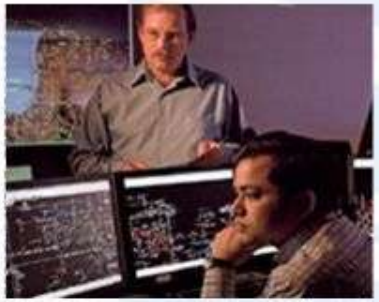
Demand Response Primer and Training Guide


2011

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Midwest ISO Disclaimer

The following training materials are intended for use as training materials only and are not intended to convey, support, prescribe or limit any market participant activities. These materials do not act as a governing document over any market rules or business practices manual. The data used in the examples is test data and should not be used to support market analyses.

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Key Assumptions

- This material will discuss a variety of concepts centered on demand response.
- This is not a stakeholder meeting. The purpose of this training is **NOT** to make or to debate market design decisions, policies, or rules (ask “how” not “why”).
- Participants will actively participate in the training by asking constructive questions in an effort to improve the overall learning experience.

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Acronyms

- **ARC** – Aggregator of Retail Customers
- **BPM** – Business Practice Manual
- **BTMG** – Behind the Meter Generation
- **DR** – Demand Resource
- **DRR** – Demand Response Resource
- **EDR** – Emergency Demand Response
- **FERC** – Federal Energy Regulatory Commission
- **LBA** – Local Balancing Authority
- **LMP** – Locational Marginal Price
- **LMR** – Load Modifying Resource
- **LSE** – Load Serving Entity
- **MECT** – Module E Capacity Tracking tool
- **MFRR** – Marginal Foregone Retail Rate

- **MP** – Market Participant
- **MTEP** – Midwest ISO Transmission Expansion Plan
- **NAESB** – North American Energy Standards Board
- **NERC** – North American Electric Reliability Corporation
- **OATT** – Open Access Transmission Tariff
- **PRC** – Planning Resource Credit
- **PRMR** – Planning Reserve Margin Requirement
- **RAR** – Resource Adequacy Requirement
- **RSG** – Revenue Sufficiency Guarantee
- **Tariff** – FERC OATT
- **TP** – Transmission Provider
- **VCA** – Voluntary Capacity Auction

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Sample of Questions Addressed:

- Why does a company or organization need to register?
- How does a company or organization register?
- What are the various types of demand resources?
- What kinds of information will I 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?

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General Outline

- First, we will define the various categories that are available to demand resources.
  - In this process, you will begin to get an idea of the differences among - and requirements confronting - demand resources.
- Second, we will briefly describe the overall environment in which demand resources operate within the Midwest ISO.
  - Our focus will be on explaining the interrelationships, overlapping possibilities, and structure within which demand resources operate.
- Third, we will discuss the various markets that are available to demand resources.
  - As we review the markets, their requirements and possibilities, you will begin to see where your demand resources might play a role.

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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)
- 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?

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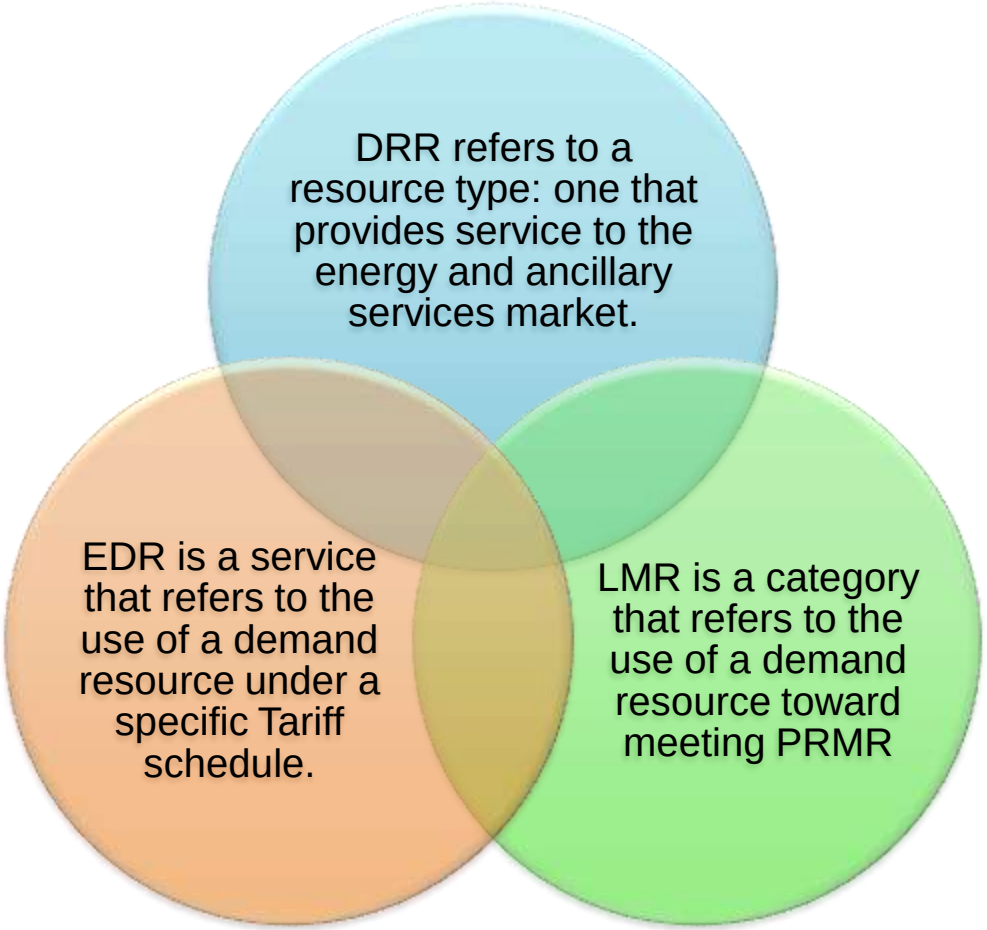
Resources, Categories, Services



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Planning Resource Categories

- Capacity Resources (can qualify)
  - Demand Response Resource-Type I (e.g. direct load control of residential water heaters)
  - Demand Response Resource-Type II (e.g. industrial customer with ability to use less electricity in a controlled manner)
- Load Modifying Resources
  - Demand Resources (e.g. a controllable device that can be turned off)
  - Behind-the-Meter Generation (e.g. a small diesel generator operating under the control of the customer)

Note: Emergency Demand Response
(not a resource "type", but a specific use)

	Planning Resource			
	Capacity Resource		Load Modifying Resource	
	Generation and External Resources	Demand Response Resource [3]	BTM Generation	Demand Resource
Capacity Verification [1]	X	X	X	X
Must Offer [1]	X	X		
GADS Data Entry [2]	X		X	
DADS Data Entry [4]		X		X
Must Respond to Emergency Operating Procedures	X	X	X	X

(1) Includes Intermittent Resources with Must Offer Requirement
(2) BTMG greater than 10 MW must supply GADS data.
(3) Resources that could qualify as Demand Response Resources need not necessarily qualify as Capacity Resources. Qualification depends, in part, upon the desired market(s) in which the resource will participate.
(4) NERC is working to establish these requirements.

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Tariff Definitions

From Module A, OATT

- **1.141 Demand Response Resource (DRR)-Type I:**
  - A Resource hosted by an Energy Consumer or Load Serving Entity that is capable of supplying a specific quantity of Energy or Contingency Reserve, at the choice of the Market Participant, to the Energy and Operating Reserve Market **through physical Load interruption**.

- **1.142 Demand Response Resource (DRR)-Type II:**
  - A Resource hosted by an Energy Consumer or Load Serving Entity that is **capable of supplying a range** of Energy and/or Operating Reserve, at the choice of the Market Participant, to the Energy and Operating Reserve Market through Behind The Meter generation and/or controllable Load.

- **1.359 Load Modifying Resource (LMR):**
  - A **Demand Resource** or **Behind the Meter Generation** Resource.
- **1.140 Demand Resource (DR):**
  - **Interruptible Load** or **Direct Control Load Management** and **other resources** that can reduce Demand during Emergencies.
- **1.44 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.

- **1.180 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.

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Products & Resources

Product → Resource ↓	Energy	Regulation Reserve	Spin / Supplemental Reserve	Module E (PRC)	Emergency Energy
DRR- Type I	√		√	→	←
DRR- Type II	√	√	√	→	←
LMR DR				◊	◊
LMR BTMG				◊	◊
EDR					√

√ Can Participate

◊ Must Participate

→ ← Participation Linked

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DRR-Type I

- Capable of supplying a specific quantity of energy to the market through physical load interruption
- Is an “On/Off” resource: provides 0 MW or Target Demand Reduction Amount
- Capable of providing Spinning or Supplemental Reserves
  - Not Capable of Providing Regulation
- Can be included in Midwest ISO 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

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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
  - Capable of providing Regulation, Spinning, or Supplemental Reserves
- Can be included in MTEP (long-term) capacity planning
- Can be counted towards 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

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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
  - Demand Resources would include resources such as interruptible load or direct load control management.
  - Behind the Meter Generation can also be classified as an LMR
- LMR *must* make themselves available to the system during Emergency conditions, but not otherwise.

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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 offer emergency energy as an EDR.

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The Planning Process

- The next series of slides provides information regarding the planning process at the Midwest ISO.
- We will begin at the “top” – the long-term view.
- We will proceed by examining the process as the time horizon shortens.
- Our primary interest is in developing an understanding of the role that demand resources play at each level of the process, as well as how their consideration at any given level influences both their ability to participate in related markets and the responsibilities associated with that participation.

