Load Modifying Resources: ‘Soup to Nuts’

08 October 2019
Sample Questions to Address

• How does a company or organization register Load Modifying Resources (LMRs)?
• What are the types of LMRs and other demand resources?
• What kinds of information will a Market Participant (MP) need to provide or prepare?
• What kinds of requirements are faced by demand resources that want to participate in the various markets?
• How is a demand resource “output” measured and verified?
• How are payments & penalties determined?
Categories of Demand Resources

• The terminology surrounding demand resources can be confusing
  – Several categories use similar words
    (e.g. demand resources, demand response resources)
  – Not necessarily exclusive definitions
    (e.g. an LMR can also provide EDR service)
  – Same words used both generically and specifically (per Tariff)
    (e.g. demand resource and Demand Resource, btmg and BTMG)

• Classification ultimately depends on two issues:
  – What are the physical capabilities of the resource?
    • Can the resource perform at varying levels of power/energy?
    • Metering capability
  – What responsibilities is the resource operator willing to accept?
    • Will the resource be available during a system emergency?
Outline

• Principles underlying demand resource participation in MISO markets
• Market activities that demand resources can potentially participate
• Types of demand resources
• Load Modifying Resources
  – Registration, testing & accreditation
  – Modeling
  – Availability reporting
  – Deployment procedures
  – Meter data submission & settlement
• Current issues under the MISO tariff and business processes
  – MP’s perspective and potential barriers to participation
Principles
Demand Resources: MISO Market Philosophy

MISO market philosophy

• open wholesale energy market where Market Participants can buy or sell energy in fair, efficient and non-discriminatory markets, while providing reliable grid operation
• markets work best when there is *vigorous* and *voluntary* participation by both buyers and sellers
  – demand response can reduce the need for new generating capacity
  – demand response can address real-time reliability issues
  – demand response can mitigate peak prices and price volatility
  – demand response can limit supplier market power
MISO market philosophy continued

• MISO market structures seek to provide opportunities for demand to participate on a comparable basis as supply side resources.
  – ability to make consumption decisions based on the value of energy consumed compared to the prevailing market price

• Demand-side
  – ability to offer and monetize the value of flexibility that can be offered to dynamically balance market supply and demand

• Supply-side
MISO currently has no demand-side “programs”

- “program” as used in some jurisdictions typically refers to temporary initiatives to promote a certain activity or action
- “program” also may provide side-payments for participation
  - funded by charges socialized across some/all MPs
- MISO approach is to provide market mechanisms that provide opportunities and incentives for full participation
- states, utilities and retail providers in the MISO footprint do have demand “programs”
Order 719

• On 28 April 2009, MISO submitted a compliance filing that responded to Order 719 requirements related to:
  – Ancillary services provided by DRRs
  – Eliminating deviation charges during system emergencies
  – Price formation during periods of operating reserve shortage
  – Reporting of barriers to comparable treatment of DRRs
  – Long-term power contracting
  – Market monitoring.

• On 2 October 2009, MISO submitted a second compliance filing that presented its proposal for facilitating ARC participation.
Aggregators of Retail Customers (ARCs) (Tariff 38.6)

• ARCs are Market Participants that combine the abilities of one or more retail customers to “provide” electricity in the wholesale markets
  – demand response resources (DRR and DR) “provide” energy by reducing the amount of electricity purchased from the grid
  – behind-the-meter generation supplies energy

• ARCs can combine customers, but only under certain circumstances
  – All customers receive service within a single LBA
  – The relevant electricity retail regulatory authority (RERRA) must allow customer participation (either directly or implicitly)

• An example of an ARC might be a business entity that combines several large retail businesses, each of which is able to turn off lighting in certain areas of their buildings’

• ARC registration instructions are included in BPM-001
Each Commission-approved independent system operator or regional transmission organization that has a tariff provision permitting demand response resources to participate as a resource in the energy market by reducing consumption of electric energy from their expected levels in response to price signals must:

(A) pay to those demand response resources the market price for energy for these reductions when these demand response resources have the capability to balance supply and demand and when payment of the market price for energy to these resources is cost-effective as determined by a net benefits test accepted by the Commission;

(B) allocate the costs associated with demand response compensation proportionally to all entities that purchase from the relevant energy market in the area(s) where the demand response reduces the market price for energy at the time when the demand response resource is committed or dispatched.
Market Activities
MISO Can Employ Demand Response to…

- **Economic Demand Response (Energy)**: Reduce loads whose values to end use customers are less than the costs of serving those loads.
- **Operating Reserves Demand Response**: Provide regulating, contingency or ramp reserves.
- **Planning Resources Demand Response**: Substitute for generating capacity.
- **Emergency Demand Response**: Reduce demand during system emergencies.
Demand Response Resource (DRR) refers to a resource type: one that provides service to the energy and ancillary services market.

