Operating Reserves

An LSE Perspective

Training Objectives

Upon completion of this training session, the participant will:

- Describe Operating Reserve charges and credits in the day-ahead and balancing markets
- Describe the difference between Operating Reserves for reliability and for deviations
- Identify the Operating Reserve impacts for deviating from a Day-Ahead market position

“Need to Know” for an LSE

- An LSE should understand Operating Reserves in order to:
  - ★ – Minimize charges that could result from deviating from the Day-Ahead market positions
  - – Recognize DA OR and BOR charges on the PJM bill
  - – View the Operating Reserve rates that are posted daily to the PJM website

DA OR = Day-Ahead Operating Reserves

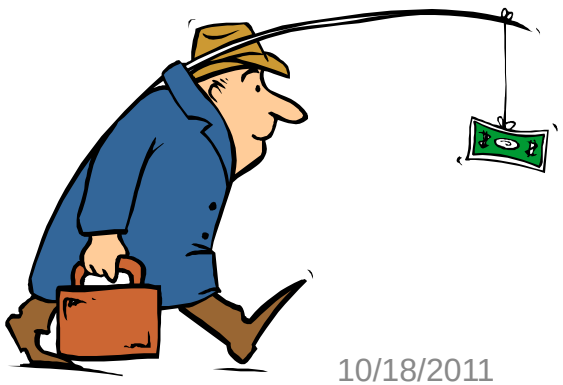
BOR = Balancing Operating Reserves

What are Operating Reserves?

- "Operations" Definition of Operating Reserves
  - "Extra" available generation that is scheduled on a day-ahead basis and maintained in real-time.
  - Defined in
    - PJM Pre-Scheduling Manual (M-10)
    - PJM Emergency Ops Manual (M-13)
- "Accounting" Definition of Operating Reserves
  - "Make-whole" payments to pool-scheduled generation and transactions.
  - Defined in Operating Agreement
    - Schedule 1-3.2.3 &3.3.3
- Following presentation deals with the **Accounting** Definition

Operating Reserves in PJM

- Preserves incentive for demand and supply to bid and offer into the day-ahead market based on their actual expectations
    - *Provides efficiency to the PJM energy markets*
- Preserves incentive for generation to follow real-time dispatch signals
    - *Resources guaranteed offer by following PJM dispatch*
    - *Provides grid reliability*
- Charges are allocated on a "cost-causation" basis
- Performed on a daily basis (Credits)
- Performed on an hourly basis (Charges)
- Somewhat complex and volatile



Basic Overview of **Day Ahead** ORs

Generator Offer: $100

- $97

$3

Total Revenue For Generator:

Day Ahead Bus LMP = $97

= $97

$3 is paid to the generator in the form of an Operating Reserve Credit.

$3 is proportionately charged to cleared demand, cleared decrement bids, & cleared exports in the Day Ahead Market.

Load and other transactions that resemble load in the Day Ahead Market

Basic Overview of **Balancing** ORs

Generator Offer: $100

- $75

$25

Total Revenue For Generator:

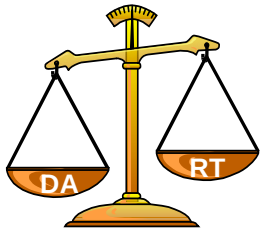
Synch Reserve Revenue = $10
DASR Market Revenue = $2
DA Op Reserve Revenue = $3
Balancing Market Revenue = $10
Day Ahead Market Revenue = $50

= $75

$25 is paid to the generator in the form of an Operating Reserve Credit.

$25 is proportionately charged to participants that deviate from Day Ahead Market position or to Load Ratio Share plus Exports in the form of an Operating Reserve Charge.

(depending on the reason the unit was committed --- to manage deviations or for reliability purposes)



or

Load Ratio Share + Exports

Day-ahead Operating Reserves Credits

- Pool scheduled generators, demand response and transactions scheduled for PJM are eligible
- For each eligible resource, daily credit is day-ahead offer amount in excess of day-ahead market revenue
  - calculation uses day-ahead scheduled MWh, offer data, and day-ahead LMPs

Total offered price for start-up and no-load costs and energy determined on the resources scheduled output shall be compared to the value of the resource's energy determined by the Day-Ahead Energy Market

Day-ahead Operating Reserves Charges

- Day-ahead Operating Reserves payments are allocated proportionately by MW to:
  - all cleared day-ahead demand
  - cleared decrement bids
  - exports that submit day-ahead schedules (not including dynamically scheduled transactions)

- Rates posted on PJM website at:

  http://www.pjm.com/markets-and-operations/market-settlements/preliminary-billing-reports/ops-rates.aspx

Balancing Operating Reserve Credits

- Daily credits for specified operating period segments provided to:
  - Pool-scheduled generators
  - Demand response
  - Import transactions

- Credits are for any portion of their offer amount in excess of:
  - Scheduled MWh times day-ahead bus LMP
  - MWh deviation from day-ahead schedule times real-time bus LMP
  - Any day-ahead operating reserve credits
  - Any day-ahead scheduling reserve market revenues in excess of offer
  - Any synchronized reserve market revenues in excess of offer plus opportunity, energy use and startup costs
  - Any applicable reactive services credits

Balancing Operating Reserve Charges

- Total daily costs of balancing operating reserve related to resources identified as **Credits for Deviations** is allocated based on regional shares of real-time locational deviations from following the day-ahead scheduled quantities of:
  - Cleared generation offers (only for generating units not following PJM dispatch instructions and not assessed deviations based on their real-time desired MWh
  - Cleared increment offers and purchase transactions
  - Cleared demand bids, decrement bids and sale transactions

- Total daily cost of operating reserve in the balancing market related to resources identified as **Credits for Reliability** is allocated based on regional shares of real-time load (without losses) plus exports.

