

Midwest ISO Energy and Operating Reserves Markets Charge Overview

Presented to
Minnesota Public Utilities Commission
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Acronyms

- **AO** – Asset Owner
- **AGC** – Automatic Generation Control
- **ARR** – Auction Revenue Rights
- **BA** – Balancing Authority
- **BPM** – Business Practice Manual
- **DA** – Day-Ahead
- **CPNode** – Commercial Pricing Node
- **EMT** – Energy and Operating Reserves Market Tariff
- **FTR** – Financial Transmission Rights
- **GENCO** – Resource Owner
- **ISO** – Independent System Operator
- **LBA** – Local Balancing Authority
- **LMP** – Locational Marginal Prices
- **LSE** – Load Serving Entity
- **MCC** – Marginal Congestion Component
- **MCP** – Market Clearing Prices
- **MP** – Market Participant
- **MW** – Megawatt
- **NERC** – North American Electric Reliability Corporation
- **RAC** – Reliability Assessment Commitment
- **RT** – Real-Time
- **RTO** – Regional Transmission Organization
- **SCED** – Security Constrained Economic Dispatch
- **SCUC** – Security Constrained Unit Commitment
- **SFT** – Simultaneous Feasibility Test
- **TC** – Transmission Customer
- **TO** – Transmission Owner

Midwest ISO Market Charges

The Midwest ISO currently has 55 individual Market Settlement Charge Types implementing the Day-Ahead and Real-Time Energy and Operating Reserves Markets, and the Financial Transmission Rights Market, including Auction Revenue Rights

These charges can be classified by their associated markets and the purpose for the charge. Purposes include; Revenue, Allocations, Compliance, and Market Administration

Settlement and Energy Market Basics

The Day-Ahead and Real-Time Energy Markets utilizes a two settlement system for market transactions.

The Day-Ahead Market utilizes SCUC and SCED to produce Energy and Operating Reserve Schedules, based on Bids and Offers submitted.

Day-Ahead Market Transaction Volumes are settled at the LMP for Energy schedules or MCP for Operating Reserves published at each CPNode.

$$[\text{DA Settlement}] = [\text{DA Quantity}] * [\text{DA Price}]$$

In general, Resource injections or Imports receive revenue credits, and Load withdrawals or Export receive revenue charges.

Settlement and Energy Market Basics

The Real-time Market utilizes SCED to produce Energy and Operating Reserve Schedules and Setpoint instructions for Generation or Demand Response Resources, based on forecasted system Load and Resource Offers.

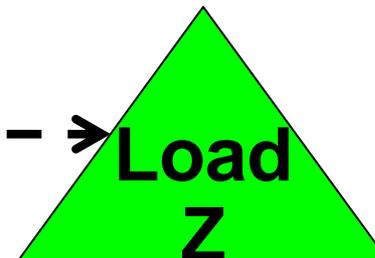
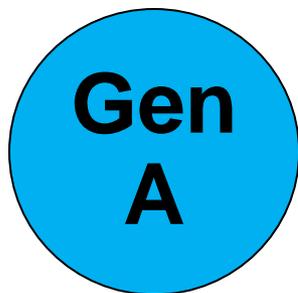
The Automatic Generation Control System (AGC) continuously evaluates system conditions and produces Dispatch Targets through the deployment of Operating Reserves

Incremental Resources may be committed via the RAC process based on the SCUC.

Real-Time Imbalances (or Deviations) from Day-Ahead Schedules are settled at the LMP or MCP published at each CPNode.

$$[\text{RT Settlement}] = \{[\text{RT Quantity}] - [\text{DA Quantity}]\} * [\text{RT Price}]$$

Simple Transaction Example Day-Ahead



Day-Ahead

Generation Schedule: -100 MW
LMP: \$27, MCC: \$ 5, MLC: \$ 2

Day-Ahead Bilateral

Schedule: 100 MW
Seller: Gen A
Buyer: Load Z

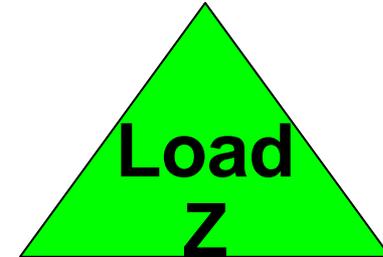
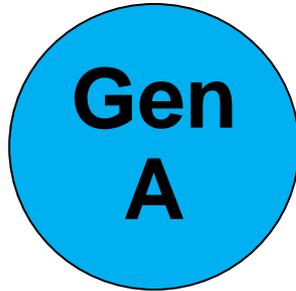
Day-Ahead