- **Demand Response Resource (DRR)-Type I:**
  - Resource owned by a single Load Serving Entity, or an ARC within the MISO BAA and that (i) is registered to participate in the Energy and Operating Reserve Markets, (ii) that is capable of supplying a specific quantity of Energy, Contingency Reserve or Capacity … through Behind the Meter Generation and/or controllable Load, (iii) is capable of complying with the Transmission Provider’s instructions, and (iv) has the appropriate metering equipment installed.

- **Demand Response Resource (DRR)-Type II:**
  - Resource owned by a single Load Serving Entity, or an ARC within the MISO BAA and that (i) is registered to participate in the Energy and Operating Reserve Markets, (ii) is capable of supplying a range of Energy, Operating Reserve, Up Ramp Capability and/or Down Ramp Capability...through Behind-The-Meter generation and/or controllable Load, (iii) is capable of complying with Transmission Provider’s Setpoint Instructions and (iv) has the appropriate metering equipment installed.
Demand Resource Participation

**Day-ahead E&OR Market:** Demand Design Elements

- **Fixed Demand Bid** – LSEs indicated an amount to be purchased, regardless of price (~85% of market demand on a daily basis)
- **Price Responsive Demand (PRD)** – LSEs submit PRD bids, either “physical” or “virtual,” to manage price risk (~15% of market demand on a daily basis)
- **DRRs** – Treated in nearly all respects like generation; DRRs are evaluated and cleared based on offer components, including start, notification and minimum run times, availability offers
  - Value in submitting a DRR offer instead of a PRD bid is that MISO will respect the DRR’s operational characteristics, which may reflect, for example, physical limitations associated with starting and stopping industrial processes
Demand Resource Participation

Real-time E&OR Market: Demand Design Elements

• Price Responsive Demand (PRD) – LSEs cannot submit PRD bids in this market yet, but instead manage their exposure to volatile prices by responding to Real-Time clearing prices

• Demand Response Resources (DRRs) – DRRs can be dispatched based on economics, in the same manner as a supply-side resource
Resource Adequacy Construct

- **Load Modifying Resource (LMR):**
  - A Demand Resource or Behind the Meter Generation Resource.

- **Behind the Meter Generation (BTMG):**
  - Generation resources used to serve wholesale or retail load located behind a CP-Node that are not included in the Transmission Provider’s set-point Instructions and in some cases can also be deliverable to Load located within the Transmission Provider Region using either Network Integration, Point-To-Point Transmission Service or transmission service pursuant to a Grandfathered Agreement. These resources have an obligation to be made available during Emergencies.

- **Demand Resource (DR):**
  - Interruptible Load or Direct Control Load Management and other resources that can reduce Demand during Emergencies.

Load Modifying Resource (LMR) is a category that refers to the use of a demand resource toward meeting Planning Reserve Margin Requirement (PRMR).
Demand Resource Participation

**Capacity construct:** Demand Design Elements
- MISO’s Module E includes the ability of demand response to fulfill capacity requirements
  - Includes Price Responsive Demand (PRD)

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**MISO FERC Electric Tariff MODULES**

**69A.3.3**
Load Modifying Resources
32.0.0

**Load Modifying Resources**
Load Modifying Resources can be offered as ZRCs in the PRA/TPRA or can be used in FRAPs pursuant to Section 69A.9. As described below, a Demand Resource or a BTMG is eligible to qualify as a Load Modifying Resource if it meets the following requirements. All LMRs that are cleared in the PRA/TPRA or were submitted in a FRAP must be available for use in the event of an Emergency as declared by the Transmission Provider, pursuant to the Emergency operating procedures of the Transmission Provider, unless replaced with other ZRCs pursuant to Section 69A.4.1.2. Transmission providers must take adequate steps to ensure...
Emergency Operating Procedures

- **Emergency Demand Response (EDR):**
  - The commitment and dispatch of Load reductions, Behind the Meter Generation Resources and other Demand Resources during an Emergency, in accordance with Schedule 30.
Demand Resource Participation

**Emergency service:** Demand Design Elements

- MISO’s Schedule 30: EDRs were created to enable more demand resources to help the system during Emergency conditions, without necessarily qualifying for the more involved.

