MWh, and (ii) the Day-Ahead Ex Post LMP at the Delivery Point CPNode minus the Day-Ahead Ex Post LMP at the Source Point CPNode. The TUCs for the buyer on the Day-Ahead FBT are calculated as the product of: (i) the amount of Energy scheduled, in MWh, and (ii) the Ex Post Day-Ahead LMP at the Sink Point CPNode minus the Day-Ahead Ex Post LMP at the CPNode for the specified Delivery Point.

4.1.3.4 Real-Time Transmission Usage Charges for Financial Schedules

MISO collects a TUC (separated into congestion and loss components for surplus distribution) for all Financial Schedules designated to be settled in the Real-Time Energy and Operating Reserve Market. The TUCs for the seller are calculated as the product of: (i) the amount of Energy scheduled, in MWh, and (ii) the Real-Time Ex Post LMP at the Delivery Point CPNode minus the Real-Time Ex Post LMP at the Source Point CPNode. The TUCs for the buyer are calculated as the product of: (i) the amount of Energy scheduled, in MWh, and (ii) the Real-Time

Ex Post LMP at the Sink Point minus the Real-Time Ex Post LMP at the specified Delivery Point.

4.2 Resource Offer Requirements

Resource Offers are submitted by MPs at Resource CPNodes for the purpose of selling Energy and Operating Reserve into the Day-Ahead and Real-Time Energy and Operating Reserve Markets and can be submitted for all types of Resources. The following are the types of Resources for which MPs may submit Offers: Generation Resources (including Jointly-Owned Generation Resources, Combined Cycle Resources, Cross Compound Resources, External Pseudo-Tied Generation Resources, Energy Limited Resources and Intermittent Resources), DRRs-Type I, DRRs-Type II, External Asynchronous Resources, and Stored Energy Resources. DRR-Type II Offer requirements are identical to Generation Resource Offer requirements and thus are combined under Section 4.2.3. Resource qualifications to provide Operating Reserve and Offer parameters are discussed for each Resource category (with Generation Resource and DRR-Type II combined) in the following Subsections.

4.2.1 Resource Qualifications and Eligibility to Provide Operating Reserve

The following subsections describe the requirements that must be met by any Resource in order to be qualified to submit Operating Reserve Offers for use in the Energy and Operating Reserve Markets. Error Exhibit 1-5 provides an Operating Reserve eligibility summary for Resources that are qualified to provide Operating Reserve and Ramp Capability.

Exhibit 1-5: Resource Eligibility Summary for Provision of Operating Reserve and Ramp Capability

Resource	Day-Ahead and Real-Time			
	Regulating Reserve	Spinning Reserve	Supplemental Reserve	Ramp Capability
Committed or on-line Generation Resources	✓	✓	✓	✓
Committed or on-line Generation Resources with Fixed Dynamic Schedule	✓*	✓*	✓*	✓*
Committed or on-line Demand Response Resources - Type II	✓	✓	✓	✓
Available External Asynchronous Resources	✓	✓	✓	✓
Available Stored Energy Resources	✓			
Available off-line or uncommitted Quick-Start Resources			✓	
Uncommitted Demand Response Resources - Type I		✓	✓	

* For a synchronized Generation Resource associated with a Fixed Dynamic Schedule to remain eligible, it must maintain an Hourly Economic Minimum Limit equal to or greater than the Dynamic Interchange Schedule cap limit associated with the resource and an Hourly Economic Maximum Limit greater than the Hourly Economic Minimum Limit.

4.2.1.1 Regulation Qualified Resource Requirements

Any Resource that meets the following criteria will be considered a Regulation Qualified Resource and may submit Offers for Regulating Reserve for use in the Energy and Operating Reserve Markets. All Regulation Qualified Resources must:

- be registered as an Regulation Qualified Resource asset in MISO Energy and Operating Reserve Markets;
- have the appropriate control equipment installed to be capable of providing Regulation Service;
- be capable of supplying Regulation Service in either the up or down direction within the Regulation Response Time;
- be capable of supplying Regulation Service for a continuous duration of 60 minutes;
- be capable of automatically responding to and mitigating frequency deviations via a speed governor or similar device;

- be capable of receiving and responding to automatic control signals on a 4 second periodicity, and providing telemetered output data that can be scanned every 2 seconds;
- if an External Asynchronous Resource, maintain firm point to point transmission service external to MISO in an amount equal to the Hourly Emergency Maximum limit of the External Asynchronous Resource for Imports into MISO, and an amount equal to the Hourly Emergency Minimum limit of the External Asynchronous Resource for Exports out of MISO;
- if an External Asynchronous Resource, use a Fixed Dynamic Interchange Schedule to transfer Energy into or out of the MISO Balancing Authority Area;
- if an external Resource, the entire Generation Resource or Stored Energy Resource must be Pseudo-tied into the MISO Balancing Authority Area, and must remain Pseudo-tied into the MISO Balancing Authority Area until the next Network Model update; and
- if a DRR-Type II, be physically located within the Market Footprint.

4.2.1.1.1 Day-Ahead Resource Eligibility

Regulation Qualified Resources that are eligible to provide Regulation Service in the Day-Ahead Energy and Operating Reserve Market are:

- Committed Generation Resources;
- Committed DRRs-Type II; and
- Available External Asynchronous Resources and Stored Energy Resources;

that have their hourly Regulation Qualified Resource availability flags set to "True".

4.2.1.1.2 Real-Time Resource Eligibility

Regulation Qualified Resources that are eligible to provide Regulation Service in the Real-Time Energy and Operating Reserve Market are:

- synchronized Generation Resources;
- synchronized DRRs-Type II; and
  available External Asynchronous Resources and Stored Energy Resources;

that have their hourly Regulation Qualified Resource availability flags set to "True".

4.2.1.2 Spin Qualified Resource Requirements

Any Regulation Qualified Resource, other than a Stored Energy Resource, is also to be registered as a Spin Qualified Resource. Regulating Reserves may be cleared and substituted

for Spinning Reserves on any Regulation Qualified and committed resource if it is economically efficient to do so. Resources that meet the following criteria are considered Spin Qualified Resources and may submit Offers for Spinning Reserve for use in the Energy and Operating Reserve Markets. All Spin Qualified Resources must:

- be registered as a Spin Qualified Resource asset in the MISO Energy and Operating Reserve Markets;
- be capable of automatically responding to and mitigating frequency deviations if required by Applicable Reliability Standards[11];
- be capable of deploying 100% of their cleared Spinning Reserve (including any Spinning Reserve cleared to meet Supplemental Reserve Requirements) within the Contingency Reserve Deployment Period;
- be capable of deploying 100% of their cleared Spinning Reserve for a continuous duration of 60 minutes or the maximum duration specified by Applicable Reliability Standards;
- be capable of providing telemetered output data that can be scanned every 10 seconds (except for DRRs-Type I, which must be capable of providing meter-before/meter-after data as described in the BPM for *Demand Response*);
- if an External Asynchronous Resource, maintain firm point to point transmission service external to MISO in an amount equal to the Hourly Emergency Maximum limit of the External Asynchronous Resource for Imports into MISO, and an amount equal to the Hourly Emergency Minimum limit of the External Asynchronous Resource for Exports out of MISO;
- if an External Asynchronous Resource, use a Fixed Dynamic Interchange Schedule to transfer Energy into or out of the MISO Balancing Authority Area;
- if an External Resource, the entire Generation Resource must be pseudo-tied into the MISO Balancing Authority Area, and must remain pseudo-tied into the MISO Balancing Authority Area until the next Network Model update; and
- if a DRR-Type I or DRR-Type II, be physically located within the Market Footprint.

[11] Current standards do not require Spinning Reserve to be frequency responsive.

4.2.1.2.1 Day-Ahead Resource Eligibility

Spin Qualified Resources that are eligible to provide Spinning Reserve in the Day-Ahead Energy and Operating Reserve Market are:

- Committed Generation Resources;
- Uncommitted DRRs-Type I with a Contingency Reserve Status of "online";
- Committed DRRs-Type II; and
- Available External Asynchronous Resources;

that have their hourly Spin Qualified Resources availability flags set to "True".

4.2.1.2.2 Real-Time Resource Eligibility

Spin Qualified Resources that are eligible to provide Spinning Reserve in the Real-Time Energy and Operating Reserve Market are:

- Synchronized Generation Resources;
- Uncommitted DRRs-Type I with a Contingency Reserve Status of "online";
- Synchronized DRRs-Type II; and
- Available External Asynchronous Resources;

that have their hourly Spin Qualified Resources availability flags set to "True".

4.2.1.3 Supplemental Qualified Resource Requirements

Any Regulation or Spin Qualified Resource is also to be registered as a Supplemental Qualified Resource. MISO may clear Regulating Reserves to substitute for Spinning or on-line Supplemental Reserves when it is economically efficient to do so. Only Resources registered as Quick Start will be eligible to clear as off-line Supplemental. The following requirements apply specifically to Resources that do not qualify as Spin Qualified Resources but are capable of providing Supplemental Reserve, with the exception that Demand Response Resources – Type I can offer Supplemental Reserves if qualified as Spin Qualified Resources. All Supplemental Qualified Resources must:

- be registered as an Supplemental Qualified Resource asset in the MISO Energy and Operating Reserve Markets;
- have a Minimum Run Time (or Minimum Interruption Time for DRRs-Type I) less than or equal to three hours if a Quick-Start Resource[12];

[12] The Quick-Start Resource designation is made and can be modified during the Asset Registration process.