Balancing Operating Reserve BOR Terminology

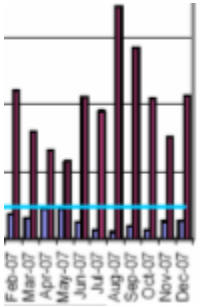
Total Cost:

- Total credit amount paid to generators to supply RT Operating Reserves
- Total "Bucket"

(8)

Rate:

- $ per MW charge that is derived from Total Cost
- Calculated daily
- http://www.pjm.com/markets-and-operations/market-settlements/preliminary-billing-reports/ops-rates.aspx



(6)

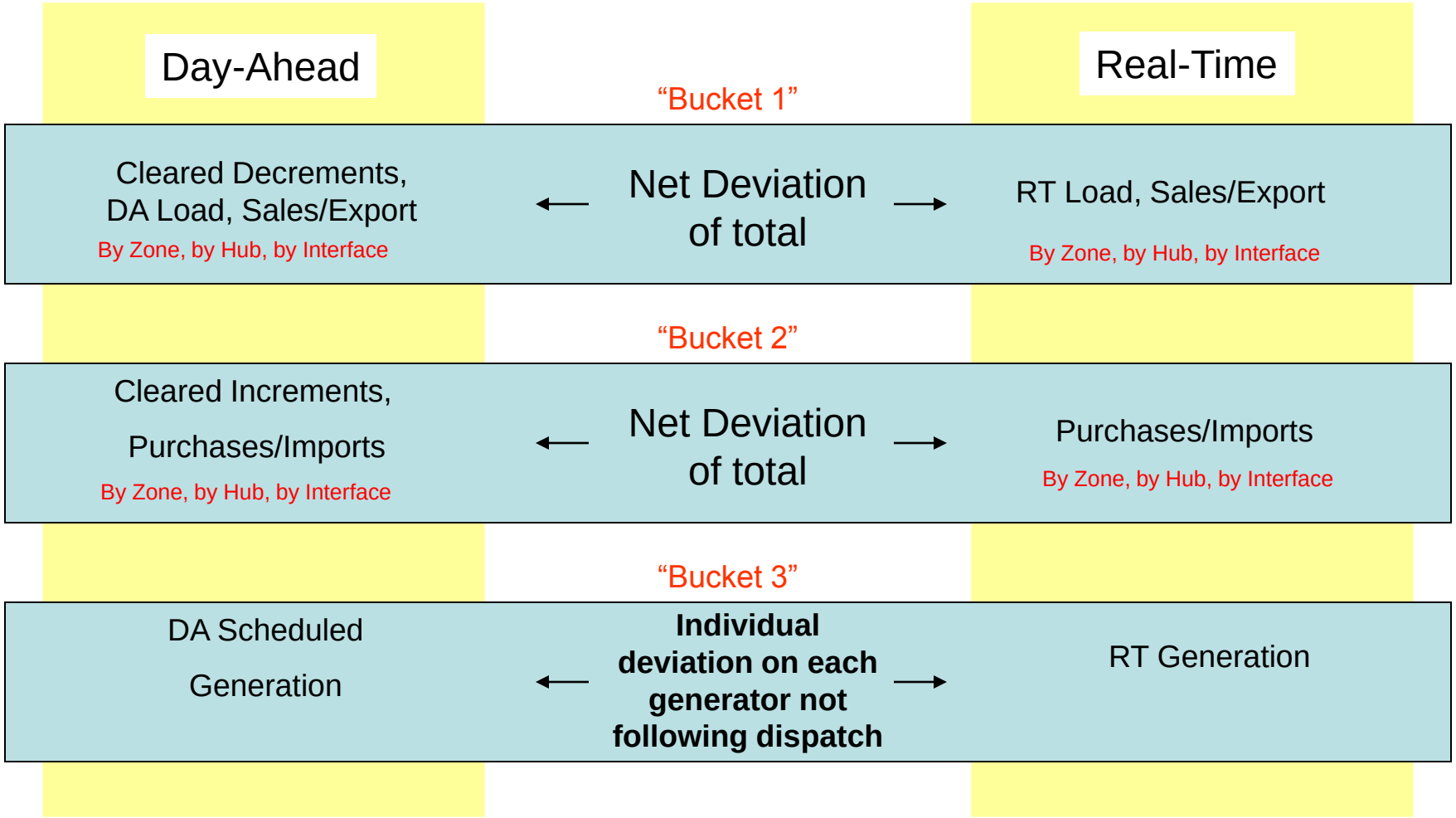
Charge:

- *Allocation* of the Total Cost to the participant based on deviations, BORCA rules, netting by location, etc.
- Charged monthly per the daily Rate

Total Cost ÷ Charge = Rate

Deviation Calculations

Balancing Operating Reserve Charges Applied to:



Deviations Across Zones - Example

LSE "EnerWave"

Serves load in two zones in different PJM regions

DA Fixed Demand = 100
RT Load Served = 0

Zone A

DA Fixed Demand = 0
RT Load Served = 100

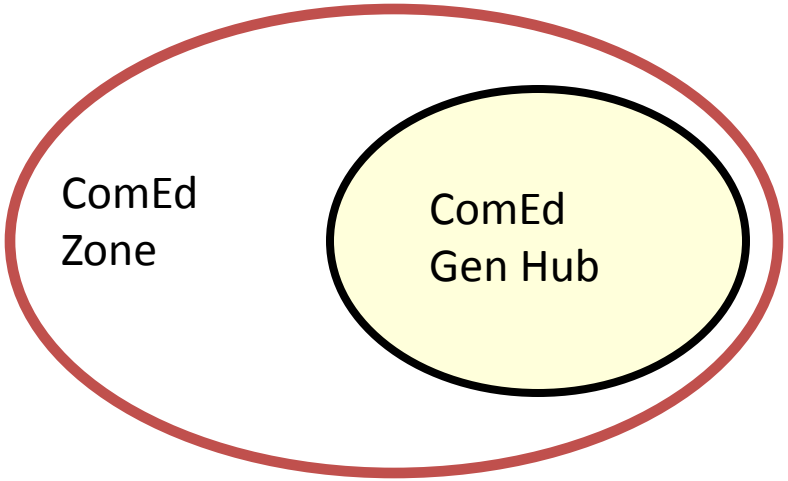
Zone B

In this example, all deviations will be subject to charges based on the daily "Rate for Deviations." (no netting across zones)

Deviation calculations are based on the Absolute Value and are performed hourly.

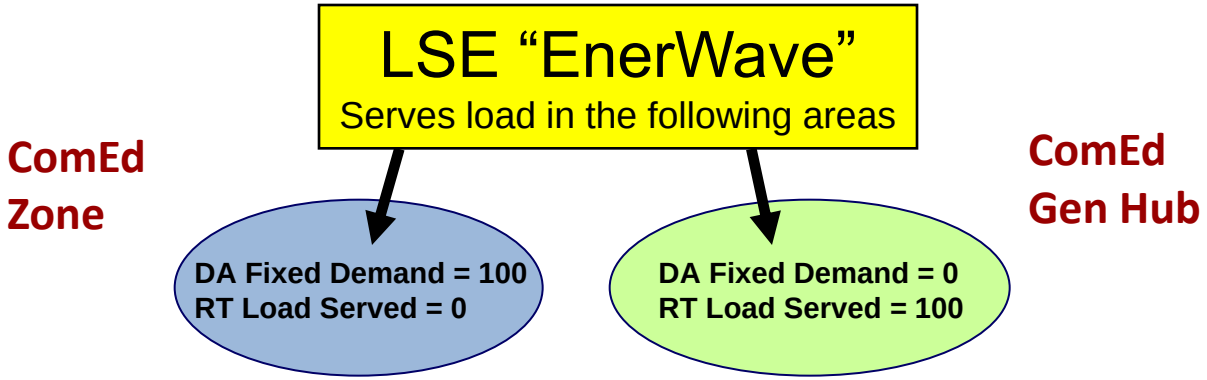
Deviation calculation = 100 (Zone A) + 100 (Zone B) = 200 MW Total Dev

Deviations Across Hubs - Example



Some hubs are wholly-contained inside a zone (nested).