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**SCHEDULE 30**

**EMERGENCY DEMAND RESPONSE INITIATIVE**

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**I. GENERAL**

Schedule 30 provides for the commitment and dispatch of interruptible demand, behind-the-meter generation and other demand resources that are capable of helping meet the energy balance during NERC Energy Emergency Alert 2 (“EEA2”), Alert 3 (“EEA3”), or any other types of Emergency events. Schedule 30 provides procedures for the Transmission Provider to be able to dispatch such resources (“Emergency Demand Response” or “EDR”) during.
Demand Resource Types
Resources, Categories, Services

Demand Response Resource (DRR) refers to a resource type: one that provides service to the energy and ancillary services market.

Emergency Demand Response (EDR) is a service that refers to the use of a demand resource under a specific Tariff schedule.

Load Modifying Resource (LMR) is a category that refers to the use of a demand resource toward meeting Planning Reserve Margin Requirement (PRMR).
Demand Resource Registration Options

As this figure shows, there are many options available for demand response registration. Note that not all of these configurations have been used by MISO Market Participants, but they are available if desired.

<table>
<thead>
<tr>
<th>#</th>
<th>Comments/Notes</th>
</tr>
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<tbody>
<tr>
<td>0</td>
<td>Not MISO Registered</td>
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<tr>
<td>1</td>
<td>There is no DRR “must offer” requirement here, since there are no capacity credits.</td>
</tr>
<tr>
<td>3</td>
<td>LMR receives capacity credits, and resource can optionally offer into the Energy &amp; AS markets.</td>
</tr>
<tr>
<td>4</td>
<td>EDR Only. No capacity credits or “must offer” requirement.</td>
</tr>
<tr>
<td>5</td>
<td>LMR that optionally provides an EDR offer for emergency energy.</td>
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<tr>
<td>6</td>
<td>Similar to “1”, but can optionally participate in emergencies.</td>
</tr>
<tr>
<td>7</td>
<td>LMR only. Not involved in Energy and AS markets.</td>
</tr>
<tr>
<td>8</td>
<td>Similar to “5”, but can optionally participate in Energy &amp; AS markets.</td>
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</table>
DRR-Type I

- Capable of supplying a specific quantity of energy to the market through physical load interruption or behind-the-meter generation
- Is an “On/Off” resource: provides 0 MW or Target Demand Reduction Amount
- Can provide Spinning or Supplemental Reserves, if qualified
  - Not Capable of Providing Regulation or Ramp Capability Product
- Can be included in MISO Transmission Expansion Planning (MTEP) (long-term) capacity planning
- Can be counted towards Resource Adequacy Requirements (RAR)
- Has a “must offer” requirement (must make its capacity available to the Day Ahead or Real Time market) if it registers to qualify as a Capacity Resource
DRR-Type II

- Capable of supplying energy to the market through behind-the-meter generation or controllable load
- Can be committed and dispatched similar to generation resources
  - Can provide Regulation, Spinning, Supplemental Reserves and Ramp Capability Product, if qualified
- Can be included in MTEP (long-term) capacity planning
- Can be counted towards Resource Adequacy Requirements (RAR)
- Has a “must offer” requirement (must make its capacity available to the Day Ahead or Real Time market) if it registers to qualify as a Capacity Resource
Load Modifying Resources

• LMR is a category of demand resources created for resources that either cannot or do not wish to qualify as Capacity Resources, but do wish to be considered as Planning Resources (and thus capable of helping to satisfy PRMR)
  – DRR can qualify as LMR, or as a Capacity Resource
  – Demand Resources would include resources such as interruptible load or direct load control management; can qualify as an LMR
  – Behind the Meter Generation can also be classified as an LMR