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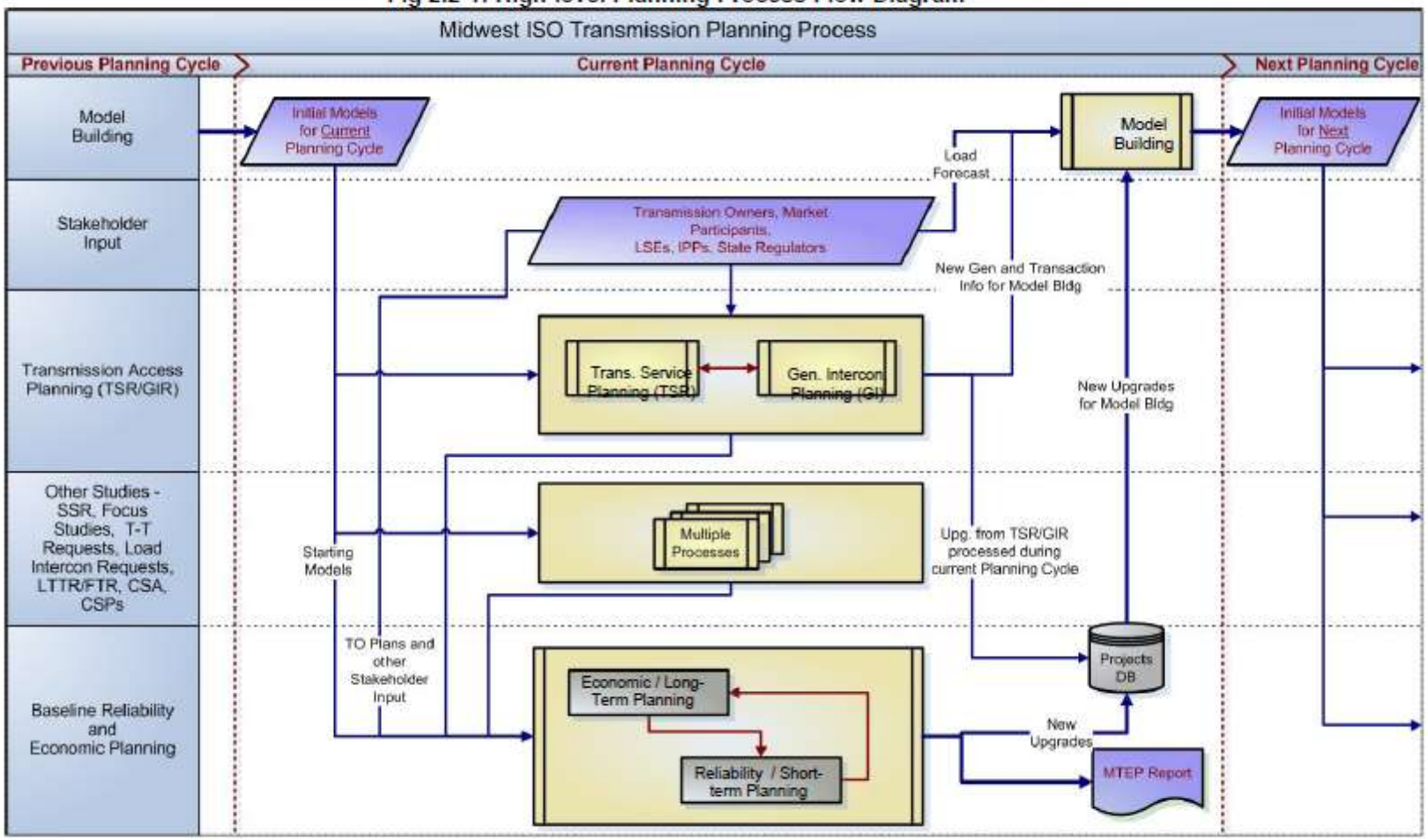
Midwest ISO Transmission Expansion Plan

Fig 2.2-1: High-level Planning Process Flow Diagram

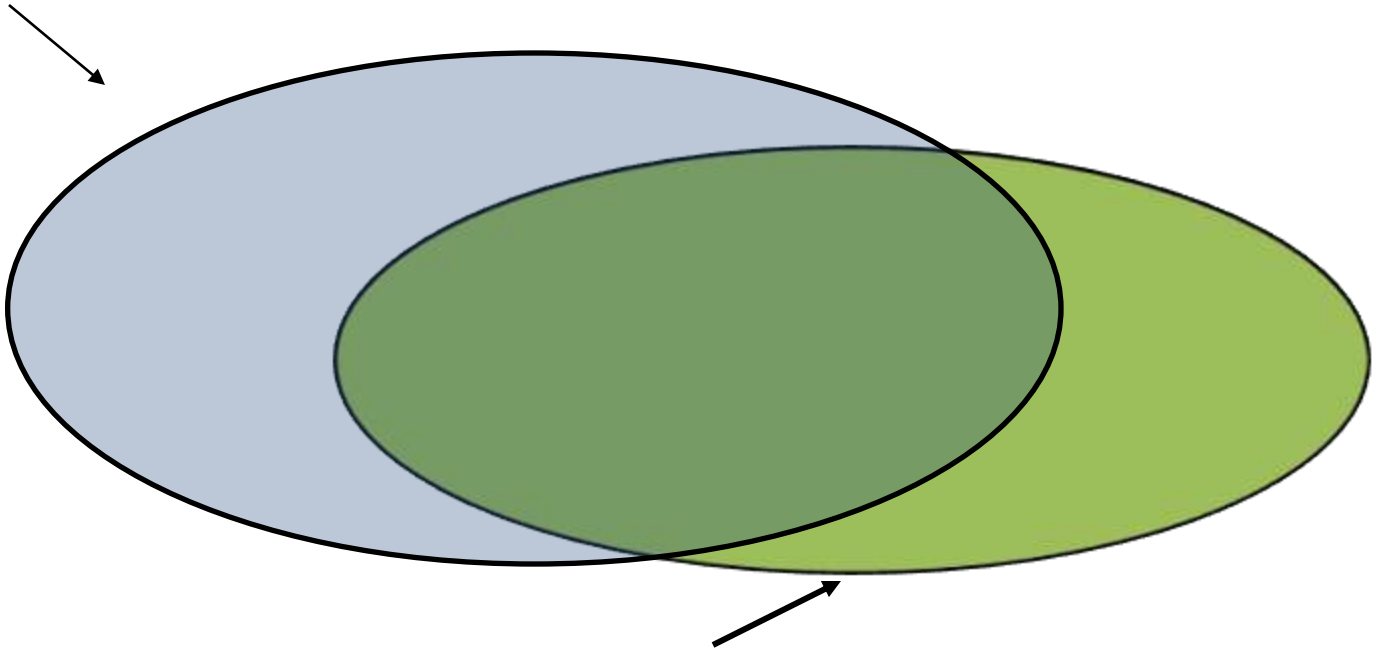


Acronyms:

TSR… Transmission Service Requests
GIR… Generation Interconnection Requests
SSR… System Support Resources
LTTR…Long-Term Transmission Rights
CSA… Coordinated Seasonal Assessment
CSP… Coordinated System Plans
IPP…. Independent Power Producers
FTR… Financial Transmission Rights

Midwest ISO 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)

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"Outside the Overlap"
Examples 1 and 2

- "In" MTEP, but outside of RAR
  - With its longer horizon, MTEP might include generic or in-development resources not included in RAR.
- "In" RAR, but outside of MTEP
  - While some RAR-qualified demand resources may be included in MTEP studies, it is possible that some will not.
    - Very recent resources might now exist that were not available for MTEP analysis (developed and activated between the MTEP horizon and the planning year)
    - Some examples would include solar panel roofs, certain Smart Grid efforts, or other renewable energy concepts

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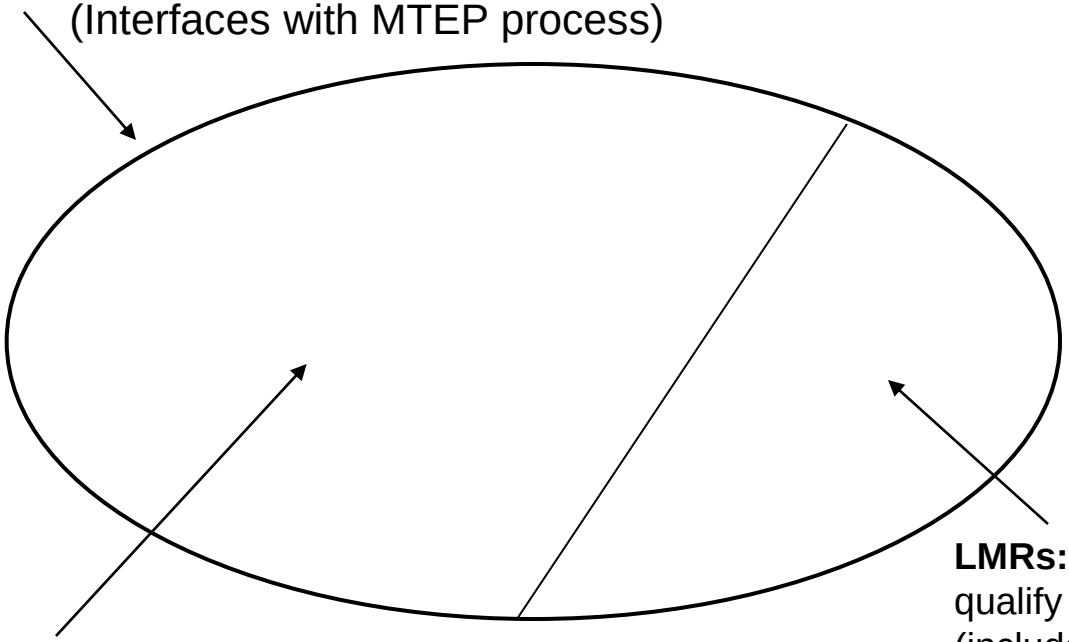
Resource Adequacy Requirements:
The Separation of Capacity Resources and LMR

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



LMRs: demand resources that elect to qualify as LMRs
(included in RAR, but not always part of MTEP due to timing, size, etc.)

Capacity Resources (included in the long term MTEP process) resources that participate in the hourly energy & ancillary services market and elect to qualify as Capacity Resources

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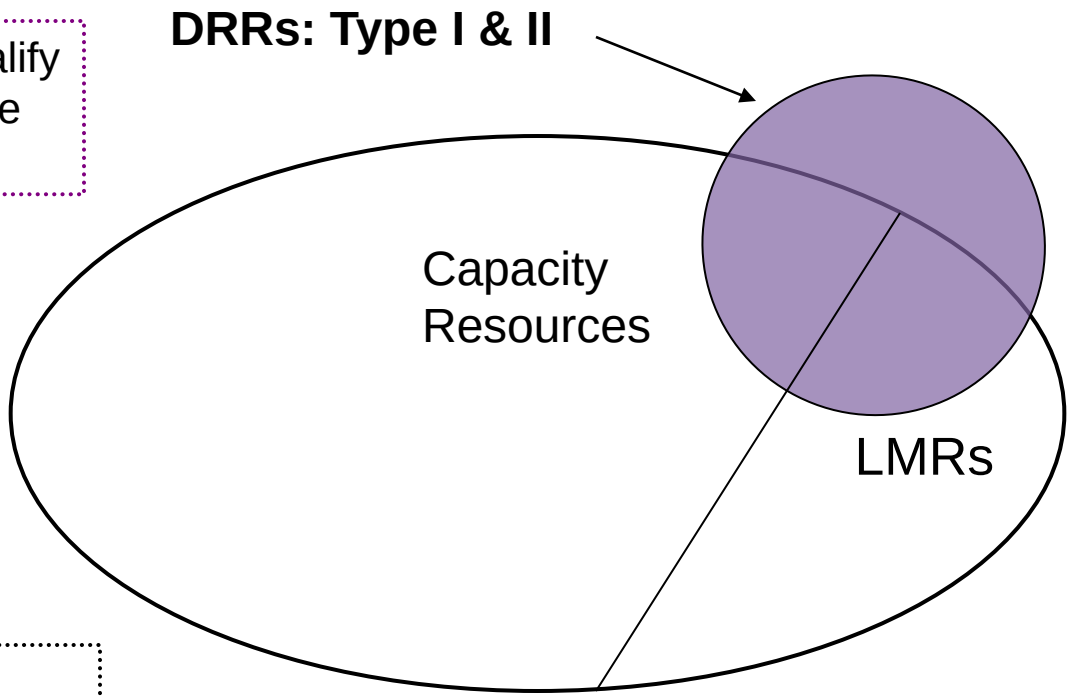
Resource Adequacy Requirements:
Demand Response Resources (Type I and II)

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



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

3. DRRs can qualify as Capacity Resources or LMRs or neither.

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"Outside the Overlap"
Example 3

- INSIDE the CAPACITY RESOURCES AREA:
  A DRR could qualify as a Capacity Resource, gaining capacity credits and offering energy & ancillary services on an hourly basis in the day-ahead and/or real-time markets.
  - "must offer" requirement would apply
- INSIDE THE LMR AREA:
  A DRR could qualify as an LMR, in order to obtain planning resource credits, and still offer hourly energy & ancillary services in the day-ahead and/or real-time markets.
  - resource would face requirement to assist during emergencies
- OUTSIDE the CIRCLE:
  A DRR need not qualify to become a Capacity Resource or an LMR;
  it might wish to only offer hourly services, on a schedule of its own choosing – no "must offer" requirements.
  - MP in this case is *not* in the business of providing electricity, but makes widgets.
  - MP willing to offer the energy of the resource on occasion, perhaps only as an EDR.