- be capable of deploying 100% of their cleared Supplemental Reserve within the Contingency Reserve Deployment Period;
- be capable of deploying 100% of their cleared Supplemental Reserve for a continuous duration of 60 minutes or the maximum duration specified by Applicable Reliability Standards;
- be capable of providing telemetered output data that can be scanned every 10 seconds (except for DRRs-Type I which must be capable of providing meter-before/meter-after data as described in the BPM for *Demand Response*);
- if an External Asynchronous Resource, maintain firm point to point Transmission Service external to MISO in an amount equal to the Hourly Emergency Maximum limit of the External Asynchronous Resource for Imports into MISO and an amount equal to the Hourly Emergency Minimum limit of the External Asynchronous Resource for Exports out of MISO;
- if an External Asynchronous Resource, use a Fixed Dynamic Interchange Schedule to transfer Energy into or out of the MISO Balancing Authority Area;
- if an external Resource, the entire Generation Resource must be pseudo-tied into the MISO Balancing Authority Area, and must remain pseudo-tied into the MISO Balancing Authority Area until the next Network Model update; and
- if a DRR-Type I or DRR-Type II, be physically located within the Market Footprint.

Note: Offers for offline Quick Start Supplemental Qualified Resources should reflect what the Resource is expected to obtain within the Contingency Reserve Deployment Period, barring any mechanical problems or other extenuating circumstances encountered during the start up of the resource, while recognizing that these issues do occur.

4.2.1.3.1 Day-Ahead Resource Eligibility

Supplemental Qualified Resources that are not Spin Qualified Resources that are eligible to provide Supplemental Reserve in the Day-Ahead Energy and Operating Reserve Market are:

- uncommitted Quick-Start Resources (Only for offline Supplemental);
- committed Generation Resources;
- uncommitted DRRs-Type I with a Contingency Reserve Status of "offline";
- committed DRRs-Type II; and
- available External Asynchronous Resources;

that have their hourly Supplemental Qualified Resource availability flags set to "True".

4.2.1.3.2 Real-Time Resource Eligibility

Supplemental Qualified Resources that are not Spin Qualified Resources that are eligible to provide Supplemental Reserve in the Real-Time Energy and Operating Reserve Market are:

- uncommitted Quick-Start Resources (Only for offline Supplemental);
- synchronized Generation Resources;
- uncommitted DRRs-Type I with a Contingency Reserve Status of "offline";;
- synchronized DRRs-Type II; and
- available External Asynchronous Resources;

that have their hourly Supplemental Qualified Resource availability flags set to "True".

4.2.1.4 Ramp Capability Resource Requirements

Resources that are qualified for energy offer will have the Ramp Capability Dispatch Status offer parameter. Valid options for ramp capability dispatch status are "Economic" or "Not Participating" with the default status of "Economic." For DRR-Type I and Stored Energy Resources ("SERs"), the default dispatch status will be "Not Participating".

4.2.1.4.1 Day-Ahead Resource Eligibility

Resources that are eligible to provide Ramp Capability in the Day-Ahead Energy and Operating Reserve Market are:

- committed Generation Resources;
- committed DRRs-Type II; and
- available External Asynchronous Resources

4.2.1.4.2 Real-Time Resource Eligibility

Resources that are eligible to provide Ramp Capability in the Real-Time Energy and Operating Reserve Market are:

- synchronized Generation Resources;
- synchronized DRRs-Type II; and
- available External Asynchronous Resources

4.2.2 Scheduling Resource Outages

The Outage Scheduler status of Generation Resources, DRRs – Type II, and Stored Energy Resources is used, along with applicable offer information, to determine market availability in both the Day Ahead and Real Time Markets. In normal operating conditions, if a Generation Resource or Stored Energy Resource is listed in Outage Scheduler with an outage type of "Out of Service", the resource will be considered unavailable. Generation Resources or Stored

Energy Resources listed in Outage Scheduler with an outage type of "Economy" or "Deration" are considered as available. Further detailed Outage Scheduler information can be found in Section 6.1.6 below, as well as the BPM for *Outage Operations*.

4.2.3 Generation Resources and DRRs-Type II Offer Requirements

The following Subsection describes the economic and operational Offer data for Generation Resources and DRRs-Type II and how these data are used in commitment and dispatch decisions.

4.2.3.1 Offer Information Summary

Generation Resource and DRR-Type II Offers consist of data submitted by MPs for consideration in commitment and dispatch activities. Such Offer data may be submitted for the Day-Ahead and Real-Time Energy and Operating Reserve Markets.

Exhibit 1-6 and Exhibit 1-7 identify the data that may be included in a Generation Resource or DRR-Type II Offer and the markets in which they apply.

Exhibit 1-6: Generation Resource and DRR-Type II Economic Data Summary

Generation and DRR-Type II Offer Data	Units	Day-Ahead Schedule Offer	Real-Time Schedule Offer	Notes
Economic Offer Data				
Energy Offer Curve	MW, $/MWh	Hourly	Hourly	
No-Load Offer	$/hr	Hourly	Hourly	4
Regulating Reserve Capacity Offer	$/MWh	Hourly	Hourly	1
Regulating Reserve Mileage Offer	$/MW	Hourly	Hourly	1
Spinning Reserve Offer	$/MWh	Hourly	Hourly	1
On-Line Supplemental Reserve Offer	$/MWh	Hourly	Hourly	1,2
Off-Line Supplemental Reserve Offer	$/MWh	Hourly	Hourly	3
Hot Start-Up Offer	$	Daily	Daily	4
Intermediate Start-Up Offer	$	Daily	Daily	4
Cold Start-Up Offer	$	Daily	Daily	4
Self-Scheduled Regulation	MW	Hourly	Hourly*	1
Self-Scheduled Spinning Reserve	MW	Hourly	Hourly*	1
Self-Scheduled On-Line Supplemental Reserve	MW	Hourly	Hourly*	1,2
Self-Scheduled Off-Line Supplemental Reserve	MW	Hourly	Hourly*	3
Self-Scheduled Energy	MW	Hourly	Hourly*	

Note 1: If qualified
Note 2: If not Spin Qualified
Note 3: Quick-Start Resources only
Note 4: Default Offers are used if no values are submitted for Energy and Operating Reserve Markets
Note *: Offer parameters can be overwritten in Real-Time Market using Real-Time Offer Override (RTOE). Override is effective next dispatch interval

Exhibit 1-7: Generation Resource and DRR-Type II Operating Parameter Data Summary

Generation and DRR-Type II Offer Data	Units	Day-Ahead Schedule Offer	Real-Time Schedule Offer	Notes
Commitment Operating Parameter Offer Data				
Hot Notification Time	hh:mm	Hourly	Hourly*	
Hot Start-Up Time	hh:mm	Hourly	Hourly	
Hot to Intermediate Time	hh:mm	Daily	Daily	
Intermediate Notification Time	hh:mm	Hourly	Hourly	
Intermediate Start-Up Time	hh:mm	Hourly	Hourly	
Hot to Cold Time	hh:mm	Daily	Daily	
Cold Notification Time	hh:mm	Hourly	Hourly	
Cold Start-Up Time	hh:mm	Hourly	Hourly	
Maximum Daily Starts	Integer	Daily	Daily	
Maximum Daily Energy	MWh	Daily	Daily	
Minimum Run Time	hh:mm	Daily	Daily	
Maximum Run Time	hh:mm	Daily	Daily	
Minimum Down Time	hh:mm	Daily	Daily	
Commitment Status	Select	Hourly	Hourly	1
Maximum Daily Regulation Up Deployment	MWh	NA	Daily	9
Maximum Daily Regulation Down Deployment	MWh	NA	Daily	9
Maximum Daily Contingency Reserve Deployment	MWh	NA	Daily	9
Dispatch Operating Parameter Offer Data				
Hourly Economic Minimum Limit	MW	Hourly	Hourly*	1
Hourly Economic Maximum Limit	MW	Hourly	Hourly*	1,5
Hourly Regulation Minimum Limit	MW	Hourly	Hourly*	1,6
Hourly Regulation Maximum Limit	MW	Hourly	Hourly*	1,6
Hourly Emergency Minimum Limit	MW	Hourly	Hourly*	1
Hourly Emergency Maximum Limit	MW	Hourly	Hourly*	1,5
Maximum Off-Line Response Limit	MW	Hourly	Hourly*	1,4,6,8
Energy Dispatch Status	Select	Hourly	Hourly*	1
Regulating Reserve Dispatch Status	Select	Hourly	Hourly*	1,6
Spinning Reserve Dispatch Status	Select	Hourly	Hourly*	1,6
On-line Supplemental Reserve Dispatch Status	Select	Hourly	Hourly*	1,6
Off-line Supplemental Reserve Dispatch Status	Select	Hourly	Hourly*	1,4,6
Hourly Single-Directional-Down Ramp Rate	MW/min	N/A	Hourly*	1,3
Hourly Single-Directional-Up Ramp Rate	MW/min	N/A	Hourly*	1,3
Hourly Bi-Directional Ramp Rate	MW/min	N/A	Hourly*	1,3
Hourly Ramp Rate	MW/min	Hourly	Hourly	1,2,3
Single-Directional-Down Ramp Rate Curve	MW/min	N/A	Hourly	3
Single-Directional-Up Ramp Rate Curve	MW/min	N/A	Hourly	3
Bi-Directional Ramp Rate Curve	MW/min	N/A	Hourly	3
Combined Cycle Status	Select	Daily	Daily	
Forecast Maximum Limit	MW	N/A	Rolling 5-Min	7
Ramp Capability Dispatch Status	Select	Hourly	Hourly*	

Note 1: Default Offers are used if no values are submitted for Energy and Operating Reserve Markets
Note 2: Hourly Ramp Rate is used in Day-Ahead and RAC
Note 3: Ramp Rates may be submitted by MPs at any time and remain fixed until changed by MPs
Note 4: Only applicable to Quick-Start Resources
Note 5: Not applicable to Dispatchable Intermittent Resources in the Real-Time Market
Note 6: Not applicable to Dispatchable Intermittent Resources
Note 7: Only applicable to Dispatchable Intermittent Resources
Note 8: Participant-limited to the level achieved during last deployment or test of Offline Supplemental Reserves issued by MISO
Note 9: Only applicable to DRR-Type II Resources in Real-Time Market
Note *: Offer parameters can be overwritten in Real-Time Market using Real-Time Offer Override (RTOE). Override is effective next dispatch interval.