Netting is allowed across areas that are nested.



Deviation calculation = 0 MW Total Dev

(DA position in ComEd Zone offsets RT position in ComEd Gen Hub)

Balancing Operating Reserve Cost Allocation (BORCA)

- Certain Balancing OR costs are incurred for reasons other than differences between Day-Ahead schedules and actual conditions. The desire is to recognize this split in cost causation and allocate the portion of Balancing OR incurred to maintain system reliability to the beneficiaries of those costs.

Solution

- **For the purposes of allocation of Balancing Operating Reserve charges, PJM will determine and identify the reasons for which operating reserve credits are earned.**
- **This determination will be conducted by PJM in two stages:**
  - **1) those resources called on during the Reliability Analysis and**
  - **2) those resources called on to operate during the operating day.**
- **The results of this determination will identify the resources for which Balancing Operating Reserve credits will be allocated to Real-time deviations from Day-Ahead schedules and identify the resources for which Balancing Operating Reserve credits will should be allocated to real-time load share plus exports.**

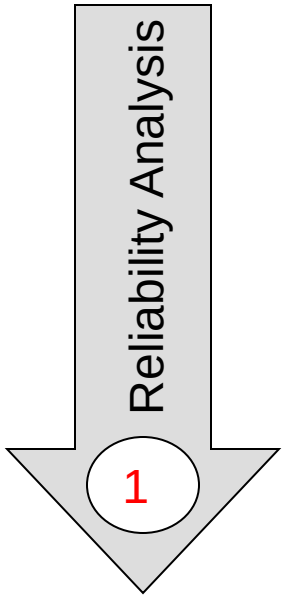
Balancing Operating Reserve Cost Allocation (BORCA)

PJM Operators will categorize (log) a generator when it is brought on to provide reserves:

a) Reliability

b) Managing Deviations from DA positions

	Reliability	Managing Deviations
Numerator	Collect system costs (BOR) due to reliability decisions	Collect system costs (BOR) due to changes (deviations) from DA schedules on a System–wide & Local basis
Denominator	RT Load and Exports	All Deviations (Including Incs & Decs)



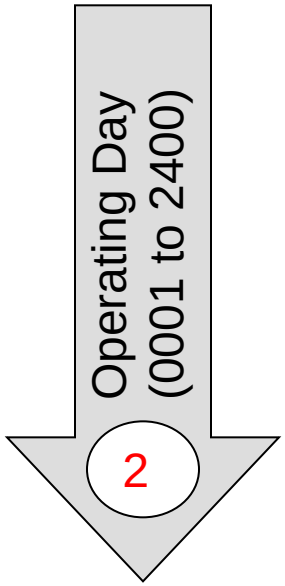
Reliability Analysis (RA) BOR Cost Allocation

RA BOR Credits for Reliability

Units committed due to extenuating conditions that warrant conservative actions to ensure the maintenance of system reliability *(i.e. – to provide reserves over and above the quantity determined by the real time load forecast)*

RA BOR Credits for Deviations

Units committed to operate in real time in order to augment the physical units committed in the Day-Ahead Market to meet the forecasted real time load plus the operating reserve requirement



Real- Time (RT) BOR Cost Allocation

RT BOR Credits for Reliability

Units called on by PJM to operate during the operating day for which the LMP at the unit's bus does not meet or exceed the unit's applicable offer (cost or price) for at least four, 5-minute intervals of at least one clock hour during which the unit was running at PJM's direction

RT BOR Credits for Deviations

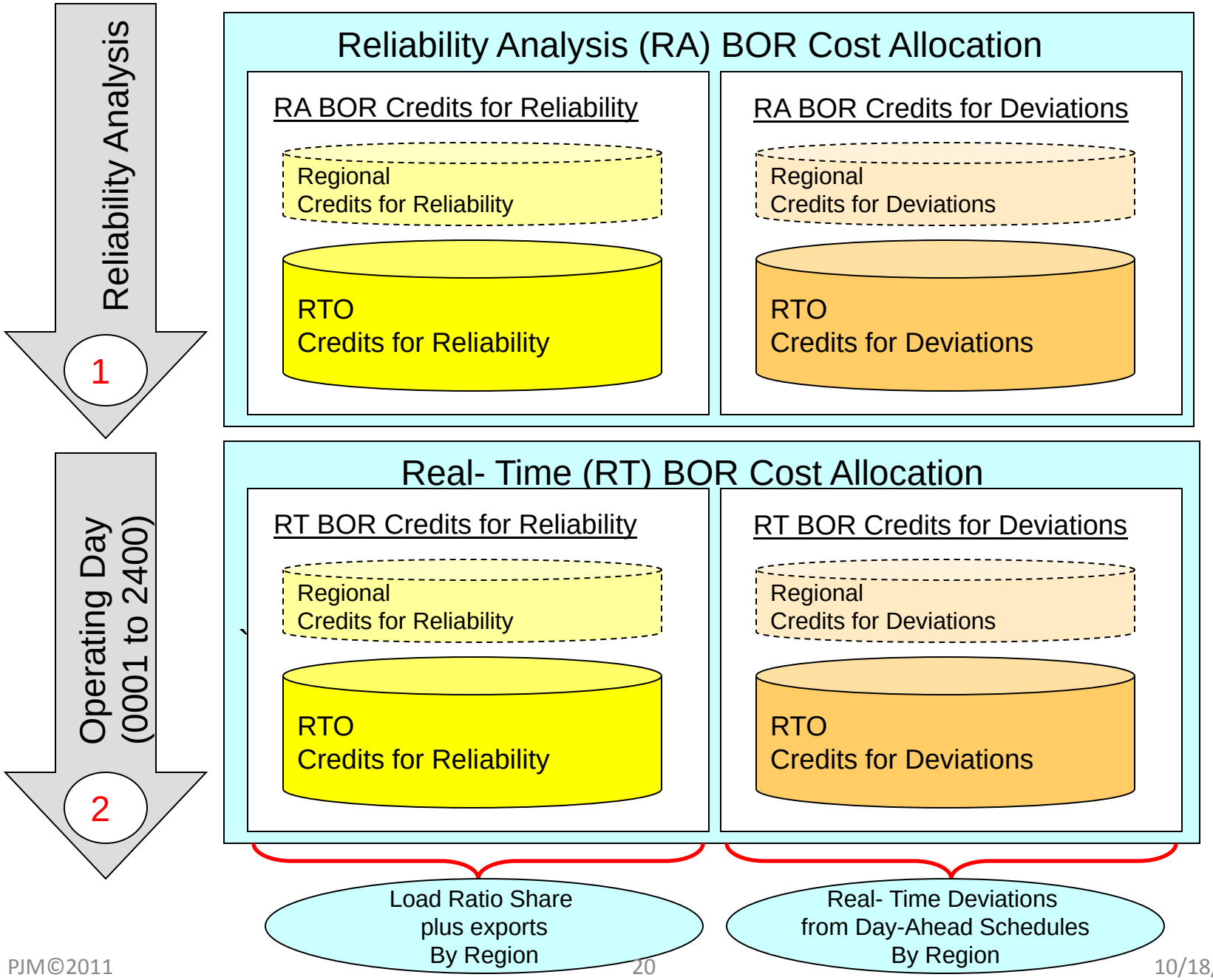
All other units operated at PJM's direction in real time