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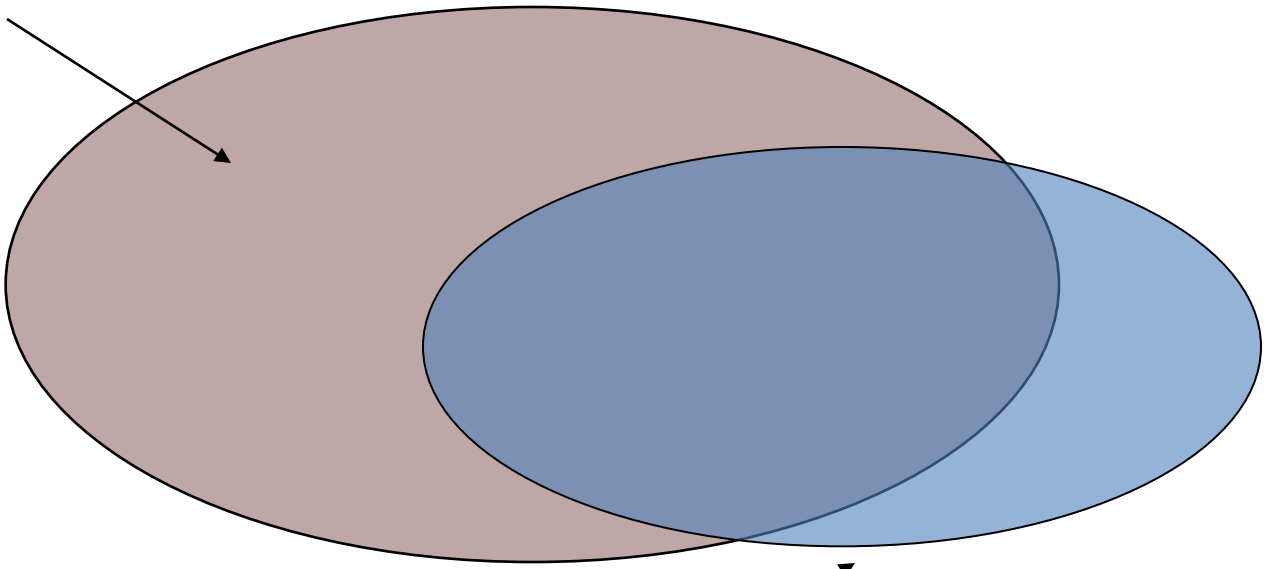
Emergency Demand Response resources: Can Qualify as LMR or not

LMRs: Demand Resources and Behind-the-Meter Generation



LMR must respond during an emergency.

EDRs:
Emergency Demand Response resources

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"Outside the Overlap"
Examples 4 and 5

- "In" LMR circle, but outside EDR
  - By registering as LMR, these resources can qualify for planning resource credits
  - These assets choose not to provide emergency energy under the EDR schedule
    - As LMR, they are 'price takers' during an emergency; if they filed under EDR, they might not be called upon ($P_{filed} > P_{emergency}$)
    - May be some issues related to retail regulatory treatment
- "In" EDR circle, but outside LMR
  - While EDR resources may qualify as LMR, they are not required to do so.
    - For example, an EDR can change its availability daily, while the LMR must be available each day.
    - The EDR gains flexibility (with respect to offering emergency energy) but loses the ability to be counted as capacity towards resource adequacy requirements.

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Introduction to Markets
Part I

- Our presentation strategy is to discuss the various ways that demand resources might want to interact with the markets.
- We will describe 3 broad categories of markets managed by the Midwest ISO:
  - Energy & Operating Reserves (Day Ahead, Real Time)
  - Resource Adequacy (PRC, VCA)
  - Emergency Response (Real Time)

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Introduction to Markets
Part II

- For each of these 3 categories, we will discuss the following issues:
  - **Requirements to Qualify**
  - **Registration**
  - **Information and Data Inputs**
  - **Resource Offers** (placing the resource in the market)
  - **Settlements** (how resources are compensated)

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The Rationale for demand resources

- The underlying concept of demand resources is to *reduce load* during hours when that electricity usage is less valuable than the current cost to supply the electricity
  - In the short-term (energy market), this implies that demand resources can be efficient during periods when LMP are high
  - In the longer-term planning sense (resource adequacy), this implies that demand resources can make a contribution to meeting the peak requirements of the system
- DR can thus improve economic efficiency
- DR also increases the competitiveness of wholesale markets overall and supports reliability

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Energy & Operating Reserve Products

- Day-Ahead and Real-Time Energy and Operating Reserve Markets have four products
  - **Energy**
    - Commodity
      - demand bids and resource offers in Day-Ahead
      - system demand and offers in Real-Time
  - **Regulating Reserve** (DRR-Type II only)
    - 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

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Requirements to Qualify
Energy & Operating Reserves

- All demand resources qualify to offer energy into the market as follows:
  - DRR can schedule energy, based on market price
    - Example: This demand resource will reduce its load (provide 2 MW) if the LMP>$60/MWh.
  - All can (and some *must*) offer the resource when the system experiences a defined emergency
    - Example: If the system is experiencing Emergency conditions, this demand resource will reduce its load (provide 3 MW), for a cost of $80/MWh and a shut-down cost of $2000.

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Requirements to Qualify
Energy & Operating Reserves

- DRR qualify* to offer Spinning and Supplemental reserves
  - Resources offering these services make themselves available if the system has an unforeseen need for additional resources in real time
  - Offered resources face a two-step process:
    - Step One ❶: Becoming “cleared” (accepted) to provide Operating Reserve
    - Step Two ❷: Being called upon to actually deliver energy to the market
  - ❶ If offered, the system will determine whether the offer is economic, given market conditions. The offer may be “cleared” (accepted) or not, depending on circumstances.
    - If cleared and not called upon, the resource will be paid the Market Clearing Price (MCP) for that type of Reserve (e.g. Spin) for its reserve offer
  - ❷ If called upon (“deployed”), the resource must respond or face penalties.
    - If cleared in the day-ahead market and then deployed for energy in real-time, the resource will receive the RT_LMP for that hour, but would “buy back” its day-ahead reserve offer (+DA_MCP) in real-time (-RT_MCP).

* Provided that the resource meets the operational capability requirements of the reserve market

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Requirements to Qualify
Energy & Operating Reserves

- At present, only some DRR-Type II can qualify for Regulation Reserve.
- This is because Regulation Reserve requires the resource to have the ability to be able to provide small changes (increases or decreases) within short time intervals (seconds) as the demand on the system varies.
- In other respects, this market operates like Spinning or Supplemental Reserves

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Registration

- Market Participant status
  - Effectively required for all types of demand resources
  - Can have a third party act on your behalf
  - Complete information regarding MP registration may be found in CS-BPM-001
- Registration is required so that demand resources are appropriately included in capacity-related calculations (e.g. resource adequacy), so that all MP are treated fairly and in an unbiased fashion, and so that demand resources can participate in the various markets (submit bids, receive settlements, etc.)

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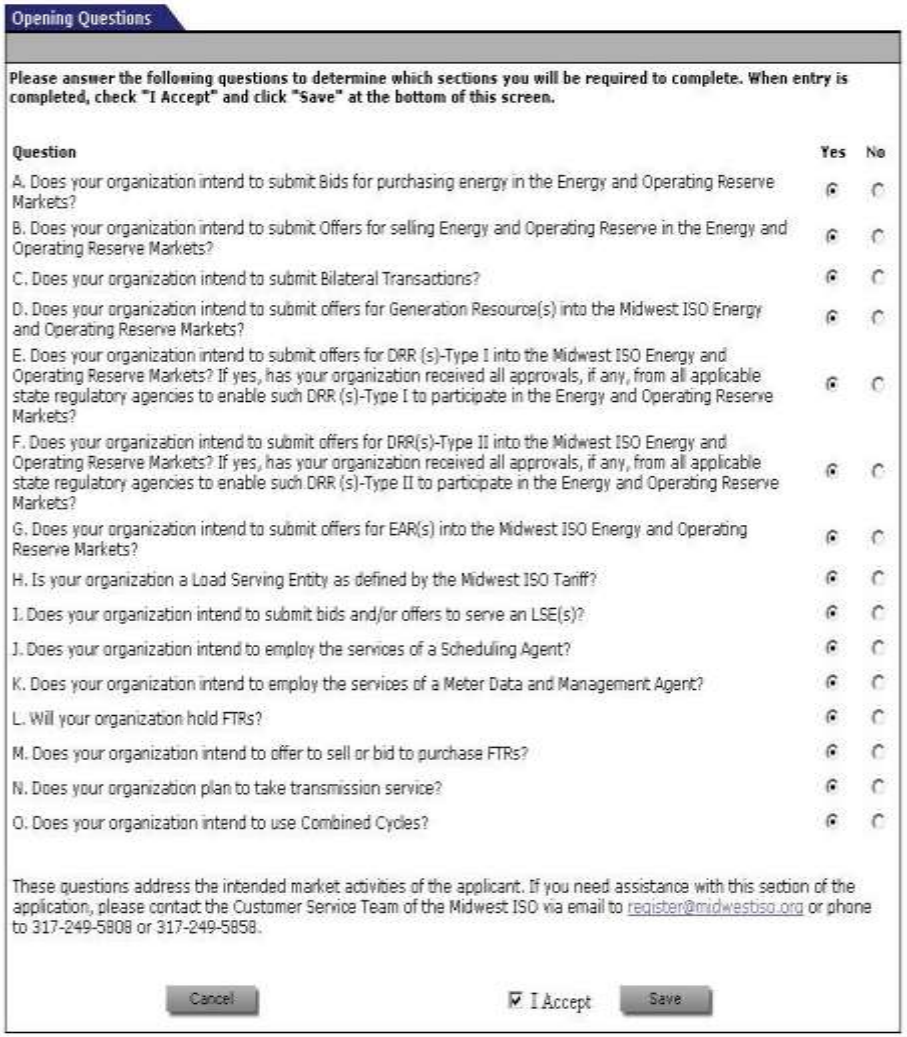
Registration

Opening Questions

- Before starting the online application process, Applicants are requested to review the list of Opening Questions as shown at right. These questions address the intended Market Activities of each Applicant, and will drive the remaining portions of the online registration process.
- These questions require a familiarity with abbreviations and concepts of the Midwest ISO.
  - LSE: Load Serving Entity (e.g. a distribution utility)
  - FTR: Financial Transmission Right (related to transmission cost hedging)



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Registration
Sections in the On-Line Process

- The following sections are included in the On-Line process, but the process itself will guide you as to those that are required or relevant to your situation:
  - Opening Questions
  - General Applicant Information
  - Billing Contact Information
  - Authorization for Automatic Credit/Debit
  - Asset Registration Information
  - Load Zone Identification
  - Designated Agents
  - Credit Sections
  - Local Security Administration Information
  - Eligible Customer Qualification Forms
  - Information regarding Network Transmission Service

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Registration
Paperwork

- In addition to the on-line tool, there are several documents that must be completed, printed, signed, and returned to the Midwest ISO:
  - Various certificates of ownership and relationships (e.g. between owner and applicant)
  - Transmission Service agreement
  - Credit application and other banking and credit related forms
- These forms will be shown, as relevant to your application, in the on-line process: Download and complete them as necessary.