MISO maintains a Day-Ahead Schedule Offer[13] and a Real-Time Schedule Offer[14] for each Generation Resource and DRR-Type II. These Offers are standing Offers and maintained for each market independently of the other. Updates to Generation Resource and DRR-Type II Offers may be designated as updating the Day-Ahead Schedule Offer only, the Real-Time Schedule Offer only, or both.

The following two Subsections describe the Economic Offer Data and the Commitment and Dispatch Operating Data Offer Parameters specified in Exhibit 1-6 and Exhibit 1-7 in more detail.

4.2.3.2 Economic Offer Data

The economic Offer data parameters for Generation Resources and DRRs-Type II as identified in Exhibit 1-6 in more detail below.

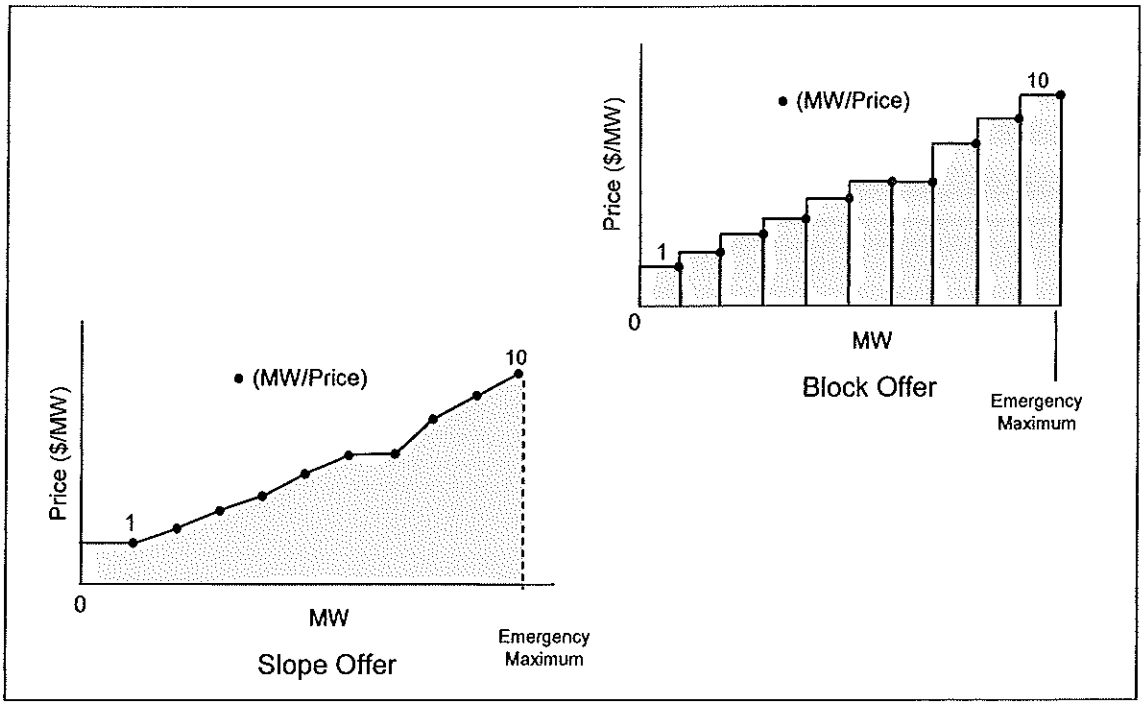
4.2.3.2.1 Energy Offer Curves (MW/Price Pairs)

Energy Offer MW/Price pairs are submitted as part of the Day-Ahead Schedule Offer, Real-Time Schedule Offer, or both. Up to ten MW/Price pairs may be submitted for each hour of the day for the Day-Ahead Energy and Operating Reserve Market and for the Real-Time Energy and Operating Reserve Market. Exhibit 1-8 illustrates the Energy Offer options.

[13] An Offer submitted for use in the Day-Ahead Energy and Operating Reserve Market clearing.

[14] An Offer submitted for use in any RAC process and for use in the Real-Time Energy and Operating Reserve Market clearing within the Operating Hour.

Exhibit 1-8: Types of Energy Offers



The MP may designate whether the MW/Price pairs are considered as a slope or block Offer. The MW values are accepted to the 10th of a MW and the Offer values from -$500 to $1,000. The MW/Price pairs must be monotonically increasing for price and strictly increasing for MW (e.g., 40 MW @ $2.00, 50 MW @ $2.00 are accepted; 40 MW @ $2.00 and 40 MW at $2.50 are not accepted due to the non-increasing MW values; and 40 MW @ $2.00, 50 MW @ $1.50 is not accepted due to the decreasing prices).

There is no connection between the MW/Price pairs for the Day-Ahead and Real-Time Energy and Operating Reserve Markets (i.e., Day-Ahead Schedule Offers only roll over to the next Day-Ahead Energy and Operating Reserve Market;. Day-Ahead Schedule Offers do not roll over into the Real-Time Energy and Operating Reserve Market and vice-versa.). A data submission to one hour of the Day-Ahead Energy and Operating Reserve Market does not affect the same hour for the Real-Time Energy and Operating Reserve Market and vice-versa. Designating the Offer MW/Price pairs as "slope" designates to the dispatch and commitment tools to interpolate a curve from the first MW point to the last MW point submitted. MPs must submit Offer MW/Price pairs for the entire operating range of the Resource up to and including the Hourly Emergency Maximum Limit. If Offer MW/Price pairs are not submitted for any hour for either

market, then the values are treated as the quantity zero (0). Generation Resource and DRR-Type II Offer MW/Price pairs are not cumulative, meaning if an MP submits an Offer MW/Price pair of 100 MW at $30 and 200 MW at $40 and the market clears at $40, the Resource clears 200 total MW.

4.2.3.2.2 Regulating Reserve Offers

Generation Resources and DRRs-Type II that are Regulation Qualified Resources may submit Regulating Reserve Offers in two parts: a Regulating Capacity Offer in $/MWh, and a Regulating Mileage Offer, in $/MW (of mileage), for use in the Energy and Operating Reserve Markets. A Regulating Reserve Offer consists of the summation of a Resource's Regulating Capacity Offer and the Resource's Regulating Mileage Offer multiplied by a deployment factor (i.e., Regulating Reserve Offer = Capacity Offer + factor*Mileage Offer). The Regulation Deployment Factor is updated for each calendar Operating Month, based on analysis performed for a one month period ending on the fifteenth of the month prior to the Operating Month. The factor is determined by first calculating the average ratio of deployed Regulating Mileage to cleared Regulating Capacity, averaged across all Resources providing Regulation, for each Dispatch Interval. This average is then multiplied by 12 to convert from average deployments per interval to average deployments per hour. The allowed range for Regulating Reserve Offers is currently -$500.00 to $500.00/MW. As with the Energy Offer Curves, there is no connection between the Regulating Reserve Offers for the Day-Ahead and Real-Time Energy and Operating Reserve Markets (i.e., Day-Ahead Schedule Offers only roll over to the next Day-Ahead Energy and Operating Reserve Market. Day-Ahead Schedule Offers do not roll over into the Real-Time Energy and Operating Reserve Market and vice-versa.). A data submission to one hour of the Day-Ahead Energy and Operating Reserve Market does not affect the same hour for the Real-Time Energy and Operating Reserve Market and vice-versa. If Regulating Reserve Capacity or Mileage prices are not submitted for any hour for either market, then the values are treated as the quantity zero (0).

DRRs-Type II may submit up to three MW/Price pairs for its Regulating Capacity Offer. Similar to Energy Offer Curves, the MP may designate whether the Regulation Offer MW/Price pairs are considered as a slope or block Offer. The MW values are accepted to the 10th of a MW and the Offer values from -$500 to $500. The MW/Price pairs must be monotonically increasing for price and strictly increasing for MW.

4.2.3.2.3 Contingency Reserve Offers

Generation Resources and DRRs-Type II that are Spin Qualified Resources may submit Contingency Reserve Offers in $/MW for use in the Energy and Operating Reserve Markets. The allowed range for Contingency Reserve Offers is currently -$100.00 to $100.00/MW. Generation Resources and DRRs-Type II that are Supplemental Qualified Resources but are not Spin Qualified Resources may submit Supplemental Reserve Offers in $/MW for use in the Energy and Operating Reserve Markets. The allowed range for Supplemental Reserve Offers is currently -$100.00 to $100.00/MW. As with the Energy Offer Curves, there is no connection between the Regulating Reserve, Spinning Reserve or Supplemental Reserve Offers for the Day-Ahead and Real-Time Energy and Operating Reserve Markets (i.e., Day-Ahead Schedule Offers only roll over to the next Day-Ahead Energy and Operating Reserve Market;. Day-Ahead Schedule Offers do not roll over into the Real-Time Energy and Operating Reserve Market and vice-versa.). A data submission to one hour of the Day-Ahead Energy and Operating Reserve Market does not affect the same hour for the Real-Time Energy and Operating Reserve Market and vice-versa. If Operating Reserve Offer prices are not submitted for any hour for either market, then the values are treated as the quantity zero (0).