Load Ratio Share plus exports

Real- Time Deviations from Day-Ahead Schedules

Balancing Operating Reserve Cost Allocation - Regional

- As determined during Real Time (RT) or during the Reliability Analysis (RA), Balancing Operating Reserve Credits will be identified for either:
  - **a) Reliability** or **b) Deviations**: and
  - will be collected for the RTO and/or each Region based on whether units were committed for transmission constraints and if so, for which constraints they were committed.
- PJM will post the aggregate amount of MWs committed that meet this criteria in all the respective buckets.
- BORs that are associated with a constraint of <=345kV will be allocated regionally


Reliability Analysis
1
Reliability Analysis (RA) BOR Cost Allocation
RA BOR Credits for Reliability
Regional
Credits for Reliability
RTO
Credits for Reliability
RA BOR Credits for Deviations
Regional
Credits for Deviations
RTO
Credits for Deviations
Operating Day
(0001 to 2400)
2
Real- Time (RT) BOR Cost Allocation
RT BOR Credits for Reliability
Regional
Credits for Reliability
RTO
Credits for Reliability
RT BOR Credits for Deviations
Regional
Credits for Deviations
RTO
Credits for Deviations
Load Ratio Share
plus exports
By Region
Real- Time Deviations
from Day-Ahead Schedules
By Region

Allocation for Reliability

BORs for Reliability are allocated by Load Ratio Share plus Exports:

Participant's Reliability Allocation (by RTO or Region) = Total BORs for Reliability (by RTO or Region) * (Customer total MWh of energy delivered to load + exports (by RTO or Region) / Total PJM MWh of energy delivered to load + exports (by RTO or Region))

Allocation for Deviations

BORs for Deviations are allocated by participants based on deviations from Day-Ahead scheduled quantities:

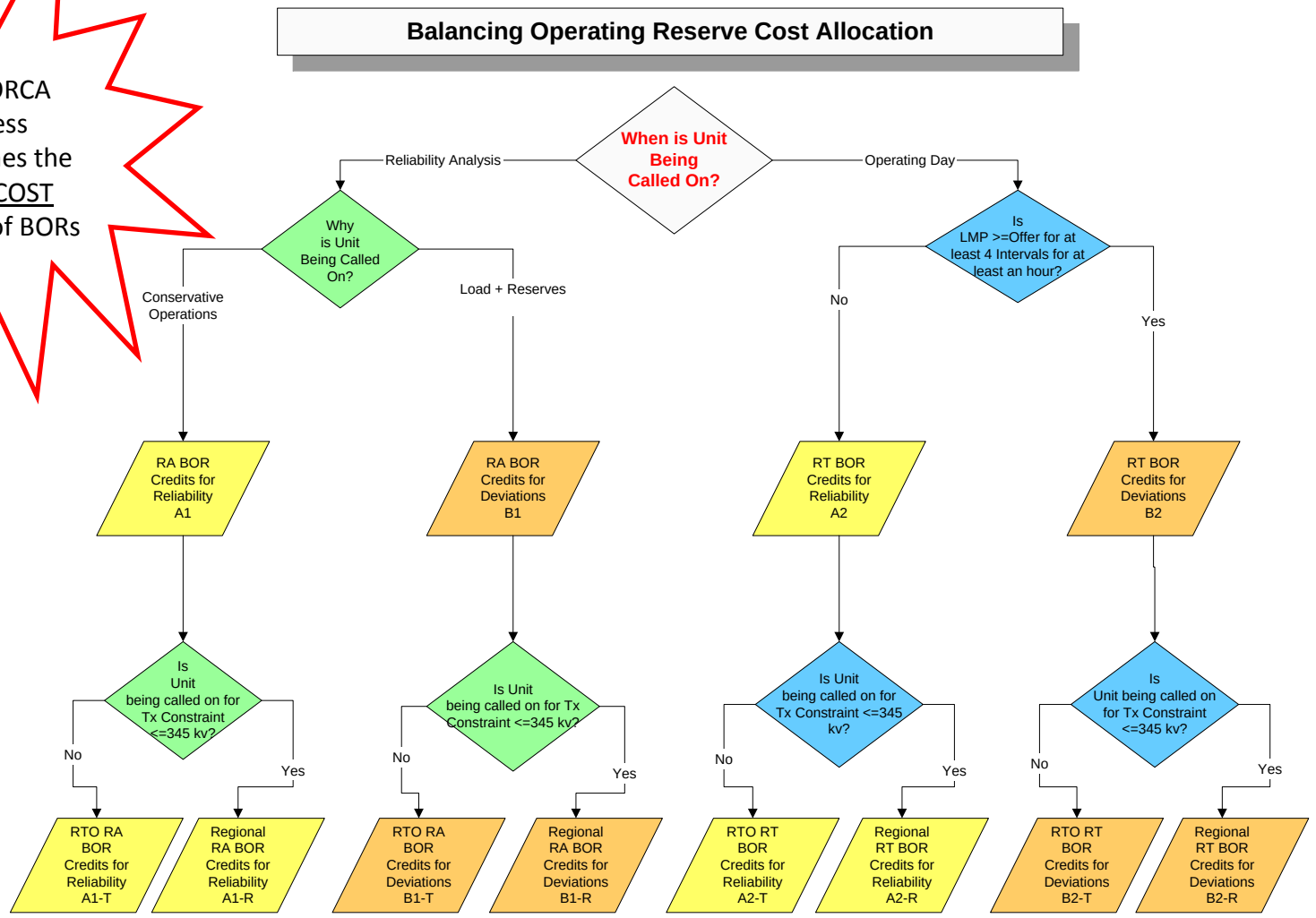
RTO Rate for BORs for Deviations = (Total $ Cost of BORs in RTO for Deviations) / (Total MW Deviations Across RTO (after netting by zone, hub, interface))

