

Operating Reserves Educational Session Part A

Energy Market Uplift
Senior Task Force
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Monitoring Analytics

Operating Reserves

Operating reserves can be grouped into five categories:

- **Day-Ahead**
- **Balancing**
- **Reactive Services**
- **Black Start Services**
- **Synchronous Condensing**
 - **For purposes other than reactive or synchronized reserves.**



Day-Ahead

Credits received for:	Credits category:	Charges category:	Charges paid by:
	<u>Day-Ahead</u>		
Day-Ahead Import Transactions and Generation Resources	Day-Ahead Operating Reserve Transaction Day-Ahead Operating Reserve Generator	Day-Ahead Operating Reserve	Day-Ahead Load Day-Ahead Export Transactions Decrement Bids
			in RTO Region
Load Response Resources	Day-Ahead Operating Reserves for Load Response	Day-Ahead Operating Reserve for Load Response	Day-Ahead Load Day-Ahead Export Transactions Decrement Bids
			in RTO Region
Unallocated Negative Load Congestion Charges Unallocated Positive Generation Congestion Credits		Unallocated Congestion	Day-Ahead Load Day-Ahead Export Transactions Decrement Bids
			in RTO Region

Day-ahead operating reserve credits associated with reactive or black start support are not part of day-ahead operating reserve charges.

Balancing

Credits received for:	Credits category:		Charges category:	Charges paid by:
			Balancing	
Generation Resources	Balancing Operating Reserve Generator	→	Balancing Operating Reserve for Reliability	Real-Time Load plus Export Transactions in RTO, Eastern or Western Region
			Balancing Operating Reserve for Deviations	Deviations
			Balancing Local Constraint	Applicable Requesting Party
Canceled Resources	Balancing Operating Reserve Startup			
Lost Opportunity Cost (LOC)	Balancing Operating Reserve LOC			
Real-Time Import Transactions	Balancing Operating Reserve Transaction	→	Balancing Operating Reserve for Deviations	Deviations in RTO Region
Resources Providing Quick Start Reserve	Balancing Operating Reserve Generator			
Load Response Resources	Balancing Operating Reserves for Load Response	→	Balancing Operating Reserve for Load Response	Deviations in RTO, Eastern or Western Region

Balancing operating reserve and LOC credits associated with black start support or testing are not part of balancing operating reserve charges.



Other Categories

Credits received for:	Credits category:	Charges category:	Charges paid by:
		<u>Reactive</u>	
Resources Providing Reactive Service	Day-Ahead Operating Reserve		
	Reactive Services Generator		Reactive Services Charge
	Reactive Services LOC	→	Real-Time Load
	Reactive Services Condensing		
	Reactive Services for Synchronous Condensing LOC		Reactive Services Local Constraint
			Applicable Requesting Party
		<u>Synchronous Condensing</u>	
Resources Providing Synchronous Condensing	Synchronous Condensing Synchronous Condensing LOC	→	Synchronous Condensing
			Real-Time Load
			Real-Time Export Transactions
		<u>Black Start</u>	
Resources Providing Black Start Service	Day-Ahead Operating Reserve		
	Balancing Operating Reserve	→	Black Start Service Charge
	Black Start Testing		Zone and Non-zone Peak Transmission Use



Make Whole in PJM

The term make whole is used for:

- **Emergency DR: Payments to cover an emergency DR resource's offer (shutdown cost and strike price) not covered by LMP revenues.**
- **Capacity Market: Payments to cover a resource's offered capacity (MW) when only a portion of the capacity is needed to clear the auction.**