DRRs-Type II may submit up to three MW/Price pairs for its Contingency Reserve Offers. Similar to Energy Offer Curves, the MP may designate whether the Contingency Reserve Offer MW/Price pairs are considered as a slope or block Offer. The MW values are accepted to the 10th of a MW and the Offer values from -$100 to $100. The MW/Price pairs must be monotonically increasing for price and strictly increasing for MW.

4.2.3.2.4 Start-Up Offers and No-Load Offers

The Cold Start-Up Offer, Intermediate Start-Up Offer and Hot Start-Up Offer may be submitted as part of the default Offer and then overridden on a daily basis for both Day-Ahead and Real-Time Schedule Offers. The No-Load Offer may be submitted as part of the default Offer and then overridden on an hourly basis for both Day-Ahead and Real-Time Schedule Offers. The Start-Up Offer and No-Load Offer are used in conjunction with Energy Offer Curves, Operating Reserve Offers and the Commitment and Dispatch Operating Parameters Offer data in the commitment and dispatch tools to determine the optimum commitment for the Day-Ahead Energy and Operating Reserve Market and the Real-Time Energy and Operating Reserve Market to meet the Energy and Operating Reserve requirements. The Real-Time Energy and Operating Reserve Market Start-Up Offers and No-Load Offers may be modified at any time prior to 1430 EPT (OD-1) for consideration in the pre Day-Ahead RAC. The Start-Up Offers may be only one value for each type of Start-Up for the day whereas the No-Load Offers may vary

for each hour of the day. If a Resource was started more than once per day during the commitment, each start would be considered separately.

4.2.3.3 Commitment Operating Parameter Offer Data

The Resource Offer parameters shown in Exhibit 1-7 associated with the starts, run time, and down time used in Day-Ahead Energy and Operating Reserve Market and RAC commitment and dispatch decisions are described in Exhibit 1-9.

Exhibit 1-9: Generation Resource and DRR-Type II Commitment Offer Parameters

Parameter	Validation	Use
Condition Times	The Hot to Cold Time and the Hot to Intermediate Time can only be submitted as part of the Day-Ahead and Real-Time Schedule Offer. The times are submitted in hh:mm format. The time prior to the Hot to Intermediate Time is considered as Hot.	The Hot to Cold Time and the Hot to Intermediate time are used in evaluating commitment in the Day-Ahead Energy and Operating Reserve Market commitment and the Real-Time Energy and Operating Reserve Market RAC. These parameters determine the Start-Up costs as a function of the unit state.
Start-Up Notification Times	The cold Start-Up Notification Time, intermediate Start-Up Notification Time and hot Start-Up Notification Time parameters are submitted as part of the Day-Ahead and Real-Time Schedule Offer. These times are accepted in hh:mm format. These values must be less than or equal to 23:59.	The notification times are used in evaluating the commitment in the Day-Ahead Energy and Operating Reserve Market and the Real-Time Energy and Operating Reserve Market. These parameters, in conjunction with the associated Start-Up Times establish the time required to start the unit from the applicable unit state of hot, intermediate, or cold.
Start Times	The cold Start-Up Time, intermediate Start-Up Time, and hot Start-Up Time parameters are submitted as part of the Day-Ahead and Real-Time Schedule Offer. These times are accepted in hh:mm format.	The cold Start-Up Time, intermediate Start-Up Time, and hot Start-Up Time are used in evaluating commitment in the Day-Ahead Energy and Operating Reserve Market and the Real-Time Energy and Operating Reserve Market. These parameters, in conjunction with the associated Notification Times establish the time required to start the unit from the applicable unit state of hot, intermediate, or cold.
Minimum Run Time	The Minimum Run Time is submitted as part of the Day-Ahead and Real-Time Schedule Offer. This time is accepted in hh:mm format.	MISO scheduled commitments in the Day-Ahead Energy and Operating Reserve Market and the Real-Time Energy and Operating Reserve Market are for at least as many consecutive hours as specified by Minimum Run Time. Commitment times may be for greater than the Minimum Run Time if a Resource is economic for additional hours.

Parameter	Validation	Use
Minimum Down Time	The Minimum Down Time is submitted as part of the Day-Ahead and Real-Time Schedule Offer. This time is accepted in hh:mm format.	The Day-Ahead Energy and Operating Reserve Market and the Real-Time Energy and Operating Reserve Market commitments respect the Minimum Down Time in determining when a unit is available for Start-Up.
Maximum Run Time	The Maximum Run Time is submitted as part of the Day-Ahead and Real-Time Schedule Offer. This time is accepted in hh:mm format.	The Maximum Run time restricts the number of hours a unit can be run during the Day-Ahead Energy and Operating Reserve Market or during a study period for the Real-Time Energy and Operating Reserve Market.
Maximum Daily Starts	The Maximum Daily Starts are submitted as part of the Day-Ahead and Real-Time Schedule Offer. These times are accepted in integer number of times.	The Maximum Daily Starts are the maximum number of times a unit may receive a Start-Up per day during the Day-Ahead Energy and Operating Reserve Market or during a study period of the Real-Time Energy and Operating Reserve Market.
Maximum Daily Energy	The Maximum Daily Energy is submitted as part of the Day-Ahead and Real-Time Schedule Offer, in MWh.	The Maximum Daily Energy is the maximum MWh a Resource is able to supply over a 24 hour period during the Day-Ahead Energy and Operating Reserve Market or during a study period of the Real-Time Energy and Operating Reserve Market.
Maximum Daily Regulation Up Deployment	The Maximum Daily Regulation Up Deployment is submitted as part of the Real-Time Schedule Offer, in MWh, and is only applicable to DRR-Type II resources.	The Maximum Daily Regulation Up Deployment is the maximum MWh a Resource is able to deploy as Regulation Up over a 24 hour Operating Day in the Real-Time Energy and Operating Reserve Market.
Maximum Daily Regulation Down Deployment	The Maximum Daily Regulation Down Deployment is submitted as part of the Real-Time Schedule Offer, in MWh, and is only applicable to DRR-Type II resources.	The Maximum Daily Regulation Down Deployment is the maximum MWh a Resource is able to deploy as Regulation Down over a 24 hour Operating Day in the Real-Time Energy and Operating Reserve Market.
Maximum Daily Contingency Reserve Deployment	The Maximum Daily Contingency Reserve Deployment is submitted as part of the Real-Time Schedule Offer, in MWh, and is only applicable to DRR-Type II resources.	The Maximum Daily Contingency Reserve Deployment is the maximum MWh of Contingency Reserves a Resource is able to deploy as Contingency Reserve over a 24 hour Operating Day of the Real-Time Energy and Operating Reserve Market.

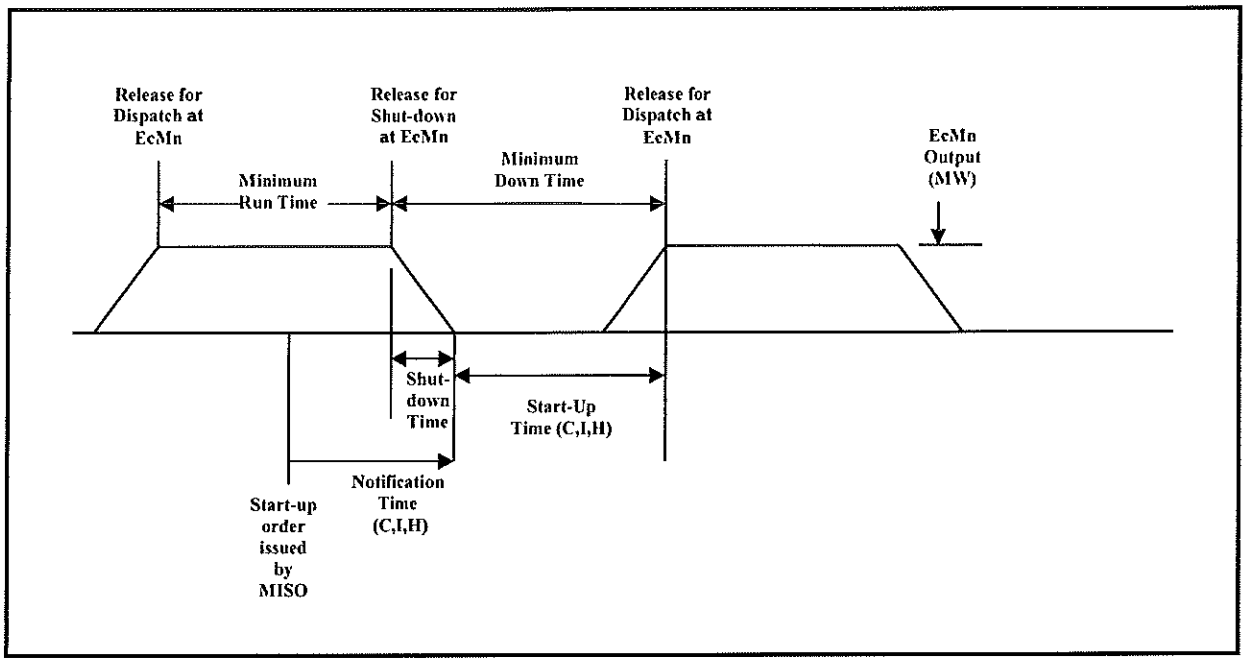
Further explanation of specific Resource parameters used for commitment purposes are provided below along with a graphical representation of how they tie together as depicted in

Exhibit 1-10:

- ***Start-Up Notification Time*** – The amount of notification time required by a Generation Resource prior to the initiation of start-up procedures or the amount of notification time required for a DRR - Type II prior to the initiation of demand reduction procedures. The minimum time required prior to receiving an order from MISO to initiate start-up procedures. Three different Start-Up Notification Times (hot, intermediate, and cold) can be submitted to allow the MP to reflect the difference in the length of time for each condition. For an off-line Quick Start Resource with cleared Contingency Reserve, the Notification Time is assumed to be zero for Contingency Reserve deployment purposes. Submitted notification times cannot exceed 23 hours, 59 minutes.
- ***Start-Up Time*** – The number of hours required to start a Generating Resource or DRR Type - II and synchronize with the MISO Region to Hourly Economic Minimum Limit consistent with the Applicable Reliability Standards. Three different Start-Up Times (hot, intermediate, and cold) can be submitted to allow the MP to reflect the difference in the length of time for each condition. For an off-line Quick Start Resource with cleared Contingency Reserve, the Start-Up Time is assumed to be zero for Contingency Reserve deployment purposes.
- ***Minimum Run Time*** – The minimum number of hours of operation at or above Hourly Economic Minimum Limit that the Resource owner requires MISO to recognize when committing the Resource. The Minimum Run Time applies from the point where the Resource is scheduled to be released for dispatch to MISO from Hourly Economic Minimum Limit to the point where MISO releases the Resource for shut down from Hourly Economic Minimum Limit. MPs should exclude the Start-Up Time and Shut-Down Time (as defined in

- Exhibit 1-10) from the Minimum Run Time to ensure the software recognizes the constraints described by all of the Resource parameters on cycling the Resource in the commitment process. Resources clearing in the DAM or committed in the RAC will have schedules for consecutive hours that are equal to or greater than the Minimum Run Time. For a Quick Start Resource with cleared Contingency Reserve, the Minimum Run Time must be 3 hours or less.
- ***Minimum Down Time*** – The minimum number of hours that the Resource owner requires between the time the Resource is released for shutdown by MISO and the time the Resource is scheduled to be released for dispatch to MISO. MPs should include the Shut-Down Time and the Start-Up Time (as defined in Exhibit 4-9) in the Minimum Down Time to ensure the software recognizes the constraints described by all of the Resource parameters on cycling the Resource in the commitment process. Resources clearing in the DAM or committed in the RAC will have schedules that do not violate the Minimum Down Time.

Exhibit 1-10: Generation Resource & DRR-Type II Operation Timeline



4.2.3.4 Dispatch Operating Parameter Offer Data

The Resource Offer parameters shown in Exhibit 1-7 associated with the Generation Resource and DRR-Type II dispatch used in Day-Ahead Energy and Operating Reserve Market and within the Operating Hour in the Real-Time Energy and Operating Reserve Market are described in the following Subsections.

4.2.3.4.1 Dispatch Limits and Ramp Rates

There are three sets of overall operating limits that can be submitted as part of the Day-Ahead Schedule Offer and Real-Time Schedule Offer data: Hourly Economic Minimum and Maximum Limits, Hourly Regulation Minimum and Maximum Limits and Hourly Emergency Minimum and Maximum Limits.[15] The Hourly Emergency Maximum Limit must be greater than or equal to the Hourly Economic Maximum Limit, which must be greater than or equal to the Hourly Regulation Maximum Limit, which must be greater than or equal to the Hourly Regulation Minimum Limit, which must be greater than or equal to the Hourly Economic Minimum Limit which must be greater than or equal to the Hourly Emergency Minimum Limit. A DRR-Type II may submit

[15] Dispatchable Intermittent Resources do not submit Hourly Economic, Regulation, or Emergency Maximum Limits as part of the Real-Time Schedule Offer data. See Section 4.2.3.4.2 for more information on DIR Forecast Maximum Limit.

dispatch limits less than zero and cover a negative operating range to reflect an associated load when not providing demand response. Additionally, there are three ramp rate options that can be submitted.

Exhibit 1-11 portrays the relationship between the normal and emergency dispatch limits and normal and Regulation limits.

Exhibit 1-11: Dispatch Limits

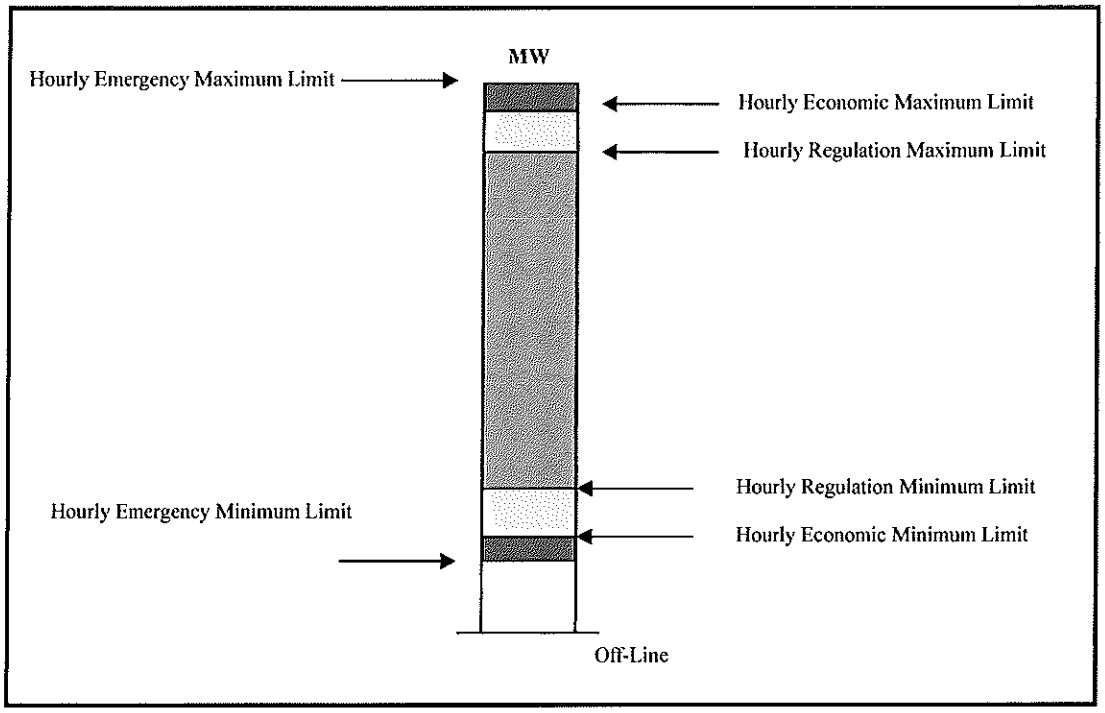


Exhibit 1-12 describes the use and validation of each of the ramp rates and limits.

Exhibit 1-12: Overall Ramp Rate and Limit Use

Limit	Validation	Use
Hourly Bi-Directional Ramp Rate or Bi-Directional Ramp Rate Curve	An Hourly Bi-Directional Ramp Rate may be submitted as part of the Real-Time Schedule Offer to override the default value. A Bi-Directional Ramp Rate Curve may also be submitted as part of the Real-Time Schedule Offer. If the Curve is submitted, it will always override the Hourly value.	The Hourly Bi-Directional Ramp Rate or the Bi-Directional Ramp Rate Curve is only applicable for use in real-time and will apply to Resources scheduled to potentially provide Regulating Reserve to limit the change in Energy Dispatch Target and/or limit the total amount of Operating Reserve that can be cleared on the Resource.
Hourly Single-Directional-Up Ramp-Up or Single-Directional-Up Ramp-Rate Curve	An Hourly Single-Directional-Up Ramp Rate may be submitted as part of the Real-Time Schedule Offer to override the default value. A Single-Directional-Up Ramp Rate Curve may also be submitted as part of the Real-Time Schedule Offer. If the Curve is submitted, it will always override the Hourly value.	The Hourly Single-Directional-Up Ramp Rate or the Single-Directional-Up Ramp Rate Curve is only applicable for use in Real-Time and will apply only to Resources not scheduled to potentially provide Regulating Reserve to limit the change in Energy Dispatch Target in the current Dispatch Interval in the up direction, and/or limit the total amount of Operating Reserve that can be cleared on the Resource. Values submitted for The Hourly Single-Directional-Up Ramp Rate or Single-Directional-Up Ramp Rate Curve must be greater than or equal to the values submitted for the Hourly Bi-Directional Ramp Rate or Bi-Directional Ramp Rate Curve.
Hourly Single-Directional-Down Ramp or Single-Directional-Down Ramp Rate Curve	An Hourly Single-Directional-Down Ramp Rate may be submitted as part of the Real-Time Schedule Offer to override the default value. A Single-Directional-Down Ramp Rate may also be submitted as part of the Real-Time Schedule Offer. If the Curve is submitted, it will always override the Hourly value.	The Hourly Single-Directional-Down Ramp Rate or Single-Directional-Down Ramp Rate Curve is only applicable for use in Real-Time and will apply only to Resources not scheduled to potentially provide Regulating Reserve to limit the change in Energy Dispatch Target in the current Dispatch Interval in the down direction Values submitted for The Hourly Single-Directional-Down Ramp Rate or Single-Directional-Down Ramp Rate Curve must be greater than or equal to the values submitted for the Hourly Single-Directional-Up Ramp Rate or Single-Directional-Up Ramp Rate Curve.
Hourly Ramp Rate	The Hourly Ramp Rate may be submitted as part of the Day-Ahead and Real-Time Schedule Offer to override the default value.	The Hourly Ramp Rate is used in the Day-Ahead Energy and Operating Reserve Market and all RAC processes but not within the Operating Hour.
Hourly Economic Minimum Limit	The Hourly Economic Minimum Limit may be submitted to override the default Offer, for both the Day-Ahead Schedule Offer and Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Economic Minimum Limit designates the minimum Energy available, in MW, from the Resource under non-Emergency conditions. This value may vary from hour to hour through submission in the Day-Ahead Schedule Offer and Real-Time Schedule Offer. The Overall Economic Minimum Limit affects both commitment and dispatch in both the Day-Ahead and Real-Time Energy and Operating Reserve Markets. Energy and Operating Reserve Market dispatch is from