Participants Deviation Allocation = RTO Rate for BORs for Deviations * Total MW Deviations of Participant

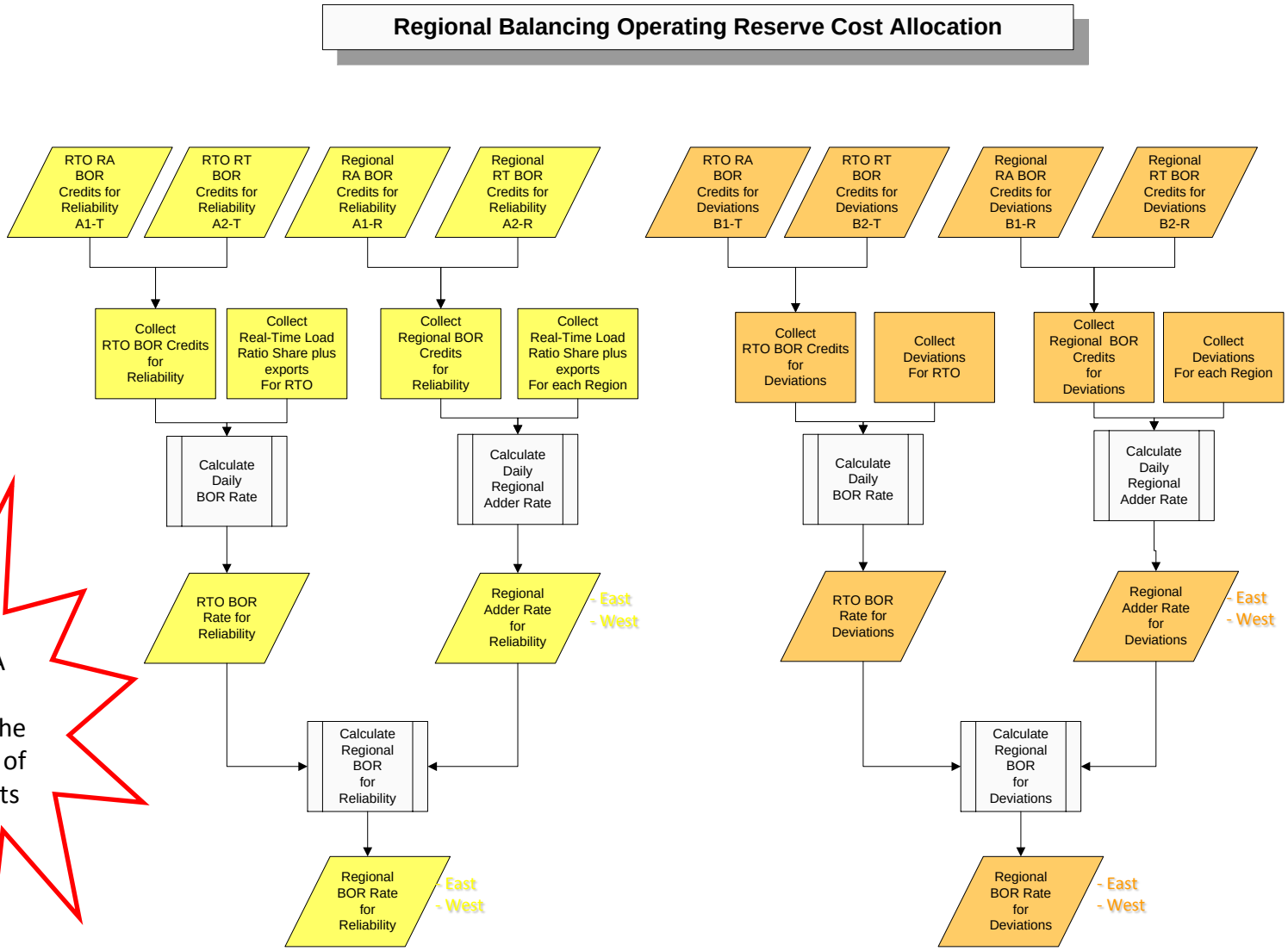
This example shows the calculation for deviations across RTO (not regional)

Balancing Operating Reserve Cost Allocation

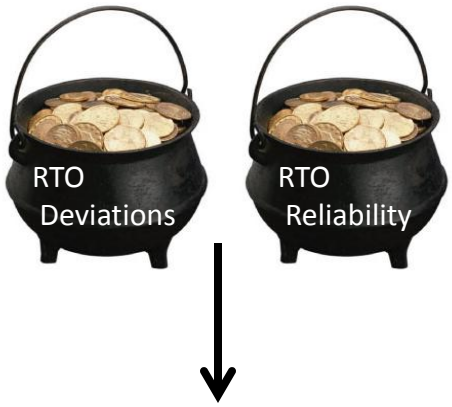
This BORCA process determines the TOTAL COST (credits) of BORs



Balancing Operating Reserve Cost Allocation - Regional



Allocation Methodology – Rates & Adders



"Reliability" allocated to real-time load plus exports and "Deviations" allocated to deviations across RTO including those who might have charges from the regional bucket

The rate for this bucket will be the RTO rate

"Reliability" Allocated to real-time load plus exports in region and "Deviations" allocated to deviations in region