• LMRs must make themselves available to the system during Emergency conditions, but not otherwise
  – LMRs can optionally dual-register as Emergency Demand Resources
Emergency Demand Response

- While not technically a ‘category’, EDR was created to enable more demand resources to help the system during Emergency conditions, without necessarily qualifying for the more involved categories.
- EDR resources submit information describing their costs incurred to reduce load (or provide energy) during an Emergency event.
  - As submitted, an EDR resource is then required to respond during an Emergency.
  - EDR can change its offer and availability day-by-day.
- An LMR can dual-register as an EDR.
# Resource Participation Summary

<table>
<thead>
<tr>
<th>Product</th>
<th>Energy</th>
<th>Regulation Reserve</th>
<th>Other Reserves</th>
<th>Module E (ZRC)</th>
<th>Emergency Energy</th>
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<tr>
<td>DRR- Type I</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>DRR- Type II</td>
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<td>1</td>
<td>1</td>
<td>1</td>
<td>1</td>
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<tr>
<td>DR - LMR</td>
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<td></td>
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<td></td>
<td>2</td>
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<tr>
<td>BTMG - LMR</td>
<td></td>
<td></td>
<td>1</td>
<td></td>
<td>2</td>
</tr>
<tr>
<td>EDR</td>
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<td></td>
<td></td>
<td></td>
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## Key

<table>
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<tr>
<th>1</th>
<th>Can Participate</th>
</tr>
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<tbody>
<tr>
<td>2</td>
<td>Must Participate</td>
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</table>
MISO Transmission Expansion Plan (MTEP) Compared With Resource Adequacy Requirements (RAR): *The Question of the Time Horizon for Resources*

MTEP process: incorporating demand response in expansion planning (long-term)

RAR: DRRs Type I & II that qualify as Capacity Resources, and Load Modifying Resources (1 year horizon)
Resource Adequacy Requirements: The Separation of Capacity Resources and LMR

RAR: Planning Resources to help ensure long-term resource adequacy (Interfaces with MTEP process)

LMRs: demand resources that elect to qualify as LMRs

Capacity Resources resources that participate in the hourly energy & ancillary services market and elect to qualify as Capacity Resources (included in RAR, but not always part of MTEP due to timing, size, etc.)
Resource Adequacy Requirements: Demand Response Resources (Type I and II)

**DRRs: Type I & II**

Resources that can qualify as Capacity Resources are not required to do so.

**LMRs**

LMRs have different obligations than Capacity Resources, but do count toward Planning Resources.

**Planning Resources**

**Capacity Resources**
Emergency Demand Response resources: Can Qualify as LMR or not

LMRs: Demand Resources and Behind-the-Meter Generation

LMR must respond during an emergency.

EDRs: Emergency Demand Response resources
How EDR Payments differ from “Standard” Payments

DRR/LMR
• Payment based on how the resource is used:
  • Energy
  • Ancillary Services
  • Planning Resources

EDR
• Emergency Energy only
• Payment is greater of:
  • LMP × Energy
  • Production Costs
Brief Look at Energy & Ancillary Services Products

Five Products for Day-Ahead & Real-Time Energy and Ancillary Services Markets

**Energy**
- Demand Bids and Resource Offers in Day-Ahead
- System Demand and Resource Offers in Real-Time

**Regulating Reserve**
- Allows the system operator to physically balance supply and demand on real-time basis

**Spinning Reserve**
- Provides energy to meet demand in the event of an unexpected loss of a generation or transmission resource