Limit	Validation	Use
		Hourly Economic Minimum Limit to Hourly Economic Maximum Limit under normal conditions.
Hourly Economic Maximum Limit	The Hourly Economic Maximum Limit may be submitted to override the default Offer as part of the Day-Ahead Schedule Offer and/or Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Economic Maximum Limit designates the maximum Energy available, in MW, from the Resource under non-Emergency conditions. This value may vary from hour to hour through submission in the Day-Ahead Schedule Offer and Real-Time Schedule Offer. The Overall Economic Maximum Limit affects both commitment and dispatch in both the Day-Ahead and Real-Time Energy and Operating Reserve Markets. Energy and Operating Reserve Market dispatch is from Hourly Economic Minimum Limit to Hourly Economic Maximum Limit under normal conditions
Hourly Regulation Minimum Limit	The Hourly Regulation Minimum Limit may be submitted to override the default offer as part of the Day-Ahead Schedule Offer and/or Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Regulation Minimum Limit designates the minimum operating level, in MW, at which the Resource can operate while scheduled to potentially provide Regulating Reserves. This value may vary from hour to hour through submission in the Day-Ahead Schedule Offer and Real-Time Schedule Offer. The Hourly Regulation Minimum Limit does not affect commitment but may affect Energy dispatch in both the Day-Ahead and Real-Time Energy and Operating Reserve Markets.
Hourly Regulation Maximum Limit	The Hourly Regulation Maximum Limit may be submitted to override the default Offer as part of the Day-Ahead Schedule Offer and/or Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Regulation Maximum Limit designates the maximum operating level, in MW, at which the Resource can operate while scheduled to potentially provide Regulating Reserves. This value may vary from hour to hour through submission in the Day-ahead Offer and Real-Time Schedule Offer. The Hourly Regulation Maximum Limit does not affect commitment but may affect Energy dispatch in both the Day-Ahead and Real-Time Energy and Operating Reserve Market.
Hourly Emergency Minimum Limit	The Hourly Emergency Minimum Limit may be submitted to override the default Offer as part of the Day-Ahead Schedule Offer and/or Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Emergency Minimum Limit designates the lowest level of energy, in MW, the Resource can produce and maintain a stable level of operation under Emergency conditions.
Hourly Emergency Maximum Limit	The Emergency Maximum may be submitted to override the Default Offer as part of the Day-Ahead Schedule Offer and/or Real-Time Schedule Offer. The data value accepted may be to the tenth of a MW.	The Hourly Emergency Maximum Limit designates the highest level of Energy, in MW, the Resource can produce and maintain a stable level of operation under Emergency conditions.

4.2.3.4.2 DIR Forecast Maximum Limit

Since they are fuel-forecast dependent, Dispatchable Intermittent Resources ("DIRs") do not offer Hourly Regulation, Economic, or Emergency Maximum Limits to the Real-Time Energy and Operating Reserve Markets. Instead, each DIR submits a forecast of its maximum capability in Real-Time, via the MUI.

The participant-generated forecast is submitted on a rolling basis for a single DIR CPNode. The time-points of the data being submitted should align with each of the next twelve UDS interval times: (that is, they should end in 00, 05, 10, 15, 20, 25, 30, 35, 40, 45, 50, or 55). The earliest forecast point being submitted must be less than ten minutes beyond the time at which the data is submitted. For example, if a forecast is being submitted at time 11:27, then the earliest forecast point in the submittal must be either 11:30 or 11:35. If the earliest forecast point in the submittal is 11:40, then the submittal will not be accepted. Requiring the first forecast time to be less than ten minutes from the submittal time ensures that each UDS interval will have an updated forecast for that interval. The forecast submittal allows for submission of at least one and no more than twelve time-quantity pairs per submission. It is important to submit *more than two* data pairs with each forecast submittal. If only two forecast data points are provided with each submittal, it is possible for each submitted forecast to be received too late for MISO to utilize in the five-minute dispatch cycle. Each participant should make a determination of how frequently to submit twelve-part forecasts, given the nature of the fuel-forecast of their DIR. Forecast submissions should be made more frequently than every twenty minutes, since a forecast received more than 30 minutes prior to the UDS interval end-time will not be used, as shown below in the hierarchy for determining the Forecast Maximum Limit[16]:

- Operator Override, as provided by the DIR Resource Asset Owner will be used as the Forecast Maximum Limit;
- If no override is in place, then the Real-Time capability forecast as provided by the DIR Asset Owner, will be used as the Forecast Maximum Limit;
- If the Real-Time capability forecast submitted by the DIR Asset Owner is not provided, or is submitted to the MUI more than 30 minutes prior to the UDS interval end-time, or the value submitted is larger than the Resource's DIR Feasibility limit

[16] For more information regarding the submission of the participant-forecast, please see the *Market User Interface – Participant XML Specification*

times a technical margin, then the Real-Time capability forecast generated by MISO will be used as the Forecast Maximum Limit[17];

- If the Real-Time capability forecast generated by MISO is not provided, or is generated more than 30 minutes prior to the UDS interval end-time, or the value is larger than the Resource's DIR Feasibility limit times a technical margin, then the most recent State Estimated output for the DIR will be used as the Forecast Maximum Limit.

It is expected that a participant-forecast submittal frequency of two and a half to five minutes will be sufficient to adequately capture the changing fuel-forecast of a DIR.

The DIR Feasibility limit described above is submitted by each DIR Asset Owner during the quarterly model process, and is used to validate the quality of each submitted forecast. It is a measure of the maximum potential capability of the DIR at the CP-Node level, taking into account any incremental increases in Resource capability that may take place over the course of a quarterly model. By incorporating a check against this feasibility limit, a faulty submission larger than the feasible maximum will be discarded. MISO will increase each submitted feasibility limit by a small percentage, referred to as the technical margin in the description above, to ensure that only faulty data submissions are discarded in this way. For example: if a Resource with a DIR Feasibility Limit of 100MW submits a forecast of 102MW, the forecast will not be rejected. But if the Resource submits a forecast of 130MW, the forecast will be rejected.

MISO does not generate a Real-Time capability forecast for non-wind DIR Resources. For non-wind DIRs that do not submit a capability limit to be used as the Forecast Maximum Limit, the most recent State Estimated output for the DIR will be used as the Forecast Maximum Limit.

The Real-Time capability forecast generated by MISO is available to the Asset Owner of each wind-fueled DIR and/or Intermittent Resource, via the MUI. The capability forecast is provided to allow each DIR Asset Owner the information necessary to determine whether or not to submit a Real-Time capability forecast, and to allow owners of Intermittent Resources to gauge MISO's capability forecast when considering a transition to Dispatchable Intermittent Resource. For

[17] An option exists, that, when enabled, causes the forecast generated by MISO to be influenced by the State Estimated resource output. That is, if the option is enabled, then the greater of state estimated output and MISO's forecast will be used. This option ONLY affects intervals if activated, and ONLY when the MISO forecast is to be used, and not intervals when the participant-provided forecast is to be used.

more information on accessing the MISO Real-Time forecast, please see the *Market User Interface – Participant XML Specification.*

4.2.3.4.3 Intermittent Resource and DIR Day-Ahead Forecast

For reliability purposes, and in accordance with the Tariff, each Intermittent Resource and Dispatchable Intermittent Resource must submit to the Transmission Provider a Day-Ahead Forecast of its intended output for the next day. The Day-Ahead forecast is not financially binding on the Resource.

MISO provides a non-financially binding DIR and Intermittent Resource Reliability Forecast submittal process through which Asset Owners can submit forecasts of the expected output of their Intermittent Resources and/or DIRs. Day-Ahead Forecasts are communicated to MISO via the MUI, by accessing the "Submit IR Forecast" submittal. Day-Ahead Forecast data must be submitted by 1700EST on the day prior to each Operating Day. For technical information regarding the Day-Ahead reliability forecast, please see the *Market User Interface – Participant XML Specification.*