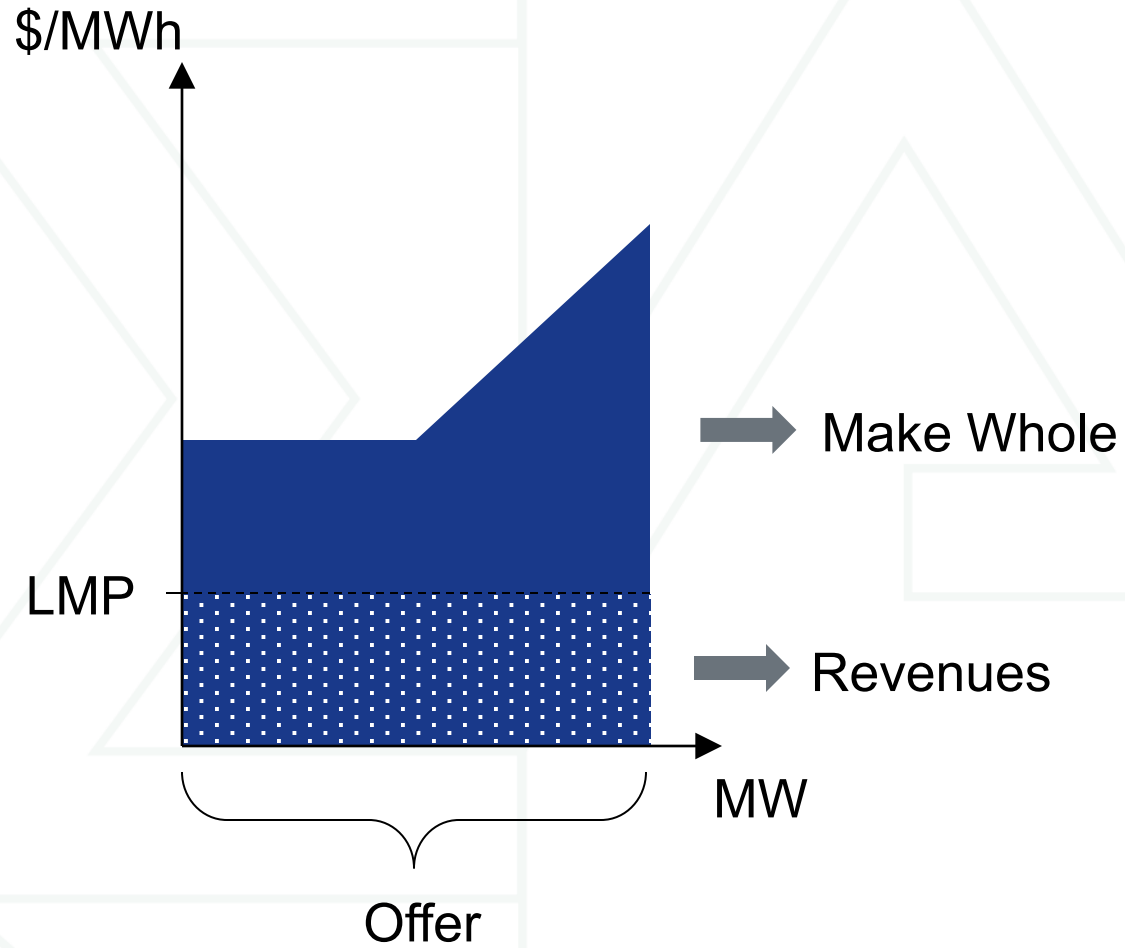


Uplift Terms

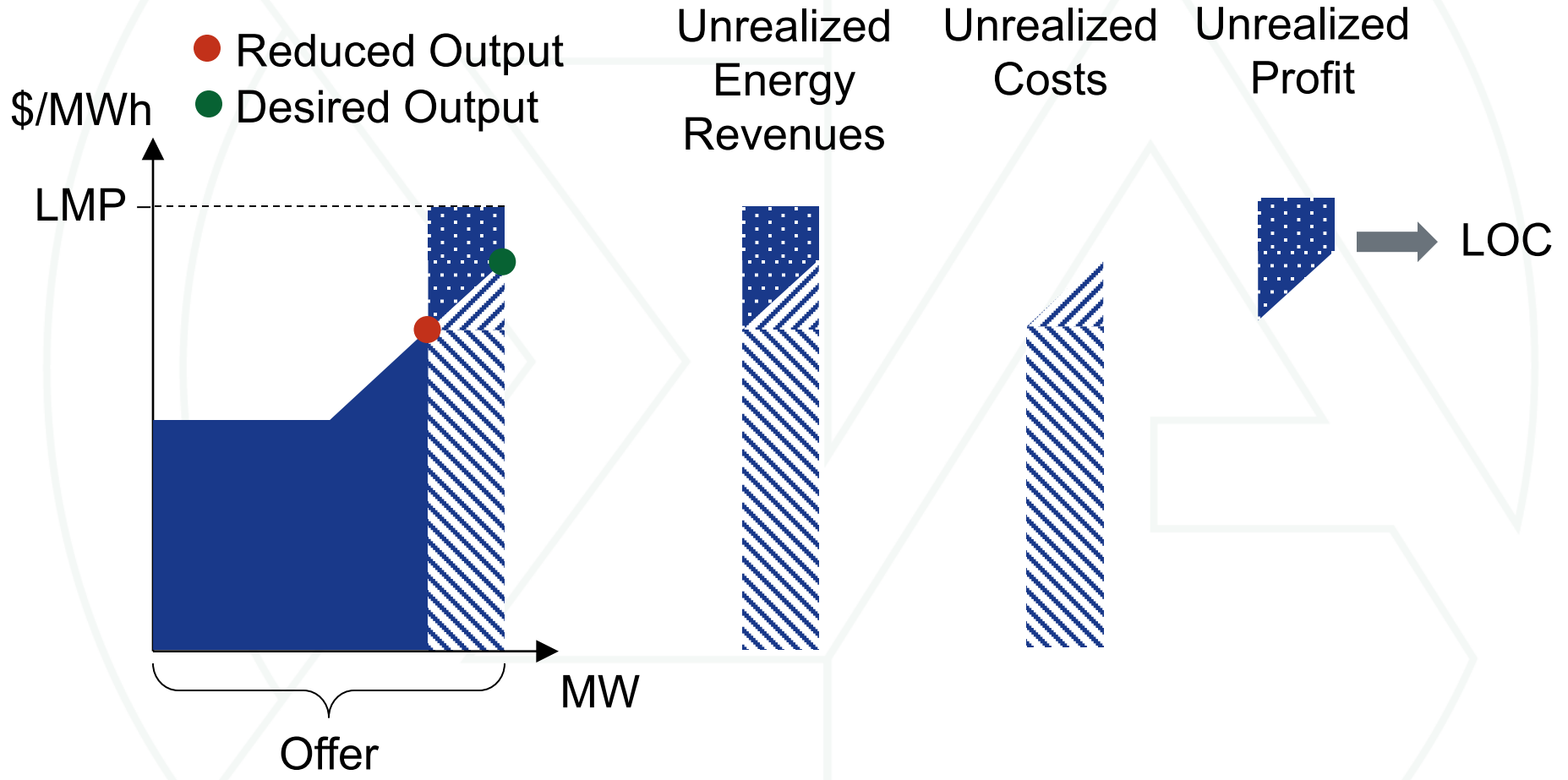
- **Make Whole: Payments to cover the portion of a unit's offer not covered by revenues.**
- **LOC: Payments to cover a unit's lost profit when offer is below energy price and**
 - **Unit is asked to reduce its output.**
 - **Unit is scheduled DA and not called RT.**
- **Uplift: Make whole and LOC.**