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Registration
Further Information

- Complete registration information may be found in the Midwest ISO BPM-001 for Market Registration.

http://www.midwestiso.org/Library/BusinessPracticesManuals/Pages/BusinessPracticesManuals.aspx

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Informational Requirements

- In order to participate in the various markets, demand resources need to provide substantial information regarding their capabilities and requirements in the form of operating and economic inputs.

- Please consult the Demand Response BPM and the Energy & Operating Reserve Markets BPM for details. See previous slide for web link.

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Informational Requirements

Credit Application: Energy & Operating Reserves

- Components of the Credit Application
  - General Applicant Contact Information
  - Applicant entity data & history
    - Date of incorporation
    - Name, stock symbol (if any), etc.
  - Reference Information
    - Bank name
    - Account numbers and related information
  - Credit Support
    - Previous 3 years annual financial statements
    - Letter of Credit, Corporate Guaranty, or Cash Deposit in lieu of financial statements
  - Also note that Market Participants are required:
    - within 90 days after the end of each fiscal year, to deliver current, audited Financial Statements
    - within 45 days after the end of each fiscal quarter, to deliver current, unaudited quarterly financial statements
- The Credit portion of the application process is included in the on-line registration tool.
- Processing the credit application does not delay the assignment and verification of assets.

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Informational Requirements

Credit Requirements ($): Energy & Operating Reserves

- The “initial value of total potential exposure” is determined by multiplying these items together:
  - PURCHASER:
    - Est. Peak Load (MWh purchase requirement)
    - 720 hours
    - Average Day Ahead Historical Price for the preceding 3 month period ($/MWh)
  - SUPPLIER:
    - Max. MWh capacity of generating unit
    - 720 hours
    - Average Day Ahead Historical Price for the preceding 3 month period ($/MWh)
    - 5%
- A reasonable value to use for the Day Ahead Historical Price might currently be $30 / MWh (example purposes only)
- For each 1 MWh of purchased load, the credit requirement would therefore be: 1 x 720 x 30 = $21,600
- For each 1 MWh of supplied power, the credit requirement would be: 1 x 720 x 30 x .05 = $1080

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Informational Requirements

Credit Evaluation: Energy & Operating Reserves

- Rating Agency Reports
- Financial Statements and Related Information
- References
  - Each Applicant is to provide at least one (1) bank and three (3) Significant Trade References
- Litigation, Commitments and Contingencies
- Other Disclosures
  - disclose any Affiliates that are Tariff Customers
  - ongoing investigations by the regulatory and oversight commissions
- Initial value of the Total Potential Exposure for credit monitoring purposes
  - Estimated Peak Load Data Requirement
  - Initial Value of Total Potential Exposure Associated with Transmission Service
  - Initial Value of Total Potential Exposure Associated with Energy and
  - Operating Reserve purchases, and Energy and Operating Reserve supply
  - Initial Value of Total Potential Exposure Associated with Virtual Transactions
  - FTR Auction Designation
  - RAR Auction Designation
  - Other Information

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Resource Offers

- What is a Resource Offer?
  - A Resource Offer is a comprehensive set of information that will allow a Market Participant with demand resources to attempt to reduce the energy taken from the Midwest ISO markets.
  - A Resource Offer consists of information and data required by the market to be able to make determinations regarding the selection and use of the resource.

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Resource Offers

Default vs. Schedule Offer

- Default values for Unit Limits and Parameters are entered into Market Portal upon registration of assets and can be updated by the Market Participant

- The Schedule Offer allows the Market Participant to temporarily override the default limits and parameters with new values when submitting an Energy and/or Operating Reserve Offer
  - Please see BPM-002-Energy & Operating Reserve Markets for greater detail.
    http://www.midwestiso.org/Library/BusinessPracticesManuals/Pages/BusinessPracticesManuals.aspx

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Resource Offers
Default Limits and Parameters

- Examples of the kinds of information required would include:
  - Economic data, such as the hourly curtailment price (offer), the shut-down price (cost), and individual prices (offers) to the separate markets (e.g. energy, spinning reserves, etc.)
  - Operational data, such as the minimum and maximum amount of time for which the resource may be curtailed, how much lead-time notification is required, and so forth

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Resource Offers
Default Parameters

- Commitment Status is the state of the Resource and impacts the considerations made in unit commitment
- There are five commitment statuses:
  - Outage
    - Resource unavailable because of a planned/forced outage
  - Emergency
    - Resource available during emergency situations only
  - Economic
    - Resource is available for commitment (default)
  - Must-Run (self-commit)
    - Committed per MP request
  - Not Participating
    - Resource will not participate in Day-Ahead and/or Real-Time Market
- Note that not all of these are available to all types of demand resources
  - Example:
    DRR-Type I can only select “Economic”, “Emergency”, or “Not Participating”

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Resource Offers
Default Parameters

- Dispatch Status is the state of the Resource and impacts the considerations made in Real Time unit dispatch
- There are five dispatch statuses:
  - Economic
    - Default status which means that if a unit is committed, then it is available for economic dispatch by SCED ("Security Constrained Economic Dispatch") computer model
  - Self-Schedule
    - Indicates a status of self-schedule for the Resource
  - Not Qualified
    - Resource is not qualified to provide Operating Reserves in an hour. Used only during physical resource restriction
  - Not Participating
    - Resource has elected not to provide Operating Reserves in an hour
  - Emergency
    - Resource to be cleared for Offline Supplemental Reserves only in an emergency. For quick start resources only
- As with Commitment Status, not all these choices are available to every resource type, and Dispatch Status choices can vary based on the Commitment Status selection.

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Scheduling Offers

- The following section will give an overview of the Schedule Offer including:
  - Energy & Operating Reserves Offers
  - Self-Scheduling a Resource
  - Updating the Default Limits and Parameters with Offer (if necessary)
  - How to submit Schedule Offers via Market Portal

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Scheduling Offers
Energy & Operating Reserve Offers

- An offer essentially consists of an amount (MW) and a required price ($/MW or $/MWh) for the service offered
  - For example, Unit A (120 MW) offers to provide spinning reserve of 20 MW at a price of $5/MW and to provide energy from 100 MW at $30/MWh.
- From a very high-level point-of-view, the market then selects the combination of energy offers and operating reserve offers that results in the lowest total cost while still meeting the demand for energy and required operating reserves.
  - If a contingency arises, some or all of the operating reserve resources will be called upon to provide energy (or, if demand response, reduce energy usage).
  - If called upon, operating reserve resources will be paid both for their reserve participation and for the energy actually provided (or curtailed).

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Scheduling Offers
Self-Schedule - Reserves

- A self-schedule is a way for a market participant to determine how many MW their unit will produce
  - Become a price-taker
  - Submitted as “economic” or “must run”

- A self-schedule essentially guarantees that the resource will be selected to provide contingency reserves, but at the cost of accepting any price that results from the market dynamics.

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Scheduling Offers
Regulation Reserve

- Available to committed DRR-Type II, located within the Midwest ISO footprint
- DRR-Type II follow the same information input requirements as generation resources (parameters for economic offers, commitment, and dispatch).
- If a resource is Regulation Qualified, it is automatically qualified for both Spin and Supplemental.

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Scheduling Offers
Spinning Reserve

- To submit Spin Offers, a Resource must be qualified and meet the following criteria:
  - Registered as Spin Qualified Resource
  - Can fully deploy within the 10 minute 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
  - Provide telemetered data every 10 seconds
    (DRR-Type I has requirement of 1 minute interval data, within 10 minutes after the applicable hour.)
  - If a resource is Spin Qualified, it is automatically qualified for Supplemental

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Scheduling Offers
Supplemental Reserve

- To submit Supplemental Offers, a Resource must be qualified and meet the following criteria:
  - Registered as Supplemental Qualified Resource
  - Can deploy if previously cleared as Supplemental Reserve within 10 minutes
  - 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
  - Provide telemetered data every 10 seconds (DRR-Type I has requirement of 1 minute interval data, within 10 minutes after the applicable hour.)
  - Minimum run time (or minimum interruption time if DRR-Type I) less than or equal to 3 hours if a Quick-Start resource

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Scheduling Offers
Examples from the Market Portal

- The following slides show how data may be entered through the on-line portal
  - Commitment Status (Energy market)
  - Interruption and Shut-Down costs
  - Shut-down time requirements
  - Curtailment and Targeted Reductions
  - Operating Reserve data
  - Commitment Status (Operating Reserves)
- Specifics apply to DRR-Type I, but provide general guidance for all demand resources