The rate for this bucket will be in the form of an adder to the RTO rate

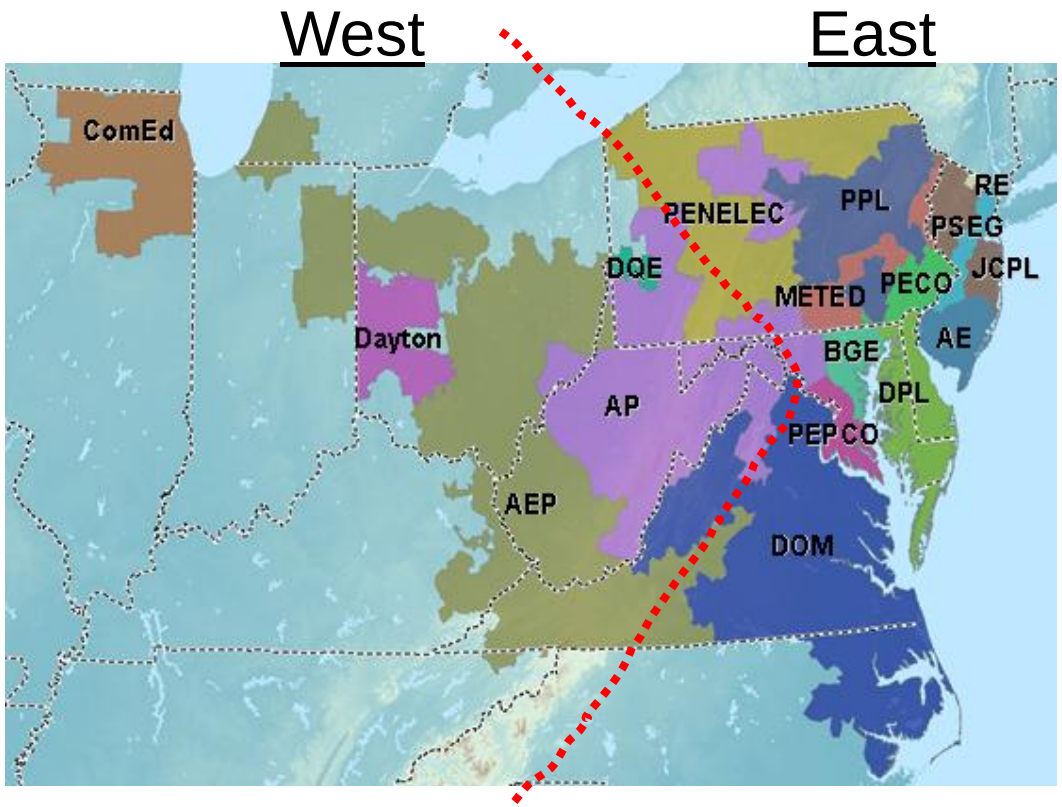
Regional costs allocated regionally

RTO costs are allocated globally

Separate buckets: The costs of Regional BORs are not contained in the costs of the RTO BORs

No "Double Dipping" of costs

Balancing Operating Reserve Regions



For regions that do not have Regional Adders, the Regional BOR Rate for Deviations and/or Reliability will equal the RTO BOR Rate for Deviations and/or Reliability

Regional BOR Rates will be calculated for the following two OR regions:

Western Region: AEP, APS, COMED, DUQ, DAYTON

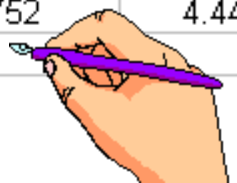
Eastern Region: BGE, DOM, PENELEC, PEPCO, METED, PPL, JCPL, PECO, DPL, PSEG, RECO, AE

Operating Reserves Rates

- There is one (1) Day-Ahead Operating Reserve rate and six (6) Balancing Operating Reserve rates
- Posted on PJM website at:

  http://www.pjm.com/markets-and-operations/market-settlements/preliminary-billing-reports/ops-rates.aspx
  - Preliminary operating reserve charges are typically posted about one week after the operating day.
  - Operating Reserve Summary reports available in MSRS are updated daily.
  - Rates not final until the 5th business day of the following month!

A	B	C
day	day_ahead_rate	balancing_rate
2/1/2007	0.0183	0.5516
2/2/2007	0.0675	0.5644
2/3/2007	0.1333	7.6307
2/4/2007	0.1228	2.6514
2/5/2007	0.0752	4.4426



Total Day-ahead and Balancing Operating Reserve Charges

	Total Operating Reserve Credits	Annual Credit Change	Operating Reserve as a Percent of Total PJM Billing	Day-Ahead $/MWh	Day-Ahead Change	Balancing $/MWh	Balancing Change
1999	$133,897,428	NA	7.5%	NA	NA	NA	NA
2000	$216,985,147	62.1%	9.6%	0.341 2	NA	0.5346	NA
2001	$290,867,269	34.0%	8.7%	0.2746	(19.5%)	1.0700	100.2%
2002	$237,102,574	(18.5%)	5.0%	0.1635	(40.4%)	0.7873	(26.4%)
2003	$289,510,257	22.1%	4.2%	0.2261	38.2%	1.1971	52.0%
2004	$414,891,790	43.3%	4.8%	0.2300	1.7%	1.2362	3.3%
2005	$682,781,889	64.6%	3.0%	0.0762	(66.9%)	2.7580	123.1%
2006	$322,315,152	(52.8%)	1.5%	0.0781	2.6%	1.3315	(51.7%)
2007	$459,124,502	42.4%	1.5%	0.0570	(27.0%)	2.3310	75.1%
2008	$429,253,836	(6.5%)	1.3%	0.0844	48.0%	2.1132	(9.3%)
2009	$325,842,346	(24.1%)	1.2%	0.1201	42.3%	1.1100*	(47.5%)

Source: http://www.monitoringanalytics.com/home/index.shtml
(PJM State of the Market Report)

Balancing Operating Reserve Scenarios

APPENDIX

Base Case

- LSE "Enerwave" serves load in the ComEd and BGE zones, HE 16

- The Load Ratio Share of Enerwave is:

ComEd – 30%	Western Region – 2%	RTO – 1%	**3% Total RTO**
BGE – 40%	Eastern Region – 4%	RTO – 2%	

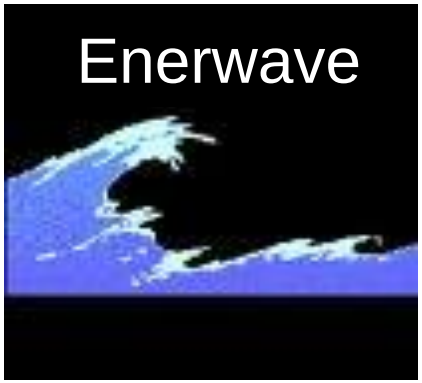
- Cleared Day Ahead Market Bids:

ComEd – 1000 MW Fixed Demand, 50 MW Dec, 10 MW Inc

BGE – 1500 MW Fixed Demand

Daily BOR Rates:

RTO Rate for Reliability: $3
Regional Adder for Reliability (East): $2
Regional Adder for Reliability (West): $1
RTO Rate for Deviations: $2
Regional Adder for Deviations (East): $2
Regional Adder for Deviations (West): n/a



Scenario #1 – BOR Cost Allocation

- Additional generation is picked up in the RA case due to an increased RTO load forecast (not for constraint control)
- The total cost of Operating Reserves for this additional unit commitment is $200,000
- The real time load for Enerwave is 900MW in ComEd and 1300MW in BGE

What is the correct BOR rate category for this unit commitment?

A) RTO BOR Rate for Reliability
B) Regional BOR Rate for Reliability (East & West)
C) RTO BOR Rate for Deviations
D) Regional BOR Rate for Deviations (East & West)

How will PJM allocate the BOR charges?