**Supplemental Reserve**
- Same as Spinning Reserve, but can be from online or offline Resources

**Ramp Capability Product**
- Prepositions resources for availability in subsequent intervals
## Market Design Elements

<table>
<thead>
<tr>
<th></th>
<th>DRR-Type I</th>
<th>DRR-Type II</th>
<th>LMR</th>
<th>EDR</th>
</tr>
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<tbody>
<tr>
<td><strong>Demand Response Type</strong></td>
<td>BTMG/(Interruptible/curtailable) load</td>
<td>BTMG / Dispatchable load</td>
<td>BTMG / DR</td>
<td>BTMG / DR</td>
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<tr>
<td><strong>Size/impact</strong></td>
<td>≥ 1 MW</td>
<td>≥ 1 MW</td>
<td>≥ 0.1 MW</td>
<td>≥ 0.1 MW</td>
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<td><strong>Real time telemetry</strong></td>
<td>No</td>
<td>Yes, for regulation service</td>
<td>No</td>
<td>No</td>
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<td><strong>In Network Model</strong></td>
<td>Through Load</td>
<td>As negative Gen</td>
<td>Through Load</td>
<td>Through Load</td>
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<tr>
<td><strong>In Commercial Model</strong></td>
<td>Yes</td>
<td>Yes</td>
<td>Through Load</td>
<td>Through Load</td>
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<td><strong>Treatment in DART market process</strong></td>
<td>On/Off, not continuously dispatchable for energy</td>
<td>Dispatchable</td>
<td>N/A</td>
<td>N/A</td>
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<td><strong>Aggregation in DART</strong></td>
<td>Allowed within single LBA</td>
<td>Allowed under single EPNode</td>
<td>N/A</td>
<td>N/A</td>
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<tr>
<td><strong>Capacity Payment</strong></td>
<td>Eligible</td>
<td>eligible</td>
<td>eligible</td>
<td>eligible</td>
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</table>
Load Modifying Resources
A Resource Adequacy mechanism should ensure enough resources available across the entire forecast load duration curve. LMRs, historically, have been used to provide summer peaking capacity requirements.

The RA mechanism should support reliable grid operation in an efficient manner.
LMR Participation in Resource Adequacy Requirements

• By qualifying as an LMR, the demand resource is able to help meet RAR obligations and receives compensation for providing planning resource capability （+）

• By qualifying as an LMR, the demand resource is obligated to curtail during emergencies and may be penalized for failure to do so （-）
Planning Resource Auction and LMRs

• The Planning Resource Auction (PRA) is where an LSE can acquire the necessary Zonal Resource Credits (ZRCs) to meet their Planning Reserve Margin Requirements (PRMR). Thus, the PRA is where MPs can trade or purchase ZRCs.

• LMRs can participate in the PRA provided that …
  – Certification is obtained by the LSE that the relevant electric retail regulatory authority does not preclude such use, and
  – The LSE agrees to be responsible for and hold harmless any LSE that purchases the LMR-related ZRCs from non-performance during Emergency penalties, and
  – The MP registers the LMR as a Planning Resource, and then converts its load reduction into ZRCs, which can be used of a part of fixed resource adequacy plan (FRAP), transferred to another MP or offered into the auction.

• DRR, if registered as Capacity Resources, function in the PRA like generation resources.
Requirements to Qualify LMR

To be qualified as an LMR, a resource must satisfy the following requirements:

- May be claimed by only 1 Market Participant
- ≥ 100 kW (grouping allowed)
- Schedulable within 12 hours (start up time ≤ 12 hours
- Able to achieve the target level provided during registration
- Maintain target level for 4 continuous hours
- Able to respond at least 5 times per year
- Response is an obligation during emergencies
- Cannot be ‘netted’ against LSE’s Forecast Demand in RAR; must be converted into Zonal Resource Credits
- Submit monthly availability in MWs and notification time for the upcoming Planning Year
  - Additional documentation may be required for LMRs with less than 9 months availability or notification times greater than 2 hours.
Planning Resource Auction
Example

• LSE has 20 MW of LMR
  – 15 MW (installed capacity) of LMR-BTMG
  – 5 MW of DR

• LSE converts its 15 MW of LMR-BTMG into ZRCs
  – ZRCs are measured in MW of Unforced Capacity (UCAP)
  – 15 MW → 14.8 MW UCAP for this particular LMR-BTMG

• LSE converts its 5 MW of DR into ZRCs
  – ZRCs are measured in MW of Unforced Capacity (UCAP)
  – 5 MW → 5.4 MW UCAP for this particular DR due to avoiding PRM obligation and transmission loss obligation

• LSE can choose to:
  – FRAP these ZRCs to offset its PRMR
  – Transfer ZRCs to another Market Participant
  – Offer the ZRCs into the PRA
Registration - LMR