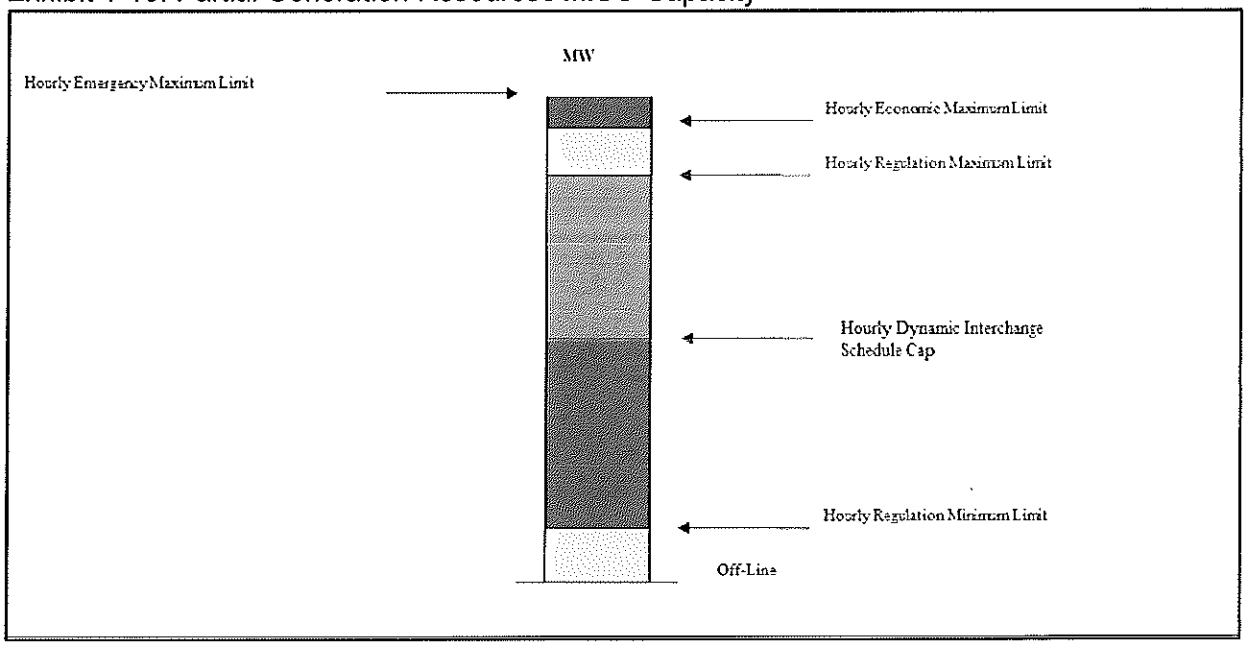
The following processes make use of the Day-Ahead Forecast:

- At the discretion of MISO, the Day-Ahead Forecast may be included in part or in whole into the Next-Day RAC, Multi-Day RAC and Intra-Day RAC study processes.
- For Intermittent Resources and DIRs that are designated as Capacity Resources for Module E purposes, the Day-Ahead Forecast is used to measure the Resource's daily capacity availability. For more information on this process, see the BPM for *Resource Adequacy.*

4.2.3.4.4 Partial Generation Resources associated with Fixed Dynamic Interchange Schedules

Partial Generation Resources associated with a Fixed Dynamic schedule to an external Balancing Authority ("BA") may maintain the remaining capacity associated with the Generation Resource within the MISO BA Area. Any portion of a Generation Resource dynamically scheduled to an external BA is not able to provide Ancillary Services to the external BA. Any capacity above the dynamically scheduled energy to an external BA Area is able to offer to provide Ancillary Services within the MISO BA Area.

Exhibit 1-13: Partial Generation Resources MISO Capacity



4.2.3.4.5 Temperature Sensitive Maximum Limits

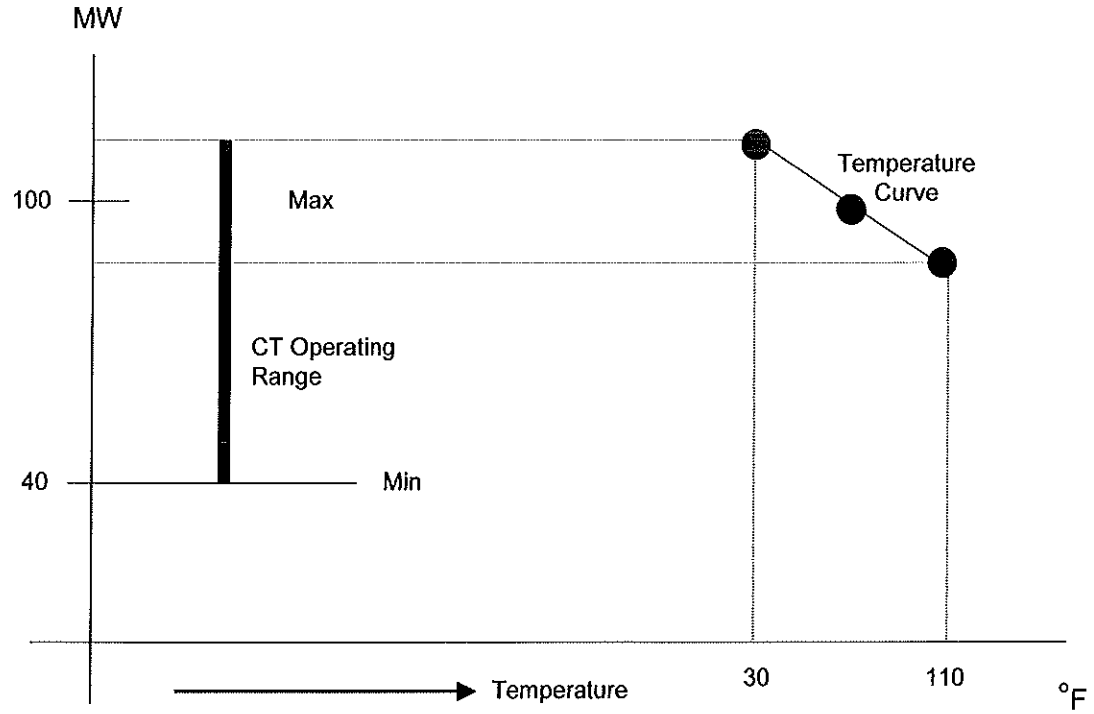
Temperature sensitive maximum limits specify MW maximum limits for Combustion Turbines ("CTs") and Combined Cycle CTs as a function of temperature. Temperature sensitive limits are composed of both normal temperature sensitive maximum limits and Emergency temperature sensitive maximum limits. Both normal and Emergency temperature sensitive maximum limits are comprised of a day-time temperature forecast (hour ending 0700 EST through hour ending 2200 EST)
and night-time temperature forecast (hour ending 2300 EST through hour ending 0600 EST) for an MP specified Weather Point and up to three maximum limit points:

- Temperature Sensitive Maximum Limit Low Point
- Temperature Sensitive Maximum Limit Mid Point
- Temperature Sensitive Maximum Limit High Point

An MP may have one or more Weather Points modeled for one or more units, with each unit pointing to only one Weather Point. Only units modeled through the registration process as CTs and Combined Cycle CTs may submit temperature sensitive maximum limits.

Exhibit 1-14 presents an example of the use of temperature sensitive limits.

Exhibit 1-14: Weather Curve Example



4.2.3.4.6 Resource Offer Commitment Status

Both Day-Ahead Schedule Offers and Real-Time Schedule Offers for Generation Resources and DRRs-Type II have an associated Offer commitment status. The commitment status impacts the considerations made in unit commitment. The five commitment statuses for Generation Resources and DRRs-Type II are:

- ***Outage*** – Designates the Resource is not available for consideration in Energy and Operating Reserve Markets commitment because the Resource is on a Generator Planned Outage or Generator Forced Outage.
- ***Emergency*** – Designates the Resource is available for commitment in Emergency situations only.
- ***Economic*** – Designates the Resource is available for commitment by MISO.
- ***Must-Run (self-commit)*** – Designates the Resource as committed per MP request and is available for dispatch by MISO.

- ***Not Participating***[18] – Designates that the Resource will not participate in the Day-Ahead and/or Real-Time Energy and Operating Reserve Market but is otherwise available.

The single value commitment status is submitted via the Day-Ahead Schedule Offer and Real-Time Schedule Offer and will override the default commit status. The default value is set during asset registration.

The Day-Ahead Energy and Operating Reserve Market and the Real-Time Energy and Operating Reserve Market may commit a unit outside of the hours it has submitted as "Must-Run" if the unit has an "Economic" status.

4.2.3.4.7 Resource Offer Dispatch Status

Dispatch Status can be selected on an hourly basis for Energy, Regulating Reserve, Spinning Reserve and Supplemental Reserve on a Resource by Resource basis as part of the Day-Ahead and Real-Time Schedule Offer and such selections will override the default dispatch status values. The default dispatch status values are set during asset registration.

Exhibit 1-15 shows the valid Dispatch Status selections. Dispatchable Intermittent Resources are not eligible to provide Operating Reserves, and therefore, do not provide Dispatch Statuses for Operating Reserve products.

Exhibit 1-15: Valid Dispatch Status Selections

Status	Product				
	Energy	Regulating Reserve	Spinning Reserve	On-Line[19] Supplemental Reserve	Off-line Supplemental Reserve[20]
Economic	√	√	√	√	√

[18] Not available to Resources designated as Capacity Resources for Module E Purposes

[19] Only applies to Resources that are not Spin Qualified Resources, or to Spin Qualified Resources that have selected "Not Qualified" for an Hour, and that are Supplemental Qualified Resources. Based on current reliability standards which do not require Spinning Reserve to be frequency responsive, resources that are synchronized to the system will always be Spin Qualified Resources.

[20] Only applicable to uncommitted Quick-Start Resources.

Status	Product				
	Energy	Regulating Reserve	Spinning Reserve	On-Line[19] Supplemental Reserve	Off-line Supplemental Reserve[20]
Self-Schedule	√	√	√	√	√
Emergency	N/A	N/A	N/A	N/A	√
Not Qualified	N/A	√	√[21]	√	√
Not Participating	N/A	√	N/A	N/A	√[22]

The five valid Dispatch Status selections and rules associated with each are as follows. The default value is set during asset registration.

- **Economic** – Designates that Generation Resources or DRRs-Type II that have been committed are available for dispatch by MISO and Dispatch Targets for Energy, Regulating Reserve, Spinning Reserve and Supplemental Reserve may be calculated for the Resource. For Generation Resources and DRRs-Type II that are Quick-Start Resources that have not been committed, only the selection for Off-Line Supplemental Reserve would apply.
- **Self-Schedule** – Indicates that the product is Self-Scheduled. The MW amounts of the Self-Schedules for Energy, Regulating Reserve, Spinning Reserve or Supplemental Reserve will be indicated as part of the Day-Ahead Schedule Offer or Real-Time Schedule Offer.
- **Not Qualified** – Indicates that Resource is not qualified to provide Regulating Reserve, Spinning Reserve, On-Line Supplemental Reserve and/or Off-Line Supplemental Reserve in an Hour. This status is only selected in the event of a physical Resource restriction that prevents the otherwise qualified Resource from providing the service in that Hour.