A) Load Ratio Share plus Exports by RTO
B) Load Ratio Share Plus Exports by Region
C) Real Time Deviations from Day-Ahead Schedules by RTO
D) Real Time Deviations from Day-Ahead Schedules by Region

Scenario #1 – BOR Cost Allocation (cont)

- Additional generation is picked up in the RA case due to an increased RTO load forecast (not for constraint control)
- The total cost of Operating Reserves for this additional unit commitment is $200,000
- The real time load for Enerwave is 900MW in ComEd and 1300MW in BGE

What are the BOR costs for Enerwave for this unit commitment?

In ComEd:
100MW X $2 = $200 (Load dev)
50MW X $2 = $100 (Dec dev)
10MW X $2 = $20 (Inc dev)

RTO Rate for Deviations

In BGE:
200MW X $2 = $400 (Load dev)

Total BOR charges for Enerwave
$720

The RTO BOR Rate for Deviations will incorporate the participants deviation from DA position and will be the vehicle for the calculation

Scenario #2 – BOR Cost Allocation

- Additional generation is picked up in the RA case due to an increased RTO load forecast (not for constraint control)
- The total cost of Operating Reserves for this additional unit commitment is $200,000
- The real time load for Enerwave is 900MW in ComEd and 1650MW in BGE

What is the correct BOR rate category for this unit commitment?

A) RTO BOR Rate for Reliability
B) Regional BOR Rate for Reliability (East & West)
C) RTO BOR Rate for Deviations
D) Regional BOR Rate for Deviations (East & West)

How will PJM allocate the BOR charges?

A) Load Ratio Share plus Exports by RTO
B) Load Ratio Share Plus Exports by Region
C) Real Time Deviations from Day-Ahead Schedules by RTO
D) Real Time Deviations from Day-Ahead Schedules by Region

Scenario #2 – BOR Cost Allocation (cont)

- Additional generation is picked up in the RA case due to an increased RTO load forecast (not for constraint control)
- The total cost of Operating Reserves for this additional unit commitment is $200,000
- The real time load for Enerwave is 900MW in ComEd and 1650MW in BGE

What are the BOR costs for Enerwave for this unit commitment?

In ComEd:
100MW X $2 = $200 (Load dev)
50MW X $2 = $100 (Dec dev)
10MW X $2 = $20 (Inc dev)

RTO Rate for Deviations

In BGE:
150MW X $2 = $300 (Load dev)

Total BOR charges for Enerwave
$620 ***

The RTO BOR Rate for Deviations incorporate the participants deviation from DA position and will be the vehicle for the calculation

Scenario #3 – BOR Cost Allocation

- PJM RTO is in a Cold Weather Alert. PJM requests 3 additional units on in addition to what was requested by the RA case
- The total cost of Operating Reserves for this additional unit commitment is $200,000

What is the correct BOR rate category for this unit commitment?

A) RTO BOR Rate for Reliability
B) Regional BOR Rate for Reliability (East & West)
C) RTO BOR Rate for Deviations
D) Regional BOR Rate for Deviations (East & West)

How will PJM allocate the BOR charges?

A) Load Ratio Share plus Exports by RTO
B) Load Ratio Share Plus Exports by Region
C) Real Time Deviations from Day-Ahead Schedules by RTO
D) Real Time Deviations from Day-Ahead Schedules by Region

Scenario #3 – BOR Cost Allocation (cont)

- PJM RTO is in a Cold Weather Alert. PJM requests 3 additional units on in addition to what was requested by the RA case
- The total cost of Operating Reserves for this additional unit commitment is $200,000

What are the BOR costs for Enerwave for this unit commitment?

In ComEd:
$200,000 X .01 = $2,000

In BGE:
$200,000 X .02 = $4,000

Load Ratio Share by Zone (totals 3%)

Total BOR charges for Enerwave
$6,000

The RTO BOR Rate for Reliability will incorporate the Load Ratio Share and will be the vehicle for the calculation

Scenario #4 – BOR Cost Allocation

- PJM RTO is in a Cold Weather Alert. Steam generation that was to be cycled, is run through the midnight period to ensure it's availability the next morning
- The total cost of Operating Reserves for this additional unit commitment is

$100,000

What is the correct BOR rate category for this unit commitment?

A) RTO BOR Rate for Reliability
B) Regional BOR Rate for Reliability (East & West)
C) RTO BOR Rate for Deviations
D) Regional BOR Rate for Deviations (East & West)

How will PJM allocate the BOR charges?

A) Load Ratio Share plus Exports by RTO
B) Load Ratio Share Plus Exports by Region
C) Real Time Deviations from Day-Ahead Schedules by RTO
D) Real Time Deviations from Day-Ahead Schedules by Region

Scenario #4 – BOR Cost Allocation (cont)

- PJM RTO is in a Cold Weather Alert. Steam generation that was to be cycled, is run through the midnight period to ensure it's availability the next morning
- The total cost of Operating Reserves for this additional unit commitment is

$100,000

What are the BOR costs for Enerwave for this unit commitment?

In ComEd:
$100,000 X .01 = $1,000

In BGE:
$100,000 X .02 = $2,000

Load Ratio Share by Zone (totals 3%)

Total BOR charges for Enerwave
$3,000

The RTO BOR Rate for Reliability will incorporate the Load Ratio Share and will be the vehicle for the calculation

Scenario #5 – BOR Cost Allocation

- Generation is requested in the RA Case for a 230 kV transmission constraint located in PSEG
- The total cost of Operating Reserves for this additional unit commitment is $100,000
- The real time load for Enerwave is 900MW in ComEd and 1300MW in BGE

What is the correct BOR rate category for this unit commitment?

A) RTO BOR Rate for Reliability
B) Regional BOR Rate for Reliability (East & West)
C) RTO BOR Rate for Deviations
D) Regional BOR Rate for Deviations (East & West)

How will PJM allocate the BOR charges?

A) Load Ratio Share plus Exports by RTO
B) Load Ratio Share Plus Exports by Region
C) Real Time Deviations from Day-Ahead Schedules by RTO
D) Real Time Deviations from Day-Ahead Schedules by Region

Scenario #5 – BOR Cost Allocation (cont)

- Generation is requested in the RA Case for a 230 kV transmission constraint located in PSEG
- The total cost of Operating Reserves for this additional unit commitment is $100,000.
- The real time load for Enerwave is 900MW in ComEd and 1300MW in BGE

What are the BOR costs for Enerwave for this unit commitment?

In BGE:
200MW X $2 = $400 (Load dev)

$2 Regional Adder (East)

Total BOR charges for PSEG constraint: $400

Total BOR charges for Enerwave: something greater than $400 for RTO BORs (calculation depends on scenario of additional BORs)

The Regional Adder for Deviations will incorporate the participants deviation from DA position and will be the vehicle for the calculation

Scenario #6 – BOR Cost Allocation

- A CT is called on by the Power Dispatcher in real-time to alleviate a 230kv transmission constraint in the AEP Zone
- Throughout the operating day, the LMP never exceeded the unit's offer (in any of the five-minute intervals)
- The cost of Operating Reserves for this additional unit commitment is $300,000. (The cost of Operating Reserves for the RTO is $700,000.)