• All LMRs utilized to meet RAR must be registered in accordance with Section 69.1.4 (“Submit Resource Plans”) of the Tariff and the BPMs for Resource Adequacy and Market Registration

• MISO will determine through the registration process whether the potential DR or BTMG qualifies as an LMR under Module E
  – If a potential DR or BTMG does not qualify as an LMR under Module E, that does not necessarily disqualify it from being an EDR resource under Schedule 30

• BTMG-LMRs will be accredited utilizing information from the Generator Availability Data System (GADS) and methods further described in the BPM for Resource Adequacy

• DR-LMRs will be accredited utilizing methods described in the BPM for Resource Adequacy
Registration – LMR
MECT Tool & Zonal Resource Credits (ZRC)

• An LMR must be registered with MISO in advance of the MP receiving ZRCs in the Module E Capacity Tracking (MECT) tool
  – The registering entity must be a Market Participant prior to registering an LMR
  – Any entity that is not a Market Participant, but desires to register an LMR, must contact the Customer and Asset Registration Services team at register@misoenergy.org to become a Market Participant

• The entity that registers the LMR has a choice of how to handle the planning resources (MW) associated with the resource:
  – The ZRCs can be used as part of a Fixed Resource Adequacy Plan (FRAP) offsetting an LSE’s planning reserve margin requirement
  – The ZRCs can be traded to another market participant or offered into the PRA
Informational Requirements

LMR

- MP Name and contact information
- Identity of the LSE and contact information
- Identification of Commercial Pricing Node of the LSE
- LMR identification information (name, city, county, state, etc.)
- LMR contact information (name, email, phone, etc.)
- Operating information *, such as:
  - Shut-down requirements, # interruptions, etc.
  - Curtailment or interruption maximum durations
  - Monthly coincident demand reductions
  - “Firm Service” level, if applicable
  - Selection of M&V protocol from list provided
- Provide written procedures demonstrating ability to reduce load
- Documentation supporting accreditation

* LMR-BTMG will provide relevant generation operating information where applicable
Informational Requirements
LMR

• Accreditation/Testing
  – Demonstrated annually
    • Performance data from the previous planning year
    • Real power test providing evidence that DR can respond if called upon
      – Credited as one deployment
    • Alternative mechanism if real power test is precluded or waived
      – Subject to potential enhanced penalties
  – LMR-BTMG must provide generation testing information
  – Please see BPM-011 for details regarding DR accreditation
Availability Reporting
LMR

• Communications
  – Through MISO communications system (MCS)
  – Provide updates to availability specific to each LMR
  – Scheduling Instructions (SI) (and performance evaluation) during Emergencies based on most recent information provided in the MCS
  – LMR availability should be decremented to reflect outages
  – Self-scheduled LMRs should be reflected in MCS
  – LMRs with dual registration: MCS adjusted to reflect net LMRs available
  – See MCS User’s Guide
Emergency Procedures

The following progression of steps is followed under Emergency conditions:

| EVENT STEP 1 | • Commit all Capacity Resources, including DRR-Type I and DRR-Type II, that are designated “Emergency only”  
|             | • Implement Emergency Max limits, excluding Regulation Reserve  
|             | • Declare EEA1 – All resources in use.  
|             | (EEA = Energy Emergency Alert) |

| EVENT STEP 2 | • Declare NERC EEA2  
|             | • Instruct Load to be reduced via Module E (LMR) and “Load Management Measures – Stage 1”  
|             | • Commit EDR Offers, in merit order  
|             | • Implement Emergency Energy purchases from LBA neighbors if available |
Emergencies
LMR

• Communications during Emergencies
  – Through MISO communications system (MCS)
  – Scheduling Instructions (SI) sent to MP and LBA
  – MP must acknowledge within the hour
  – MP must submit which of its LMRs & associated MWs it will use to meet the issued SI
  – Self-scheduled MWs included in SI
Emergencies
LMR

• Performance evaluation
  – MPs with LMR availability less than the MWs cleared in the PRA will need to provide documentation explaining why
  – Meter data for the MWs requested in the SI must be uploaded to the Demand Response Tool (DRT) within 53 days of the Emergency event
  – Must respond at a level \( \geq \) target level of demand reduction
    • Or below registered firm service level
  – Adjusted to account for self-scheduled levels
  – Adjusted if the LMR reduction is temperature dependent
Performance Evaluation
Measurement & Verification