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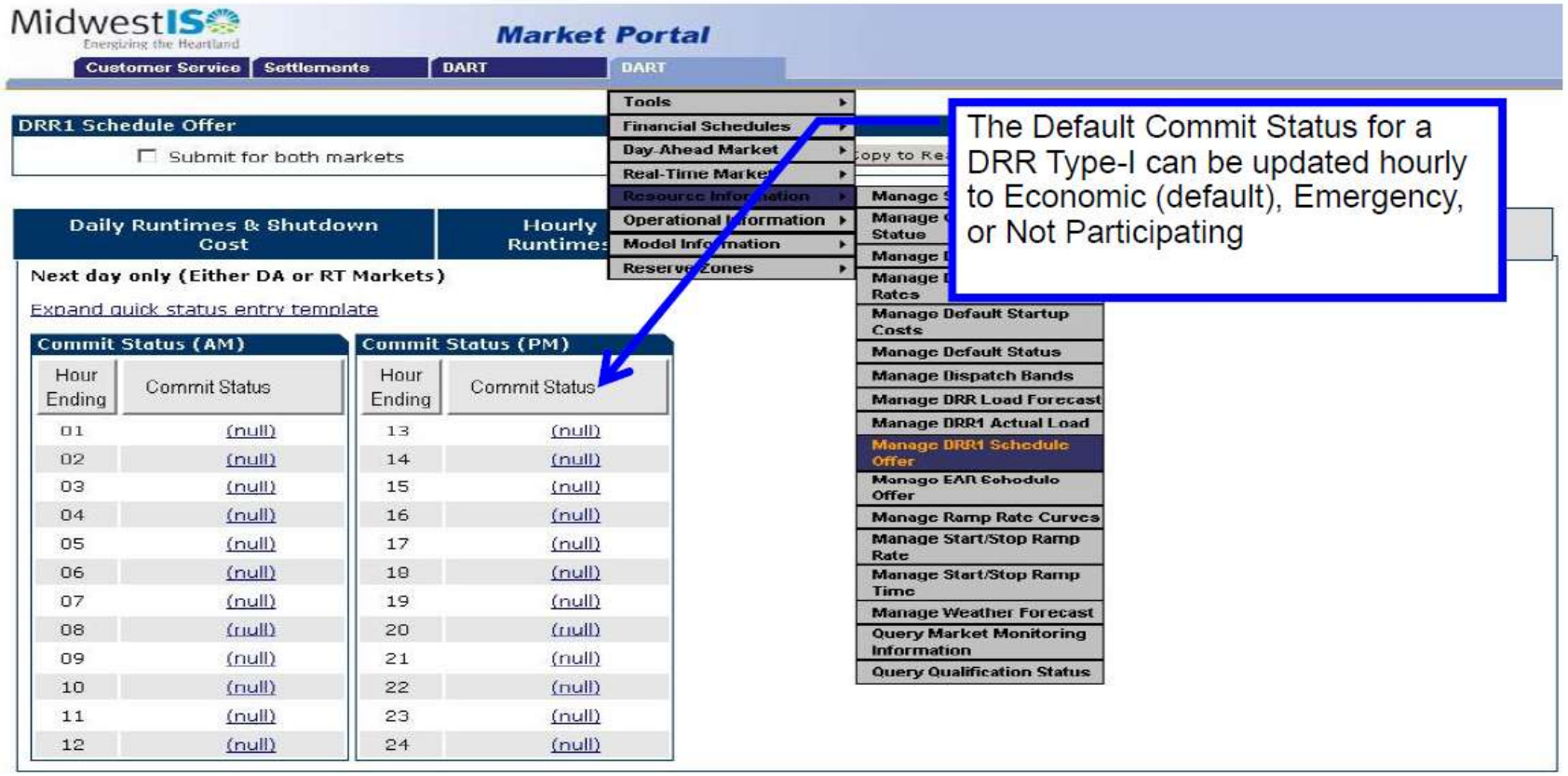
Scheduling Offers

DRR-Type I Commit Status (Energy)



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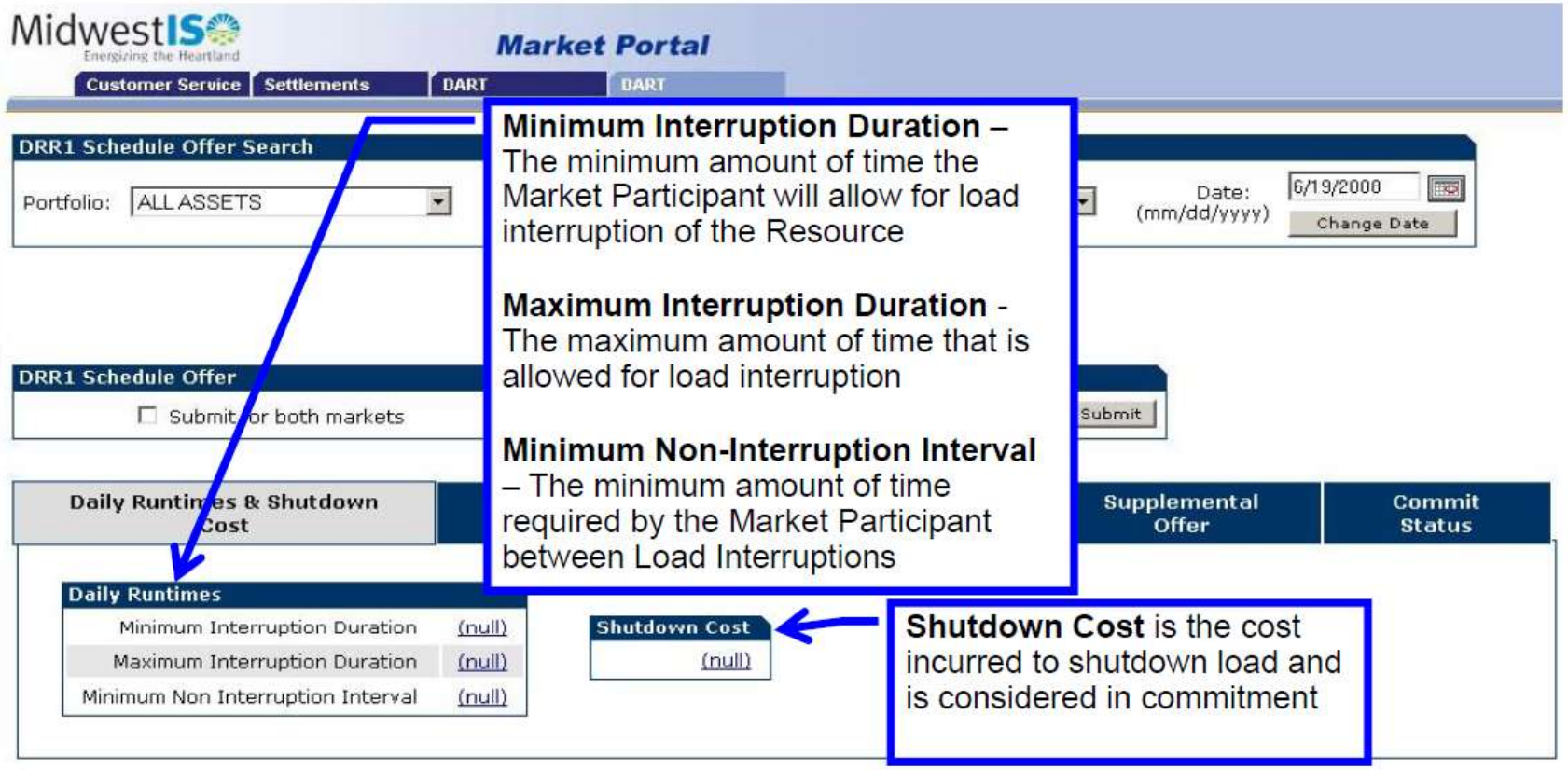
Scheduling Offers

Interruption & Shut-Down Data



Duration/Interval Values from 0 to 999.59 (HR.MIN); Shutdown Cost from ±$99,999,999.99/MW

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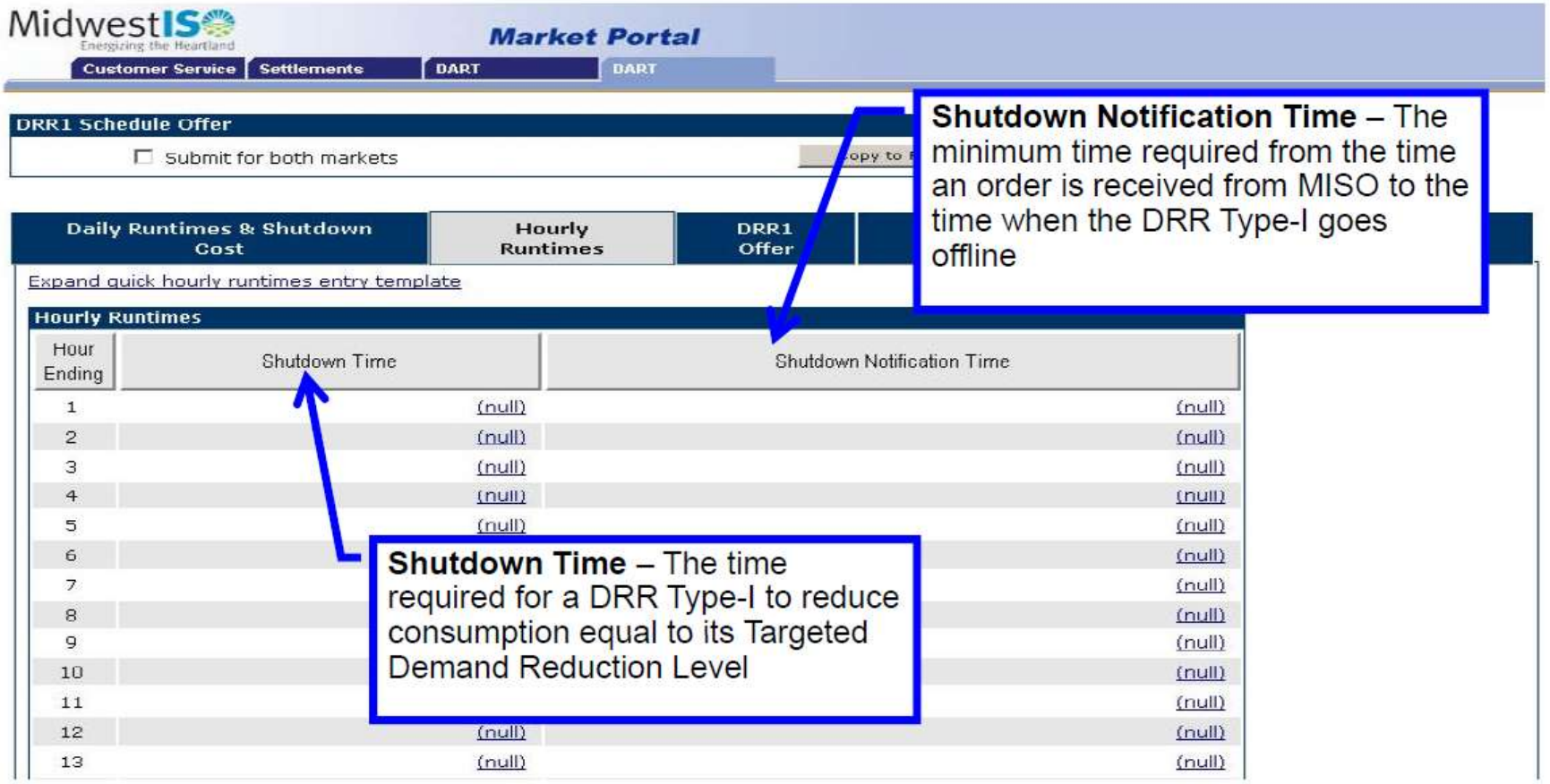
Scheduling Offers
Shut-Down Times