Load Schedule: 100 MW
LMP: \$30, MCC: \$ 7, MLC: \$ 3

Charge Types	Day-Ahead Calculation
Energy at Gen A, Load Z	Settled Between Buyer and Seller outside of Market
Congestion	Schedule Volume * (MCC@Sink – MCC@Source) (100) * (\$7 - \$5) = \$200.00
Losses	Schedule Volume * (MLC@Sink – MLC@Source) (100) * (\$3 - \$2) = \$100.00

Simple Transaction Example

Real-Time



Day-Ahead

Generation Schedule: -100 MW

Real-Time

Generation Schedule: -105 MW

LMP: \$45, MCC: \$ 6, MLC: \$ 2

Day-Ahead

Load Schedule: 100 MW

Real-Time

Generation Schedule: 102 MW

LMP: \$49, MCC: \$ 9, MLC: \$ 3

Charge Types	Real-Time Calculation
Energy at Gen A	{RT Schedule – DA Schedule} * RT LMP $(-105 - (-100)) * \$ 45 = - \$ 225$ [Credit]
Energy at Load Z	{RT Schedule – DA Schedule} * RT LMP $(102 - 100) * \$ 49 = \$ 98$ [Charge]

Energy Market Transactions

Charge	Entity	Type	Basis
Day Ahead and Real Time Asset Energy Amount	GENCO/LSE	Revenue	Schedule Volumes
Day Ahead and Real Time Financial Bilateral Transaction Congestion Amount	GENCO/LSE	Revenue	Schedule Volumes
Day Ahead and Real Time Financial Bilateral Transaction Loss Amount	GENCO/LSE	Revenue	Schedule Volumes
Day Ahead and Real Time Non-Asset Energy Amount	MP	Revenue	Schedule Volumes
Day Ahead and Real Time Virtual Energy Amount	MP	Revenue	Schedule Volumes
Real Time Distribution of Losses Amount	GENCO/LSE	Revenue	Schedule Volumes
Excessive Energy Amount	GENCO	Revenue	Excessive Energy Injection Volumes
Net Regulation Adjustment Amount	GENCO	Revenue	Deployed Reserve Volumes
Non-Excessive Energy Amount	GENCO/LSE	Revenue	Schedule Volumes

Uplift and Compliance in Energy Markets

- In order to operate efficient markets and incent appropriate behavior, the Midwest ISO Market provides Revenue Guarantees, or Make-Whole Payments, to Resources, and assesses Compliance charges on Resources that fail to meet performance criteria.
- These Charges and their allocation incent Market Participants to:
 - Offer Resources at their actual costs and capabilities
 - Follow Setpoint Instructions and Dispatch Targets
 - Schedule accurately in the Day-Ahead Market
 - Comply with Reserve Deployments

Uplift, Revenue Sufficiency, and Compliance

Uplift, Revenue Sufficiency, Compliance	Entity	Type	Basis
Day Ahead Revenue Sufficiency Guarantee Make Whole Payment Amount	GENCO	Revenue	Schedule Volumes
Real Time Revenue Sufficiency Guarantee Make Whole Payment Amount	GENCO	Revenue	Schedule Volumes
Real Time Price Volatility Make Whole Payment Amount	GENCO	Revenue	Schedule Volumes
Day Ahead Revenue Sufficiency Guarantee Distribution Amount	MP	Allocation	Load, Virtual Demand & Exports
Real Time Net Inadvertent Distribution Amount	MP	Allocation	Aggregate Energy Transaction Volumes
Real Time Revenue Neutrality Uplift Amount	LSE/MP	Allocation	Load and Exports
Real Time Revenue Sufficiency Guarantee First Pass Dist Amount	MP	Allocation	Schedule Deviation Volumes
Contingency Reserve Deployment Failure Charge Amount	GENCO	Compliance Charge	Deployed Reserve Volumes
Real Time Excessive Deficient Energy Deployment Charge Amount	GENCO	Compliance Charge	Deployed Reserve Volumes
Real Time Miscellaneous Amount	MP	Various	Various

Ancillary Services Markets

In January 2009, the Midwest ISO consolidated its member Balancing Authorities within the Market Footprint to form the Midwest ISO Balancing Authority Area.