[21] Can only be selected if Regulating Reserve "Not Qualified" status is selected and Resource cannot meet reliability standards relating to provision of Spinning Reserve. Based on current reliability standards which do not require Spinning Reserve to be frequency responsive, resources that are synchronized to the system will always be Spin Qualified Resources.

[22] Not available to Resources designated as Capacity Resources for Module E purposes.

- **Not Participating –** Indicates that the Resource has elected not to provide either Regulating Reserve of Off-Line Supplemental Reserve in an Hour but is otherwise available to provide the service.
- **Emergency** – This option is only available to Generation Resources and DRRs-Type II that are Quick-Start Resources. Selection of this status option indicates that the Resource will be cleared for Off-Line Supplemental Reserve only in an Emergency.

4.2.3.4.8 Ramp Capability Dispatch Status

Ramp Capability Dispatch Status can be selected on an hourly basis on a Resource by Resource basis as part of the Day-Ahead and Real-Time Schedule Offer and such selections will override the default dispatch status values. The default dispatch status values are set during asset registration. The two valid Ramp Capability Dispatch Status selections and rules associated with each are as follows. The default value is set during asset registration.

- **Economic** – Designates that Generation Resources or DRRs-Type II that have been committed are available for ramp capability by MISO.
- **Not Participating –** Designates that Generation Resources or DRRs-Type II are not participating for ramp capability and won't be committed or dispatched to meet ramp needs.

4.2.3.4.9 Resource Self-Schedule

MPs may submit Self-Schedules, which consist of a fixed quantity (in MW) of Energy, Regulating Reserve and Spinning Reserve or On-Line Supplemental Reserve[23] per hour that may be dispatched from the Resource if it is on-line. In addition, an MP with a Quick-Start Resource may choose to Self-Schedule Off-Line Supplemental Reserve from that Resource.

- To submit a Self-Schedule for Energy, the MP submits a Resource Self-Schedule MW value for Energy and sets Energy Dispatch Status to Self-Schedule. If the Self-Schedule MW value is less than the Resource's Hourly Economic Maximum Limit, the Resource may be dispatched above the Self-Schedule MW amount, based upon the Resource's Energy Offer, on an economic basis as part of the Energy and Operating Reserve Markets clearing and dispatch process.
- To submit a Self-Schedule for Regulating Reserve, the MP submits a Resource Self-Schedule MW value for Regulating Reserve and sets the Regulating Reserve Dispatch Status to Self-Schedule. If the Self-Schedule MW value is less than the

[23] If not a Spin Qualified Resource.

Resource's Regulating Reserve capability, the Resource may clear Regulating Reserve above the Self-Schedule MW amount, based upon the Resource's Regulating Reserve Offer, on an economic basis as part of the Energy and Operating Reserve Markets clearing process. The maximum amount of Regulating Reserve that can be self-scheduled on a Resource is equal to the lesser of i) the applicable bi-directional ramp rate multiplied by the Regulation Response Time or ii) the difference between the applicable regulation maximum limit and regulation minimum limit divided by 2. The Self-Schedule MW value shall be relaxed if necessary to enforce Resources limits or ramp rates and may be relaxed if necessary to manage transmission congestion, the Sub-Regional Power Balance constraint, supply Energy and/or meet Operating Reserve requirements.

- To submit a Self-Schedule for Spinning Reserve or On-Line Supplemental Reserve, the MP submits a Resource Self-Schedule MW value for Spinning Reserve or On-Line Supplemental Reserve and sets the Spinning Reserve Dispatch Status or On-Line Supplemental Reserve Dispatch Status to Self-Schedule. If the Self-Schedule MW value is less than the Resource's Spinning Reserve or On-Line Supplemental Reserve capability, the Resource may clear Spinning Reserve or On-Line Supplemental Reserve above the Self-Schedule MW amount, based upon the Resource's Spinning Reserve Offer or On-Line Supplemental Reserve Offer, on an economic basis as part of the Energy and Operating Reserve Markets clearing process. The maximum amount of Contingency Reserve that can be self-scheduled on an on-line Resource is equal to the lesser of i) the applicable ramp rate multiplied by the Contingency Reserve Deployment Period or ii) the difference between the applicable maximum limit and minimum limit. The Self-Schedule MW value shall be relaxed if necessary to enforce Resources limits or ramp rates and may be relaxed if necessary to manage transmission congestion, the Sub-Regional Power Balance constraint, supply Energy and/or meet Operating Reserve requirements.
- Self-Schedules for Off-Line Supplemental Reserve can only be submitted for an uncommitted Quick-Start Resource that is a Supplemental Qualified Resource. To submit a Self-Schedule for Off-Line Supplemental Reserve, the MP submits a Resource Self-Schedule MW value for Off-Line Supplemental Reserve and sets the Off-Line Supplemental Reserve Dispatch Status to Self-Schedule. If the Self-Schedule MW value is less than the Resource's Maximum Off-Line Response Limit, the Resource may clear Off-Line Supplemental Reserve above the Self-Schedule MW amount, based upon the Resource's Off-Line Supplemental Reserve Offer, on an economic basis as part of the Energy and Operating Reserve Markets clearing

process. The maximum amount of Supplemental Reserve that can be self-scheduled on an off-line Resource is equal to the lesser of i) the Maximum Off-Line Response Limit or ii) the applicable economic maximum limit of the Resource. The Self-Schedule MW value shall be relaxed if it becomes necessary to commit the Resource.

In all cases, the minimum amount of Self-Schedule MW for Energy, Regulating Reserve, Spinning Reserve or Supplemental Reserve is equal to 1 MW, with the exception of Self-Scheduled Energy for DRR-Type II resources. A DRR-Type II may self-schedule Energy MW less than zero in its negative operating range.

Submitting a Self-Schedule value does not guarantee the unit is committed; the MP must designate the commitment status as "Must-Run" to achieve this result. A Self-Schedule is a price taker up to Self-Schedule MW level. Any amounts cleared above Self-Scheduled amounts are eligible to set price.

Submitted Self-Schedules will be reduced by MISO if such submitted schedules cannot be physically implemented based upon submitted Resource limits and ramp rates. Additionally, MISO may reduce accepted Self-Schedules as necessary to manage transmission constraints, the Sub-Regional Power Balance Constraint, maintain Operating Reserve requirements, satisfy Energy demand and/or maintain reliable operating conditions. In no case will the Transmission Provider violate the Resource limits or ramping capabilities.

4.2.4 Demand Response Resources-Type I ("DRR-Type I") Offer Requirements

The following Subsection describes the economic and operational Offer data for DRRs-Type I and how these data are used in commitment and dispatch decisions.

4.2.4.1 Offer Information Summary

DRR-Type I Offers consist of data submitted by MPs for consideration in commitment and dispatch activities. Such Offer data may be submitted for the Day-Ahead and Real-Time Energy and Operating Reserve Markets.

Exhibit 1-16 identifies the data that may be included in a DRR-Type I Offer and the markets in which they apply.

Exhibit 1-16: DRR-Type I Offer Data Summary

DRR-Type I Offer Data	Units	Day-Ahead Schedule Offer	Real-Time Schedule Offer	Notes
Economic Offer Data				
Energy Offer	$/MWh	Hourly	Hourly	2
Hourly Curtailment Offer	$/hr	Hourly	Hourly	2
Shut-Down Offer	$	Daily	Daily	2
Spinning Reserve Offer	$/MW	Hourly	Hourly	1, 2
Supplemental Reserve Offer	$/MW	Hourly	Hourly	1, 2
Self-Scheduled Spinning Reserve	MW	Hourly	Hourly	1
Self-Scheduled Supplemental Reserve	MW	Hourly	Hourly	1
Commitment and Dispatch Operating Parameter Offer Data				
Targeted Demand Reduction Level	MW	Hourly	Hourly	2, 3
Minimum Interruption Duration	hh:mm	Daily	Daily	3
Maximum Interruption Duration	hh:mm	Daily	Daily	3
Minimum Non-Interruption Interval	hh:mm	Daily	Daily	3
Shut-Down Time	hh:mm	Hourly	Hourly	3
Shut-Down Notification Time	hh:mm	Hourly	Hourly	3
Energy Commitment Status	Select	Hourly	Hourly	
Spinning Reserve Dispatch Status	Select	Hourly	Hourly	1
Supplemental Reserve Dispatch Status	Select	Hourly	Hourly	1
Maximum Daily Contingency Reserve Deployment	MWh	NA	Daily	1

Note 1: If qualified.
Note 2: The Targeted Demand Reduction is valid for the indicated hour. A DRR-Type I resource is capable of delivering this full reduction or no reduction, i.e., intermediate values are infeasible.
Note 3: Default Offers are used if no values are submitted for the day.

MISO maintains a Day-Ahead Energy and Operating Reserve Market Offer and a Real-Time Energy and Operating Reserve Market Resource Offer for each DRR-Type I. These Offers are standing offers and are maintained for each market independently of the other. Updates to DRR-Type I Offers may be designated as updating the Day-Ahead Energy and Operating Reserve Market Offer only, the Real-Time Energy and Operating Reserve Market Offer only, or both. If a submittal update is not received prior to the applicable Offer submittal timelines, the previous Offer data is in place and used unless otherwise removed or set to "Unavailable".

4.2.4.2 Economic Offer Data

The economic Offer data parameters for a DRR-Type I as identified in