• For Demand Resources:
  – After an event, MISO will evaluate the performance of Demand Resources which were sent scheduling instructions during an event
  – Performance is assessed as the consumption baseline minus the metered data during the event
  – During registration, customers can choose to use a default MISO consumption baseline or submit a custom baseline methodology for MISO review and approval
  – Demand Resources can also use a direct load control (DLC) methodology which includes a study to determine the capacity available for the specific program
  – See Attachment TT for details regarding all types of M&V methodologies
Performance Evaluation Type

- **Firm Service Level**: A performance evaluation methodology based solely on a Demand Resource’s ability to reduce to a specified level of electricity demand, regardless of its electricity consumption or demand at Deployment.

- **Meter Before / Meter After**: A performance evaluation methodology where electricity consumption or demand over a prescribed period of time prior to Deployment is compared to similar readings during the Sustained Response Period.

- **Baseline Type-I**: A Baseline performance evaluation methodology based on a Demand Resource’s historical interval meter data which may also include other variables such as weather and calendar data.
  - Symmetric or weather sensitive adjustments allowed

- **Baseline Type-II**: A Baseline performance evaluation methodology that uses statistical sampling to estimate the electricity consumption of an Aggregated Demand Resource where interval metering is not available on the entire population.

- **Metering Generator Output**: A performance evaluation methodology, used when a generation asset is located behind the Demand Resource’s revenue meter, in which the Demand Reduction Value is based on the output of the generation asset.
• For BTMG, the MP registering the LMR-BTMG must measure and record the electrical output of the generator(s) during the hour preceding an Emergency Event and all hours the Event is active
  – The MP shall submit meter data to MISO following an Emergency Event in which the LMR-BTMG was designated in an LSE’s Resource Plan and deployed
  – MISO will review the meter data to verify that the LMR-BTMG increased energy output to the level instructed by MISO
Compensation
LMR

• Compensation
  - For Capacity: MPs with LMRs clearing the PRA are credited with the Auction Clearing Price (ACP)
  - For Energy: unless the LMR is unavailable due to maintenance or force majeure, MP is charged for the portion of non-reduction
    • Payment to replace non-reduction, at RT prices, incl. RSG
    • May include disqualification for the remainder of the Planning Year
      – Discontinue PRA payments at ACP
    • Upon second non-reduction, LMR will be disqualified for the remainder of the current Planning Year and will be ineligible for LMR participation in the following Planning Year.
Issues, Market Participant's view and possible barriers to participation
Market Participant's view

Market Participants with demand resources can voluntarily participate in MISO markets as long as the MPs are willing & able to provide the commensurate service.

- Energy: probably not their business model, though do have the ability to specify physical operating constraints
- Operating Reserves: could be best opportunity in E & OR markets
- Capacity: absolutely can be part of their business model, see previous section
- Emergency Energy: offer cap at $3500, plus shutdown costs
Potential barriers to participation

RERRA approval and
- Energy: cannot specify PRD in the RT market
- Operating Reserves:
  - Regulation: > 1 MW, location limited to 1 EPNode
  - Spin: > 1 MW, (10%, then 30%, now 40% CAP), 1 LBA
  - Supplemental: > 1 MW, 1 LBA
  - Ramp Capability: need to be dispatchable
- Capacity: ?, summer capability
- Emergency Energy: rarely been called by MISO, offer cap at $3500, plus shutdown costs
Registration issues

Most of the current issues revolve around ARC registration, including but not limited to:

• Identifying and getting approval from LSE
• Identifying and getting approval from RERRA
• Identifying and getting approval from LBA
• Names and addresses of end-use customers
• EPNode & CPNode identification
• Avoiding double counting
• Information sharing protocols
• In a timely manner
• Entire registration submission process
Settlement issues

Most of the current issues revolve around M&V procedures (measurement & verification), including but not limited to:

*How to observe the counterfactual consumption level?*

- Adverse selection problem
- Moral hazard problem

Attachment TT (consumption baselines)
- Metered generation baseline (BTMG)
- Meter before/meter after
- Firm service level
- Calculated baseline
  - 10 in 10
  - With symmetric adjustment
  - With weather adjustment
- Direct load control baseline
- Custom baseline
Disparate set of tools

A disparate set of tools at MISO are used to manage the demand resource asset base.