In order to meet NERC Reliability Standards, the Midwest ISO procures Operating Reserves; Regulation, Spinning, and Supplemental Reserve Capacity, in the Day-Ahead and Real-Time Markets based on Market Participant Offers.

Requirements establish the Operating Reserve volumes to procure to ensure compliance with standards during normal operations as well as contingency events

Operating Reserve Costs are allocated to Load and exports based on a formula rate developed on the cost of reserves in each of seven Reserve Zones

Ancillary Services

Ancillary Services Charge	Entity	Type	Basis	Approx. Rate* (\$/MWh)
Day Ahead and Real Time Regulation Amount	GENCO	Revenue	Cleared Schedule Volumes	\$ 12.16
Day Ahead and Real Time Spinning Reserve Amount	GENCO	Revenue	Cleared Schedule Volumes	\$ 3.66
Day Ahead and Real Time Supplemental Reserve Amount	GENCO	Revenue	Cleared Schedule Volumes	\$ 1.26
Regulation Cost Distribution Amount	LSE	Allocation	Market Load	\$ 0.07
Spinning Reserve Cost Distribution Amount	LSE/MP	Allocation	Market Load and Exports	\$ 0.05
Supplemental Reserve Cost Distribution Amount	LSE/MP	Allocation	Market Load and Exports	\$ 0.02

*July 2010

The FTR Market

The Midwest ISO makes Financial Transmission Rights available to provide a hedge against Congestion Costs in the Day-Ahead Market

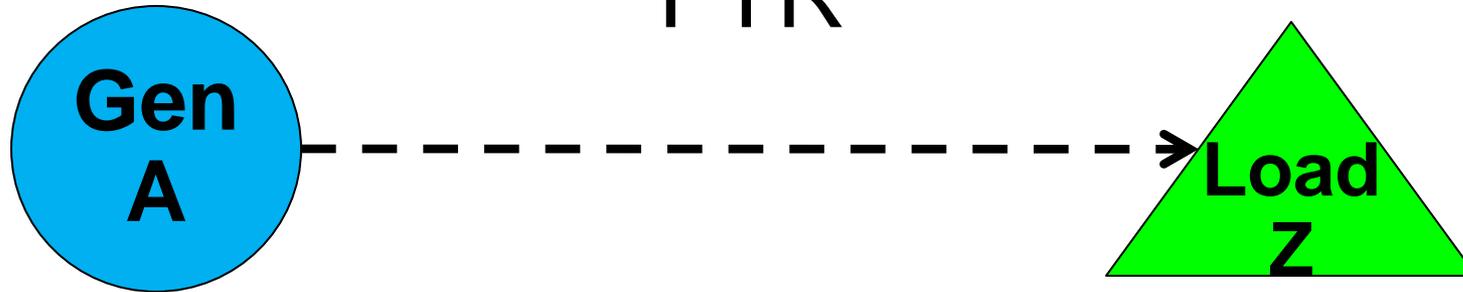
FTRs are financial instruments, not physical rights, that can entitle the holder to a stream of revenue based on Congestion over the FTR path. They can also obligate the holder to a charge based on the direction of congestion over the FTR path

FTRs are obtained through Annual or Monthly Auctions for Seasonal and Peak periods

Revenues to fund FTRs are provided from hourly congestion amounts in the Day-Ahead Market. Monthly and Annual true-ups utilize hourly excess funds

Simple Transaction Example

FTR



Day-Ahead
LMP: \$27, MCC: \$ 5, MLC: \$ 2

FTR
Profile Volume: 100 MW
Owner: Load Z

Day-Ahead
LMP: \$30, MCC: \$ 7, MLC: \$ 3

Charge Types	FTR Calculation
FTR Target Hourly Allocation	Profile Volume * (MCC@Source – MCC@Sink) (100) * (\$5 - \$7) = - \$200.00 [Credit]

ARR Concepts

Market Participants require firm Transmission Service in order to serve load in the Midwest ISO Market Footprint