Shutdown Time from 0 to 999.59 (HR.MIN); Notification Time from 0 to 23.59 (HR.MIN)

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Scheduling Offers
Curtailment & Targeted Reduction

Curtailment Offer Price from ±$99,999,999.99/MW; Target Demand Reduction ±99,999,999.9 MW

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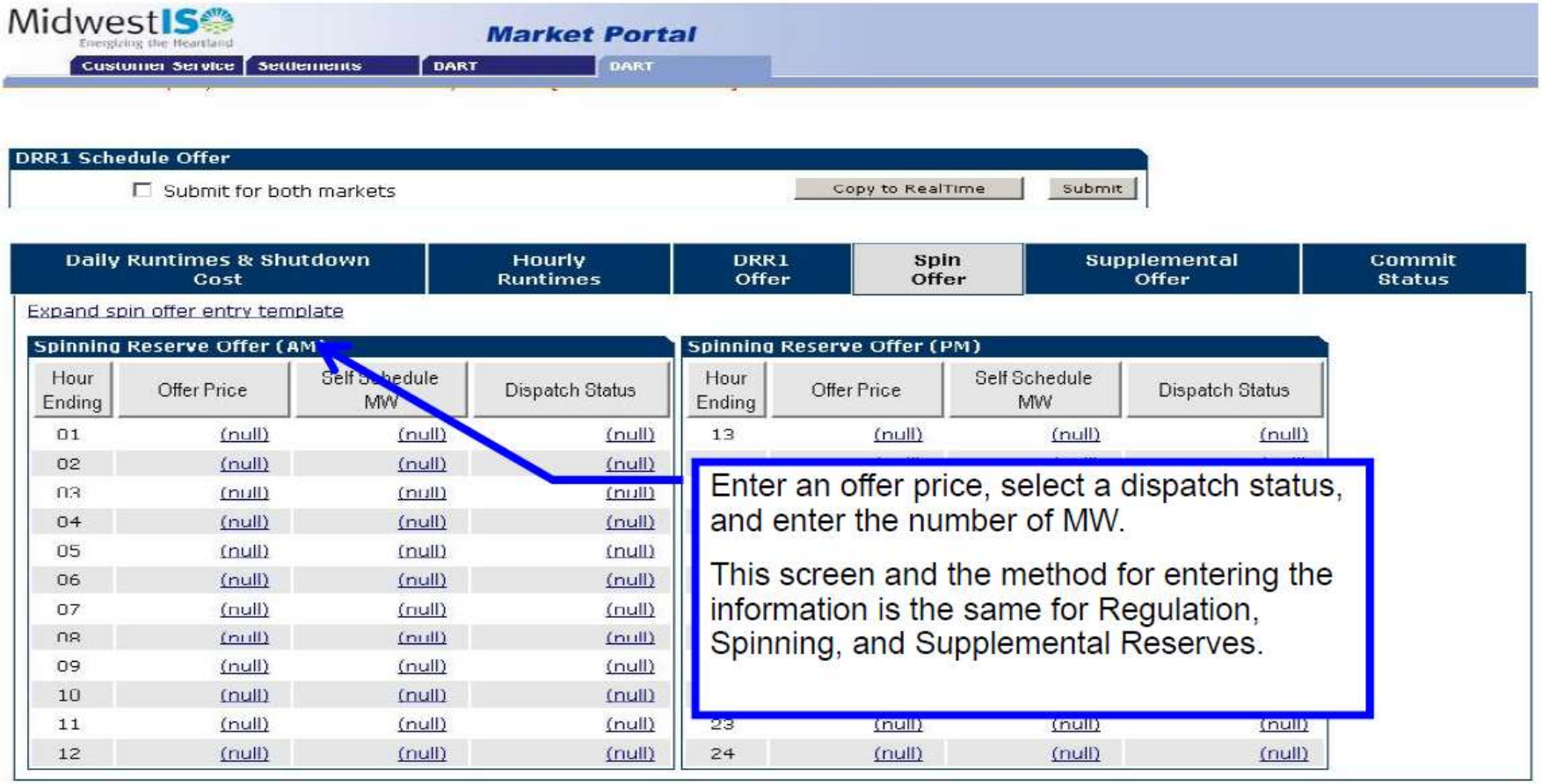
Scheduling Offers

Entering Operating Reserve Information



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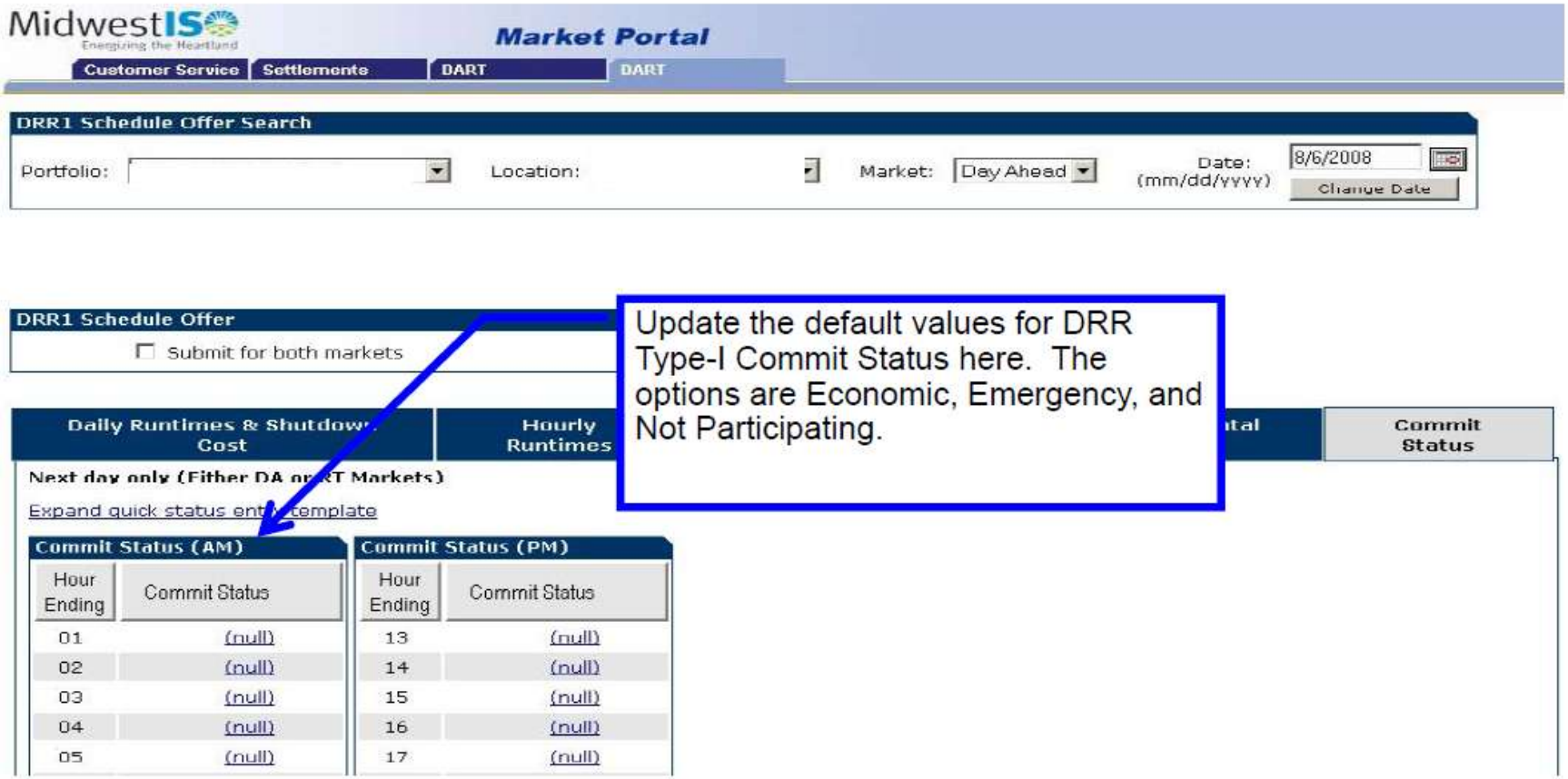
Scheduling Offers
Commit Status data



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Settlements

- Market Participants who provide resources that are “cleared” or utilized by the various markets receive compensation through the settlements process.
- Energy & Operating Reserve settlements can be confusing because there are two markets: Day-Ahead (DA) and Real-Time (RT).
  - While the DA and RT markets each operate independently, many RT settlement values depend upon DA positions.
  - The DA market, while financial in nature, is conceptually a ‘forward’ market in that participants pay (or are paid) for services that will be received (provided) in the RT market.
    - To the extent that actual provision of services differs, there will typically be a charge (or credit) to reflect the discrepancy.
    - To the extent that DA positions are taken, the parties avoid the uncertainty of RT rates

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Settlements: Energy
Simplified Example 1

- DRR MP reduced load by 5 MW during a given hour
- DRR MP shows a metered demand of 12 MW for that hour
- For that hour, the DRR MP forecast a demand of 17 MW (including the use normally associated with the DRR).
- Previously, the DRR MP provided information leading to the determination of a forecast cap of 20 MW
- DRR output = forecast – metered = 17 – 12 = 5 MW
- Consumption = reduction + metered = 5 + 12 = 17 MW
- Forecast must be less than cap (17 < 20) OK
- Payment to DRR, based on DRR output = 5 * LMP
- Payment by LSE, based on Consumption = 17 * LMP

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Settlements: Operating Reserves
Simplified Example 1

- DRR are paid at the appropriate zonal rate (regulation, spin, supplemental) for the reserve provided.
- Operating Reserve payments settled the same as Energy market
  - If **DA cleared MW = RT cleared MW**, then payment based on DA amounts and rates
    - Asset Owner receives \$ = $MW \cdot MCP_{DA}$
  - If **DA cleared MW < RT cleared MW**, then payments based on the amount cleared DA, plus the additional amount cleared RT
    - Asset Owner receives \$ = $MW_{DA} \cdot MCP_{DA} + (MW_{RT} - MW_{DA}) \cdot MCP_{RT}$
  - If **DA cleared MW > RT cleared MW**, then payments based on the amount cleared DA, minus the amount not needed in RT
    - Asset Owner receives \$ = $MW_{DA} \cdot MCP_{DA} - (MW_{DA} - MW_{RT}) \cdot MCP_{RT}$
- If deployed, assets are also paid for the energy "provided"

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Resource Adequacy
Module E (PRC, VCA)

- All DRR registered as Capacity Resources participate in RAR
  - There are no special or additional requirements of DRR to participate in RAR
- All LMR participate in RAR
  - The following section describes
    - Requirements to Qualify
    - Registration
    - Information and Data Inputs

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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 (-)