LMRs
- The Module E Capacity Tracking (MECT) system
- The MISO Communication System (MCS)
- The Demand Response Resource Tool (DRT)

DRRs
- Market registration system
- DRT

EDRs
- spreadsheet

Unit Dispatch System (UDS) only includes DRRs
Additional questions

• MISO operational awareness
  – Demand resources not registered with MISO
• Is there a limit to ‘emergency-only’ resources?
• Relationship with retail tariffs
• Cross-registering demand resources
• Third-party/end-user ownership
• Deliverability & interconnection issues
  – See BPM for Resource Adequacy
  – Section 4.2.8.5
Appendix
### Acronyms

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>ARC</td>
<td>Aggregator of Retail Customers</td>
</tr>
<tr>
<td>BTMG</td>
<td>Behind the Meter Generation</td>
</tr>
<tr>
<td>CPNode</td>
<td>Commercial Pricing Node</td>
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<tr>
<td>DR</td>
<td>Demand Resource</td>
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<tr>
<td>DRR</td>
<td>Demand Response Resource</td>
</tr>
<tr>
<td>EDR</td>
<td>Emergency Demand Response</td>
</tr>
<tr>
<td>EEA(1, 2, 3)</td>
<td>NERC Energy Emergency Alert levels</td>
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<tr>
<td>EOP</td>
<td>Emergency Operations Procedures</td>
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<tr>
<td>EPNode</td>
<td>Electrical Pricing Node</td>
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<td>FRAP</td>
<td>Fixed Resource Adequacy Plan</td>
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## Acronyms (Cont.)

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>GADS</td>
<td>Generating Availability Data System</td>
</tr>
<tr>
<td>LBA</td>
<td>Local Balancing Authority</td>
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<tr>
<td>LMP</td>
<td>Locational Marginal Price</td>
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<tr>
<td>LMR</td>
<td>Load Modifying Resource</td>
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<td>LSE</td>
<td>Load Serving Entity</td>
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<td>MCS</td>
<td>MISO Communications System</td>
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<tr>
<td>MECT</td>
<td>Module E Capacity Tracking tool</td>
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<tr>
<td>Module E-1</td>
<td>MISO EMT module regarding Resource Adequacy</td>
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<tr>
<td>MP</td>
<td>Market Participant</td>
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<tr>
<td>MTEP</td>
<td>MISO Transmission Expansion Planning</td>
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<tr>
<td>M&amp;V</td>
<td>Measurement &amp; Verification</td>
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<tr>
<td>NERC</td>
<td>North American Electric Reliability Corporation</td>
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## Acronyms (Cont.)

<table>
<thead>
<tr>
<th>Acronym</th>
<th>Description</th>
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<tbody>
<tr>
<td>PRA</td>
<td>Planning Resource Auction</td>
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<tr>
<td>PRD</td>
<td>Price Responsive Demand</td>
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<tr>
<td>PRMR</td>
<td>Planning Reserve Margin Requirement</td>
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<tr>
<td>RAR</td>
<td>Resource Adequacy Requirement</td>
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<tr>
<td>RERRA</td>
<td>Relevant Electric Retail Regulatory Authority</td>
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<tr>
<td>RSG</td>
<td>Revenue Sufficiency Guarantee</td>
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<tr>
<td>SI</td>
<td>Scheduling Instruction</td>
</tr>
<tr>
<td>ZRC</td>
<td>Zonal Resource Credit</td>
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</table>
References and Links

• Documents
  – Business Practices Manuals (BPM)
    • https://www.misoenergy.org/Library/BusinessPracticesManuals
    • BPM-026– Demand Response
    • BPM-011– Resource Adequacy
    • BPM-020 – Transmission Planning
    • BPM-010 – Network and Commercial Models
    • BPM-002 – Energy and Operating Reserve Markets
  – MISO Tariff (EMT)
    • https://www.misoenergy.org/Library/Tariff
  – NERC EOP-011-1, Emergency Operations