An ARR is a Market Participant's entitlement to a share of the revenue generated in the annual FTR auctions

ARRs are allocated to Market Participants based on firm, historical usage of the Midwest ISO transmission system

ARRs can be a revenue credit or charge based on the annual FTR auction clearing price of the ARR path

ARR Allocation and Auction

Auction Revenue Rights	Entity	Type	Basis
Auction Revenue Rights Transaction Amount	MP	Revenue	ARR Allocation Volumes
Financial Transmission Rights Annual Transaction Amount	MP	Revenue	FTR Auction Transaction Volumes
Auction Revenue Rights Stage 2 Distribution Amount	MP	Revenue	FTR Profile Volumes
Auction Revenue Rights Infeasible Uplift Amount	MP	Allocation	ARR Allocation Volumes

FTR Market

Financial Transmission Rights	Entity	Type	Basis
Financial Transmission Rights Hourly Allocation Amount	MP	Revenue	FTR Profile Volumes
Financial Transmission Rights Monthly Allocation Amount	MP	Revenue	FTR Profile Volumes
Financial Transmission Rights Yearly Allocation Amount	MP	Revenue	FTR Profile Volumes
Financial Transmission Rights Full Funding Guarantee Amount	MP	Revenue	FTR Profile Volumes
Financial Transmission Rights Monthly Transaction Amount	MP	Revenue	FTR Monthly Auction Transactions
Financial Transmission Guarantee Uplift Amount	MP	Allocation	FTR Funding Shortfall

Administrative Charges

The Midwest ISO recovers its costs to administer its Open Access Transmission Tariff, including provision of transmission service, reliability coordination, and settlements via Schedule 10 of the EMT. Schedule 10 Charges apply to Transmission Owners and Transmission Customers.

The Midwest ISO recovers its costs to administer the Energy and Operating Reserves Markets and the FTR Market via Administrative Cost Adders

The rates are developed via specific formulas contained in Schedules 16 and 17 of the EMT. Schedules 16 and 17 charges apply to Market Participants transacting in the Day-Ahead and Real-Time Markets, as well as FTR Holders.

Additionally, the Midwest ISO recovers Market related costs for Local Balancing Authorities (LBA's) via Schedule 24 of the EMT.