Make Whole



LOC



Reasons for Day-Ahead Make Whole

Units are made whole in day ahead due to:

- **Scheduled economically, but no load and startup costs are not covered by LMP revenues.**
- **Scheduled economically, but due to its min run time it is scheduled to run noneconomically through some hours before it can be scheduled to be turned off.**
- **Scheduled noneconomically due to a reliability issue or requirement.**
 - **Black Start**
 - **Voltage / Reactive**
 - **Conservative Operations**



Reasons for Balancing Make Whole

Due to the nature of real time operation, the factors that generate make whole payments in day ahead are exacerbated in real time.

- **Shorter look ahead window**
- **Real time fluctuations**
 - **Generator outages**
 - **Line outages**
 - **Deviations from day ahead**
 - **Deviations from forecast**
- **Energy pricing (hourly vs. 5 minute intervals)**



Reasons for Balancing Uplift

Credits in real time are generated by:

- **Make whole payments to units called on or extended in real time.**
 - **Offer not covered by revenues**
- **LOC credits to combustion turbines and diesels called off or not called.**
 - **LMP above offer**
- **LOC credits to units reduced.**
 - **LMP above offer**
- **Cancellation credits.**
 - **Costs incurred during startup process**



Allocation

- **Day Ahead: DA Demand, DA Exports and DEC's**
- **Balancing Reliability: RT Load and RT Exports**
- **Balancing Deviations:**

Deviations		
Day-Ahead		Real-Time
Day-Ahead Demand Bid	Demand (Withdrawal)	Real-Time Load
Day-Ahead Bilateral Sales	(RTO, East, West)	Real-Time Bilateral Sales
Day-Ahead Export Transactions		Real-Time Export Transactions
Decrement Bids		
Day-Ahead Bilateral Purchases	Supply (Injection)	Real-Time Bilateral Purchases
Day-Ahead Import Transactions	(RTO, East, West)	Real-Time Import Transactions
Increment Offers		
Desired Output or Day-Ahead Scheduled Generation	Generator (Unit)	Real-Time Generation
Desired Reduction	Demand Response	Real-Time Reduction

Deviations Netting

- **Requirements for DA vs. RT deviation netting:**
 - **Same hour**
 - **Same type of transaction**
 - **Demand: Load, Export, IBT Sale, DEC**
 - **Supply: Import, IBT Purchase, INC**
 - **Same location**
 - **Control zone, hub, aggregate or interface**
- **Generators and demand response:**
 - **Different, more complicated rules. Based on desired output, if pool scheduled and not following dispatch, or based on day-ahead scheduled output if self scheduled.**