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Requirements to Qualify
LMR

- To be qualified as an LMR, a demand resource must satisfy the following requirements:
  - May be claimed by only 1 Market Participant
  - ≥ 100 kW (grouping allowed)
  - Schedulable within 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
  - Can be 'netted' against LSE's Forecast Demand in RAR, or converted into Planning Resource Credits, but not both
    - Exception: BTMG cannot be "netted"
      (because it is generation and must be backed by reserves)

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Requirements to Qualify
BTMG

- BTMG additional requirements … subject to previous requirements plus:
  - Must demonstrate capability annually (See BPM for details.)
  - Must be able to be dispatched during emergencies

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Registration - LMR

- All LMR 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.
- The Midwest ISO 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.
- LMRs will be accredited utilizing information from the Generator or Demand Availability Data System (GADS or DADS) and methods further described in the BPM for Resource Adequacy.
- Written documentation from state having jurisdiction over the LSE, or from customers represented by the LMR MP, with the amount and type of Demand Resource and the procedures for achieving the demand reduction

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Registration – LMR
MECT Tool & Planning Resource Credits (PRC)
TP-BPM-003-r3 Section 4.4.1

- An LMR must be registered with the Midwest ISO in advance of an LSE receiving LMR accreditation 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 Registration team at register@midwestiso.org to become a Market Participant.
- Once accredited by the Midwest ISO, the LMR with its associated MWs will be entered into the MECT by the Midwest ISO.
- The entity that registers the LMR has a choice of how to handle the planning resources (MW) associated with the resource:
  - The default use is direct subtraction from an LSE's Forecast Requirement
    - BTMG is not eligible to be subtracted directly from an LSE's Forecast Requirement
  - Can be converted into PRCs for use in meeting RAR obligations and possible trading in the Voluntary Capacity Auction (VCA)

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Informational Requirements
LMR

- MP Name and contact information
- Identity of the LSE and contact information
- Identification of Commercial 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 emergency protocol from list provided
- Provide written procedures demonstrating ability to reduce load
- Develop and submit testing procedures, including past performance or mock test results

* BTMG will provide relevant generation operating information where applicable

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Informational Requirements
LMR

- Changes to Registration
  - Cannot ‘un-register’; must amend “Stop Date”
  - Must provide 45 day notice prior to the month in which changes are to be effective
- Accreditation
  - Written support
    - From the state having jurisdiction over the LSE
    - M&V Certification using NERC or NAESB procedures
  - See § 69.2.2.1 of the Tariff for details
  - BTMG must provide generation testing information

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Informational Requirements
Measurement & Verification

- For Demand Resources:
  - The Baseline Usage or Customer Baseline for an DR is the average hourly load, rounded to the nearest kWh, for each of the 24 hours in a day for such Resource.
  - The Customer Baseline will be calculated by the MP registering the DR after an Emergency is called. The Customer Baseline used for computing performance for Demand Resources shall consist of eligible weekdays (weekdays that are non-Demand Response Holidays and non-interruption days). A Customer Baseline is required for a Demand Resource that is listed in an LSE's Resource Plan.
  - For an asset with no previously computed baseline, the Customer Baseline is based upon a simple average and will be calculated for each hour in a day based on meter data from the ten business days prior to an event, if the DR was deployed during an Emergency, which is referred to as the default baseline. This default baseline calculation will be used unless an alternative baseline calculation is proposed in the registration process and accepted by Midwest ISO.
  - The MP that registered the DR will collect and provide the meter data and its Customer Baseline. The MP shall document these comparisons and submit the results to the Midwest ISO within 60 days of the declared Emergency that a DR designated in an LSE's Resource Plan was deployed. In the event of an Emergency, the Midwest ISO will review metering data to verify that the Demand Resource reduced to the targeted MW level or to a specified firm service level when called upon by the Local Balancing Authority.

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Informational Requirements
Measurement & Verification: BTMG

- For BTMG, the MP registering the 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 the Midwest ISO within 60 days following an Emergency Event in which the BTMG was designated in an LSE's Resource Plan and deployed.
  - The Midwest ISO will review the meter data to verify that the BTMG increased energy output to the level instructed by the Local Balancing Authority.
- BTMG consisting of one or more generating units that have been identified by the Midwest ISO must have metering (MWh) equipment for operational security purposes. BTMG consisting of multiple generating units at a single site that have been identified by the Midwest ISO must have metering (MWh) equipment and may be metered as a single unit, however, multiple BTMG units that have a single meter will be treated as a single unit for purposes of section 4.4.5 penalties.
- The Midwest ISO may periodically audit MP performance reports and other data to ensure that it is consistent with the requirements described in this BPM.

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Informational Requirements
Credit Requirements: Capacity (Module E)

- There are no additional credit requirements for LMR that provide service under Module E.
- The results of the creditworthiness evaluation will determine the maximum value of PRC bids that the Market Participant may submit during the VCA.
  - Example: You are informed that your credit limit is $20,000. You could bid for a maximum of 500 APRC at $40 each.

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Capacity Market and LMR

- The Capacity Market is where LSE can acquire the necessary Planning Resource Credits (PRCs) to meet their Planning Reserve Margin Requirements (PRMR). Thus, the Capacity Market is where MP can trade PRCs, either bilaterally or through the Voluntary Capacity Auction (VCA).
- LMR can participate in the VCA provided that …
  - Certification is obtained by the LSE that the relevant 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 PRCs from non-performance during Emergency penalties, and
  - The Midwest ISO evaluates the "universal deliverability" of the LMR PRCs
- LMR choices (at registration):
  - The LSE may simply subtract accredited LMR capacity (excl. BTMG) from its Forecast LSE Requirement
  - Alternatively, the LMR may register as a Planning Resource, and then convert its load reduction into PRCs.
- DRR, if registered as Capacity Resources, function in the Capacity Market like generation resources

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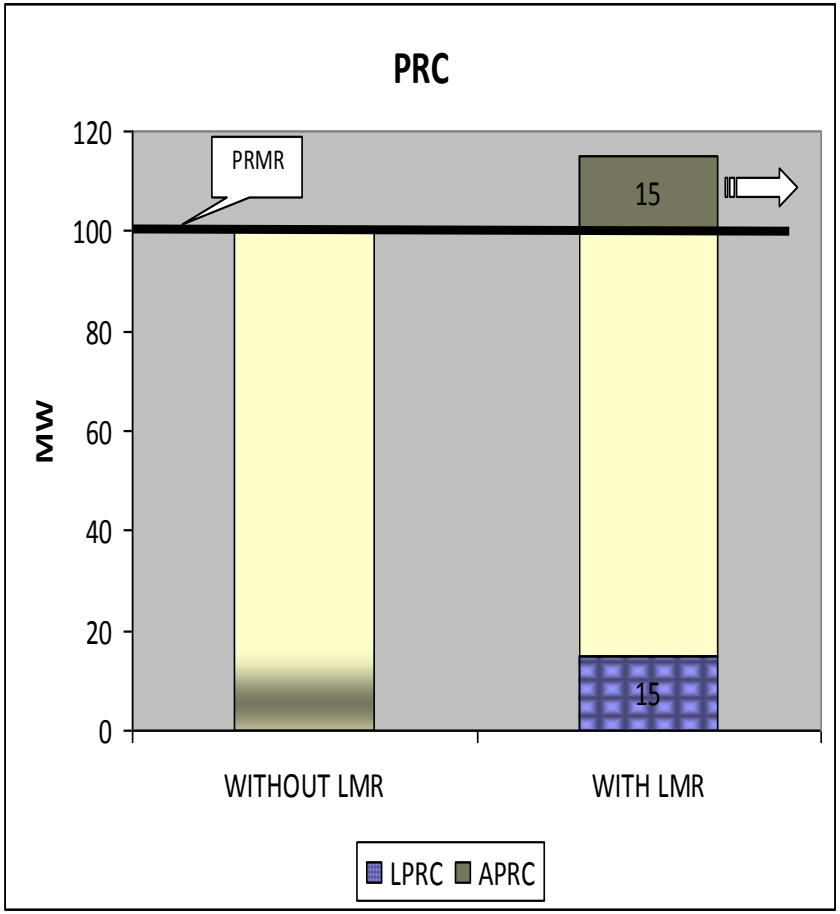
LMR and PRC

- LMR provide PRCs by virtue of their ability to decrease load or provide supply
- Such load reductions or supply injections may not be “universally deliverable” (bottlenecks)
- PRCs provided by LMR are effectively treated as LPRC (local PRC)
- LSE which have APRC can now use the PRCs provided by the LMR to satisfy their PRMR, freeing up a like quantity of APRC for potential VCA trading
- Thus, the “universal deliverability” of LMR is not an issue; they simply provide the LSE with the ability to trade its existing APRC.



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Capacity Market: Summary
LMR Requirements to Participate in the VCA

- LMR that wish to trade in the VCA must …
  - Meet the eligibility requirements
    (cf. slide 65 ff: Registration - LMR)
  - Certify that the local regulatory authority does not *prevent* its participation
  - Not be used to directly reduce LSE PRMR
    (no “double counting”)
  - Because of planning margin requirements, LMR resources that qualify for ‘netting’ against load will typically want to take advantage of that ability.
  - BTMG (unable to ‘net’) will want to understand the advantages and responsibilities of registering as LMR as compared to EDR participation.

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Capacity Market
Example

- LSE has a Forecast Demand Requirement of 400 MW
- LSE has a PRMR of 416 MW (400 × 1.04) (1.04 assumed for example)
- LSE has 20 MW of LMR
  - 15 MW (installed capacity) of BTMG
  - 5 MW of DR
- LSE can 'net' the 5 MW of DR, reducing its Forecast Demand Requirement to 395, and its PRMR to 410.8 = 395 × 1.04.
- LSE coverts its 15 MW of BTMG into PRCs
  - PRCs are measured in MW of Unforced Capacity (UCAP)
  - 15 MW → 14.8 MW UCAP for this particular BTMG
- LSE can choose to:
  - Apply all, some or none of these PRCs to reduce its PRMR
  - Sell (offer) surplus PRCs in the VCA for direct compensation

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Emergency Demand Response

- To enable demand resources that might otherwise be discouraged or prevented from participating in the market, a separate service (EDR) was instituted.
- EDR is a service, required of DRR that qualify as Capacity Resources and LMR, but also available to resources that might otherwise fail to qualify for DRR or LMR status.
  - DRR (that qualify as Capacity Resources) and LMR *must* make themselves available for emergency use
- EDR participants are able to make an offer to provide energy (BTMG) or reduce load (DR) during emergency conditions.
- EDR offers ($ and availability) can change daily.
- While the EDR offer is in-force, emergency response is required.