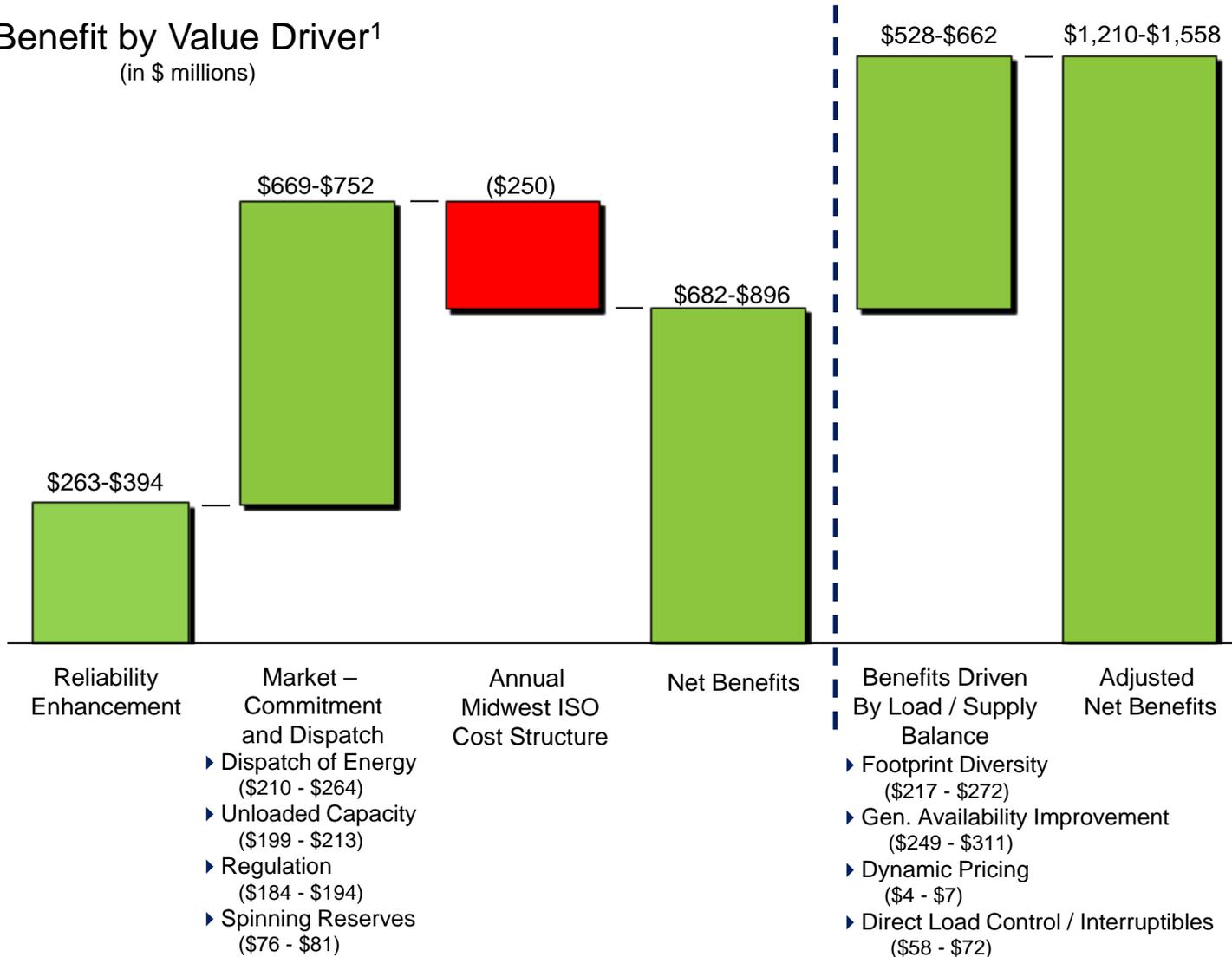
Administrative Charges

Administrative Charges	Entity	Type	Basis	Current Rate* (\$/MWh)
ISO Cost Recovery	TO, TC	Administrative – Midwest ISO	Monthly Peak Load	\$0.1271
Day Ahead and Real Time Market Administration Amount	MP	Administrative - Midwest ISO	Aggregate Energy Transaction Volumes	\$0.0920
Day Ahead and Real Time Schedule 24 Allocation Amount	MP	Administrative – LBA	Aggregate Energy Transaction Volumes	\$0.0194
Financial Transmission Rights Market Administration Amount	MP	Administrative - Midwest ISO	Aggregate FTR Profile Volumes	\$0.0105
Real Time Schedule 24 Distribution Amount	MP	Administrative - LBA	Aggregate Energy Transaction Volumes	N/A

*July 2010

Midwest ISO's Value Proposition

Benefit by Value Driver¹
(in \$ millions)



¹Figures shown reflect annual benefits and costs for 2009

Additional References

Additional Details on the Midwest ISO's Value Proposition are available on our public Website at the following link

<http://www.midwestmarket.org/page/Value%20Proposition>

Later this month, the Midwest ISO will commence publishing a monthly report providing the Average Cost per MWh Paid by Load. The report will include:

- Weighted LMP
- Administrative Costs
- Uplifts (Revenue Sufficiency, Revenue Neutrality)
- Operating Reserve Costs
- Marginal Loss Distributions

Report will be located in the Market Reports Summary tab

http://www.midwestmarket.org/publish/Folder/25228f_10631e11216_-7fe30a48324a?rev=11

Average Cost per MWh Paid by Load Report – Sample

Cost Paid by Load (Hourly Average per Month)	July 2010
Weighted LMP	\$38.94
DA-RT Market ADMIN	\$0.23
FTR Market ADMIN	\$0.04
Local Balancing Authority ADMIN	\$0.01
DA Revenue Sufficiency Guarantee	\$0.07
RT Revenue Sufficiency Guarantee	\$0.34
Real-Time Distribution of Losses Amount	(\$0.59)
Revenue Neutrality Adjustment Credit or Charge Amount	\$0.10
Regulation Reserve Distribution Rate	\$0.07
Spinning Reserve Distribution Rate	\$0.05
Supplemental Reserve Distribution Rate	\$0.02
Total AVG COST/MWh for Load	\$39.28

Questions?

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