Allocation Summary

Resource / Transaction	Impact		Make Whole Charges Allocation				
	Energy Prices / Dispatch	Day-Ahead *	Balancing Reliability	Balancing Deviation **	Reactive Services	Synchronous Condensing	Black Start
Load	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Generation	Yes	No	No	Yes	No	No	No
Imports ***	Yes	No	No	Yes	No	No	No
Exports ***	Yes	Yes	Yes	Yes	No	Yes	Yes
INCs	Yes	No	No	Yes	No	No	No
DECs	Yes	Yes	No	Yes	No	No	No
Demand Response	Yes	No	No	Yes	No	No	No
Internal Bilateral Transactions	No	No	No	Yes	No	No	No
Up-to Congestion Transactions	Yes	No	No	No	No	No	No
Financial Transmission Rights	No	No	No	No	No	No	No

* Cleared day ahead

** Used in deviation calculation

*** Excluding Dynamically Scheduled

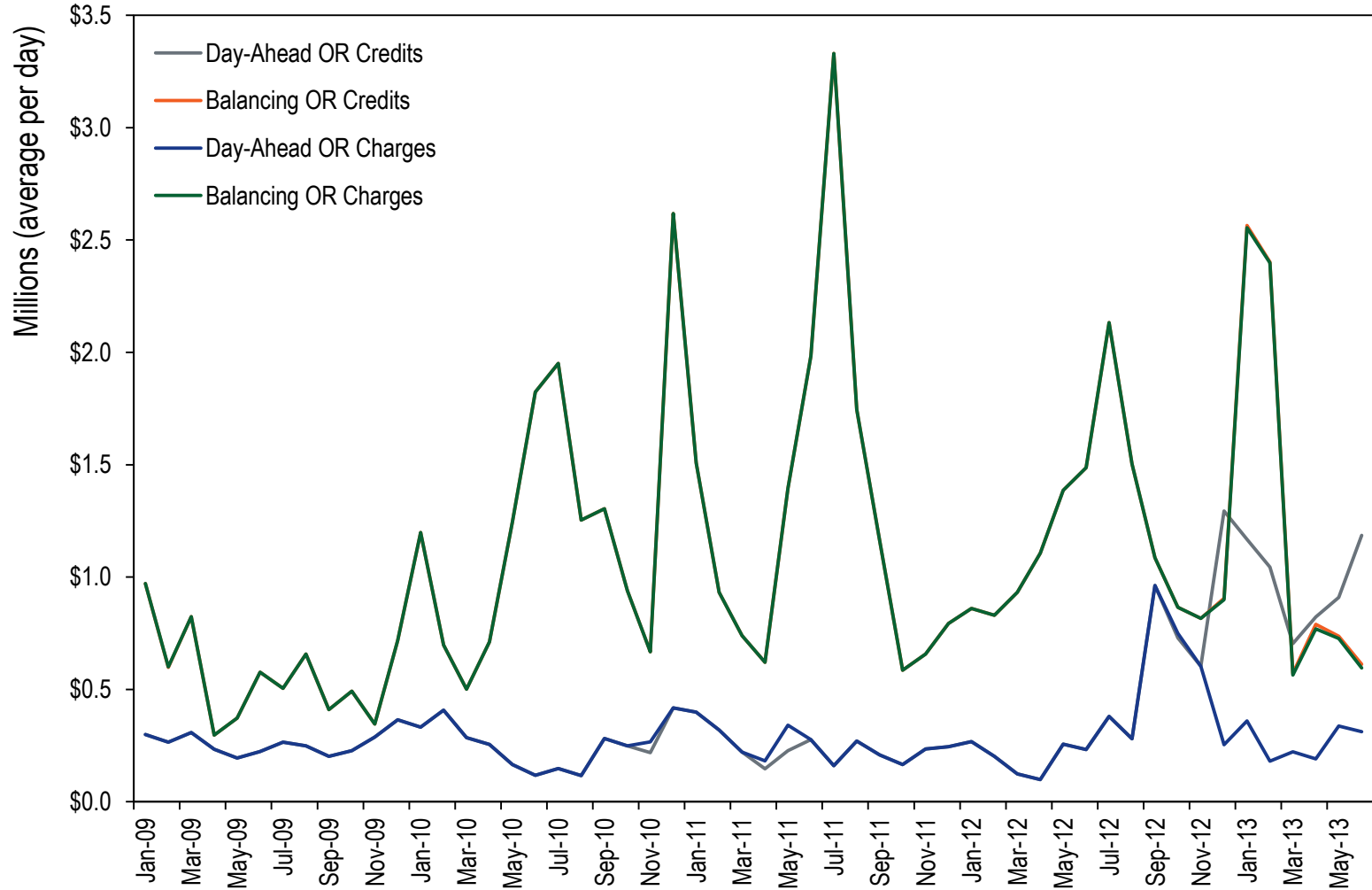


Operating Reserves

- **Total operating reserve charges from Jan 2009 – Jun 2013: \$2,248 million**
 - **Day-Ahead Charges: \$462 million (21%)**
 - **Balancing Charges: \$1,786 million (79%)**



Operating Reserves



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