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Registration
EDR

- To register an EDR, must either be a MP or have MP-representation
- Requires completion of
  - Registration form
  - Certification form
  - Offer form
    (following notification of acceptance)

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Informational Requirements
EDR

- Submit documentation of State regulatory approvals
- **Provide and specify (e.g. labor, equipment) shut-down costs**
- Must be able to respond to dispatch via XML
- **Specify the daily availability of demand response**
- Specify the number of hours of advanced notice required
- **Specify min. and max. # of contiguous hours for which the EDR can curtail its load**
- Offer must be not later than next day and will remain in-force unless changed (daily)
- **Provide limitations, if any, for # of times of curtailment available during the year, # of times already curtailed, and any other restrictions on curtailment**
- EDR Offer can specify *either:*
  - The minimum and maximum amount of reduction, in 100 kWh increments OR
  - The Firm Service level AND the EDR's peak demand
- **Specify a single value for the hourly curtailment offer < $3500/MWh**
- Hourly metered data will be deemed sufficient certification that resource was not used for any other non-emergency purpose
- **Obligated to interrupt in an emergency, given the parameters supplied**

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Informational Requirements
Credit Requirements: EDR

- EDR providers have no additional (*) credit requirements

(*) EDR providers must complete the standard credit forms and registration process required of all market participants.

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Scheduling (Offers)
EDR

- **Offer Data:**
  - Commercial Pricing Node Name
  - Emergency Demand Response Name
  - Effective Date, representing the first day of the month for which the monthly offer is valid
  - Minimum Reduction MW value
  - Maximum Reduction MW value
  - Minimum Reduction Time in Hours
  - Maximum Reduction Time in Hours
  - Reduction Notification Time in Hours
  - Shut Down Cost in dollars, representative of the cost to curtail use
  - Reduction Offer in dollars per MWh

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How EDR Payments Differ from 'standard' Payments

DRR/LMR

- Payments based on how the resource is used: energy (LMP) possibly including make-whole payment, operating reserves (MCP), or planning resources (VCA)

EDR

- Emergency Energy only
- Payment is *greater* of:
  - ❑ LMP × Energy or
  - ❑ Production Costs
    - ❑ Shut-Down costs +
    - ❑ Curtailment offer × Energy

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Settlement Example
EDR

- A 5 MW EDR provides Shut-Down costs of $1000 and a curtailment offer of $80/MWh
- During an emergency, the EDR responds completely as offered for 4 hours.
- The LMP for each of those hours is $150/MWh
- The EDR would receive the greater of:

LMP:	$5_{MW} \times 4_{HR} \times \$150_{/MWh}$	=$3000
Costs:	$\$1000 + 5_{MW} \times 4_{HR} \times \$80_{/MWh}$	=$2600

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Comparing Emergency Penalties

LMR

- Penalized for failure to respond or to reach target
- May be denied participation as a planning resource
- Penalty = LMP_{RT} × shortfall + RSG $_{pro\text{-}rata}$

EDR

- Penalized if response<95% targeted amount
- If response<95%, EDR is not eligible for make-whole payment
- Shortfall defined as
  Targeted Amount × 95% - Actual Reduction
- Penalty = LMP_{RT} × shortfall

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Settlement Example continued
EDR Penalty

- If the EDR had only been able to reduce load by 4 MW rather than 5 MW:
- Response 80% < 95%
- Shortfall Penalty =
  $(5 \times .95 - 4)_{MW} \times 4_{HR} \times \$150_{/MWh} = \$450$
- Payment =
  $4_{MW} \times 4_{HR} \times \$150_{/MWh} = \$2400$
  Note that because the EDR did not fulfill its obligation, it is not entitled to automatic recovery of its production costs.
- Net to EDR = $2400 - $450 = $1950

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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

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Emergency Procedures continued

EVENT STEP 3	• Typically, Supplemental, then Spinning reserves are utilized as co-optimized by Unit Dispatch System (UDS) • Regulation Reserve maintained, but deployed immediately prior to next Step • Instruct Load to be reduced via “Load Management Measures – Stage 2”
EVENT STEP 4	• Implement Reserve Call from Contingency Reserve Sharing Group • Implement purchase of Operating Reserves from neighboring LBAs, if available
EVENT STEP 5	• Declare NERC EEA3 • Direct Firm Load Shedding

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Emergency Progression Summary

- Capacity Resources (DRR)
- Planning Resources (LMR that are not also registered as EDR)
- "Load Management Measures – Stage 1"
  - **Load Management actions** that can be taken to reduce demand to preserve or maintain Operating Reserves **that are not EDRs or LMRs**
- EDR Offers in merit order (per Schedule 30)
- "Load Management Measures – Stage 2"
  - Load Management actions that can be taken to reduce demand *including* voltage reductions and reducing load that, by contract, cannot be interrupted until reserves are being or are expected to be depleted and energy from emergency Offers by Market Participants are being or are expected to be depleted.
    These actions do not include EDRs or LMRs.

Ref: RTO-EOP-002-R8 and NERC EOP-002

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Questions Answered

- Why does a company or organization need to register?
  - Only by registering can a company/organization participate actively in the various markets and procedures administered by the Midwest ISO.
- How does a company or organization register?
  - Please see slides with this color header, beginning slide 31.
- What are the various types of demand resources?
  - Types and categories are discussed beginning on slide 7.
- What kinds of information will I need to provide or prepare?
  - Please see slides with this color header, beginning on slide 36.

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Questions Answered

- What kinds of requirements are faced by demand resources that want to participate in the various markets?
  - Please see slides with this color header, beginning slide 28.
- How is a demand resource "output" measured and verified?
  - Please see slides 69 and 70.
  - Note that these procedures will change with ARC implementation.
- How are payments & penalties determined?
  - Please see slides 81 through 84.

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Frequently Asked Questions

- "I'm an LSE that has demand resources. What do I need to do to participate effectively in the Midwest ISO markets?
  - As an LSE, you are already registered as a Market Participant, but you will need to register your demand resources.
  - Determine the type(s) of demand resources that you have available:
    - Are they "on/off" or are they able to vary their load reduction in response to dispatch instructions?
    - What sort of metering is used to measure the electricity used by the resource?
    - Are they able to respond to power emergencies at all times, or do they have other commitments?

    Answering these questions will help you determine where your demand response resource fits into the larger scheme of markets administered by the Midwest ISO. See slides 6-14.
  - Are you interested in obtaining capacity-related revenues for this demand resource?

    To receive capacity-related payments, the resource must be generally available to reduce demand in case of electric system Emergencies.
  - Investigate the data requirements of the potential categories available to your demand resource. See Informational Requirements sections: slides 36-39 (DRR), slides 67-71 (LMR), slides 78-79 (EDR).
  - To participate in the Energy & Operating Reserve markets where buying/selling of power and/or capacity is performed hourly each day, the demand resource must be either a DRR-Type I or DRR-Type II. See slides 28-30.
  - If you do not wish to participate (or your resource is unable to participate, for example, because of metering inadequacies) in the hourly markets, your primary decision will then be whether you want to receive capacity-related payments for the resource. If your decision is 'Yes', then you will need to qualify your demand resource as an LMR. See slides 63-64.

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Frequently Asked Questions

- LSE Checklist:
  - ❑ Registered as a Market Participant with Midwest ISO?
  - ❑ Demand Resources Categorized?
  - ❑ Demand Resources appropriately Registered?
  - ❑ Informational Requirements satisfied for each demand resource?
  - ❑ Ability to provide data?
  - ❑ Reviewed appropriate Business Practice Manuals (BPMs) for details?

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Questions/comments?

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Glossary

The following Glossary is provided in an effort to assist the reader in understanding the concepts presented in the Demand Response Training Primer. *However, the reader is advised that the definitions provided below may not be precise or accurate in every circumstance. Therefore, the reader should not rely on these definitions for any considerations having financial implications. Please consult the Tariff or appropriate Business Practice Manual for precise definitions.*

- **ARC** Aggregator of Retail Customers: An entity that combines one or more retail customers into a group for purposes of offering electricity into the wholesale market. The electricity "offered" can be from demand resources (that reduce consumption) or from behind-the-meter generation (that produce electricity).

- **BPM** Business Practice Manual: An "official" document that contains detailed information regarding the markets and operating procedures of the Midwest ISO.

- **BTMG** Behind-The-Meter Generation: (1) General: Electrical generation that due to its location and metering is not "seen" by the Midwest ISO through telemetry. (2) Specific: A defined term in the Tariff that refers to behind-the-meter generation participating as a Load Management Resource in the Midwest ISO markets.

- **DR** Demand Resource: (1) General: Any 'resource' that can reduce its demand for electricity in response to a request from its electricity supplier. (2) Specific: A defined term in the Tariff that refers to a demand resource participating as a Load Management Resource in the Midwest ISO markets.

- **DRR** Demand Response Resource: A defined term in the Tariff that refers to a type of demand resource that has (or could be) qualified as a Capacity Resource in the Midwest ISO markets.

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- **EDR** Emergency Demand Response: A defined term in the Tariff that refers to energy provided during Emergency conditions from a demand resource or behind-the-meter generation that has qualified under Schedule 30.
- **FERC** Federal Energy Regulatory Commission: The national agency responsible for energy regulation.
- **LMP** Locational Marginal Price: A wholesale price for electricity, as provided by the Midwest ISO, that includes three components: energy, transmission losses, and transmission congestion. LMP is expressed in $/MWh.
- **LMR** Load Modifying Resource: A defined term in the Tariff that refers to resources that have qualified as planning resources, that is, resources that contribute towards the system's ability to meet the reserve adequacy requirement. LMRs consist of two distinct resource types: Demand Resources, such as interruptible customer loads, and Behind-the-Meter Generation.
- **LSE** Load Serving Entity: A defined term in the Tariff that typically refers to an organization (e.g. electric distribution utility) that is responsible for serving customer load.
- **MECT** Module E Capacity Tracking Tool: The Web-based computer program and interface that allows Market Participants to enter various data related to their loads and Module E requirements.
- **MFRR** Marginal Foregone Retail Rate: A rate that expresses the revenue lost by a LSE when one of its retail customers reduces energy consumption.

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- **Module E** of the Tariff: A part of the Tariff; a formal expression of how the Midwest ISO attempts to provide adequate resources to meet the peak demand of customers.
- **MP** Market Participant: A business entity involved in transactions with the Midwest ISO
- **MTEP** Midwest ISO Transmission Expansion Plan: A long-term plan for transmission expansion in the geographical area covered by the Midwest ISO
- **OATT** Open Access Transmission Tariff ("the Tariff"): The formal regulatory document that describes the terms, conditions, and operations of a transmission system operator.
- **PRC** Planning Resource Credit: The fungible unit of account used by LSE to meet their PRMR (see below), measured in MW.
- **PRMR** Planning Reserve Margin Requirement: The total capacity requirement, measured in MW, for an LSE, based on its customers' peak load during the year
- **RAR** Resource Adequacy Requirement: The requirement to meet peak customer load through the provision of reliable electricity resources.

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- **RSG** Revenue Sufficiency Guarantee: The financial mechanism through which the Midwest ISO obtains and transfers funds to offset direct costs incurred by suppliers that is not compensated through normal market prices.
- **TP** Transmission Provider: A business entity involved in the activity of providing electrical transmission services, e.g. the Midwest ISO.
- **VCA** Voluntary Capacity Auction: The monthly auction at which LSEs may purchase or sell PRCs in order to meet their PRMR.

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