What is the correct BOR rate category for this additional unit commitment?

A) RTO BOR Rate for Reliability
B) Regional BOR Rate for Reliability (East & West)
C) RTO BOR Rate for Deviations
D) Regional BOR Rate for Deviations (East & West)

How will PJM allocate the BOR charges?

A) Load Ratio Share plus Exports by RTO
B) Load Ratio Share Plus Exports by Region
C) Real Time Deviations from Day-Ahead Schedules by RTO
D) Real Time Deviations from Day-Ahead Schedules by Region

Scenario #6 – BOR Cost Allocation (cont)

- A CT is called on by the Power Dispatcher in real-time to alleviate a 230kv transmission constraint in the AEP Zone
- Throughout the operating day, the LMP never exceeded the unit's offer (in any of the five-minute intervals)
- The cost of Operating Reserves for this additional unit commitment is $300,000. (The cost of Operating Reserves for the RTO is $700,000.)

In ComEd:
$300,000 X .02 = $6,000

Load Ratio Share for Western Region

Total BOR charges for CT in AEP: $6,000

Total BOR charges for Enerwave: something greater than $6,000 (calculation depends on scenario of additional BORs)

The Regional Adder for Reliability will incorporate the Load Ratio Share and will be the vehicle for the calculation:

RTO Rate for Reliability: $3 ⟸ Charged for BORs across RTO
Regional Adder for Reliability (West): $1 ⟸ Charged for BORs for CT in AEP
Enerwave's Total Rate for Reliability: $4 ⟸ **Enerwave's total charge for all BORs**

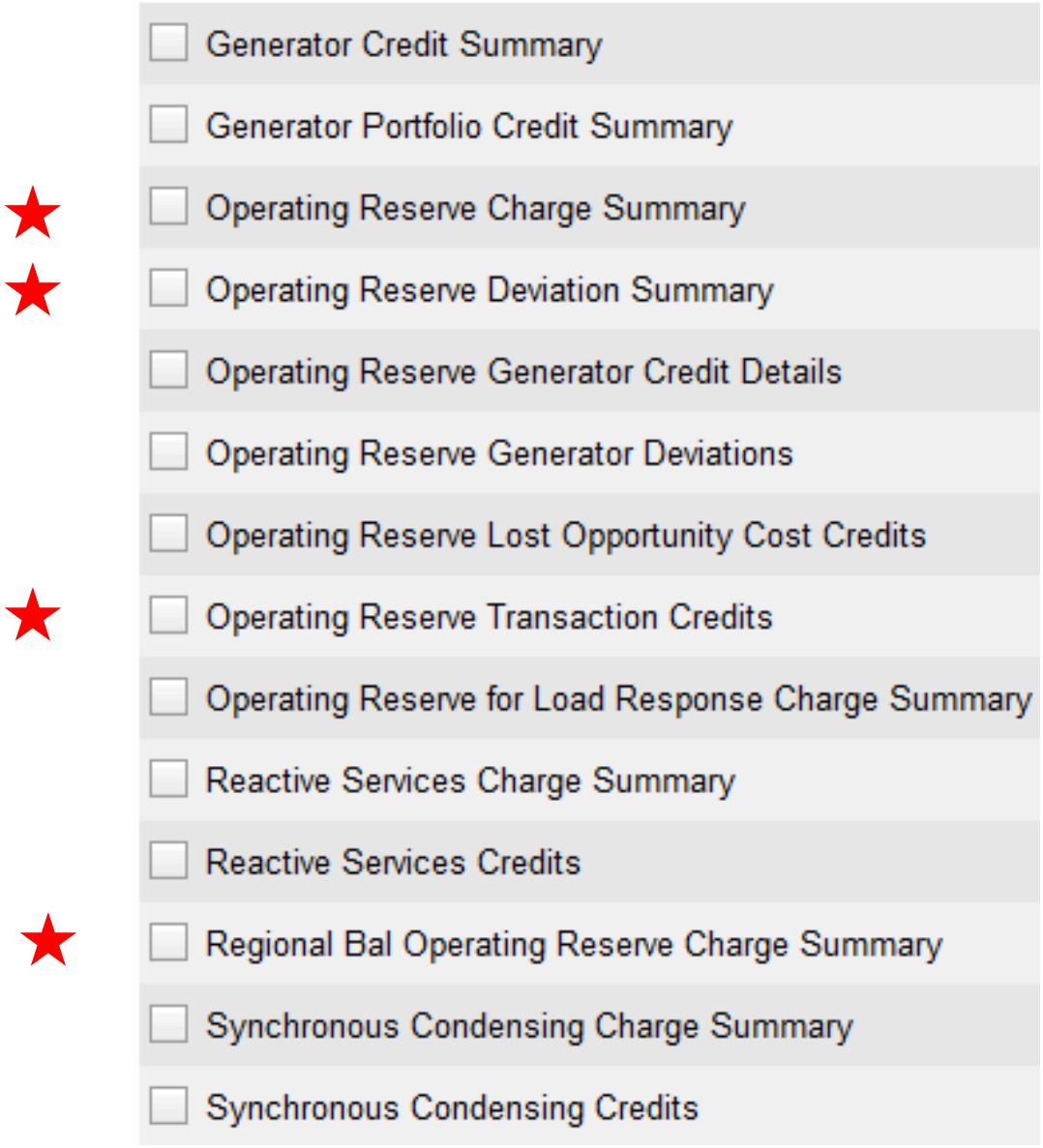
BORCA & Regional BORCA – Summary

- The allocation of Balancing Operating Reserve Charges will be “cost causation” focused

- BOR costs associated with reliability will be allocated based on Load Ratio Share. BOR costs associated with deviations from DA commitments will be allocated to those entities who deviated from DA scheduled quantities.

- Using the above criteria, BORs that are associated with a constraint of <=345kV will be allocated regionally

MSRS Operating Reserve Reports



★ = LSE related reports

MSRS Operating Reserve Charge Summary

	A	B	C	D	E	F	G	H	I	J	K	L	M
1	Operating Reserve Charge Summary												
2	Customer .	PJM Intercon	Report	6/5/2009 13:42									
3	Start Date:	########	End D:	2/5/2009									
4	4000.01	4000.02	4000	1370.11	3000.37	1370.12	1370.13	1370.01	1375.36	1375.37	1375.01	1375.02	4000.07
5	Customer ID	Customer Code	Date	Total PJM DA Operating Reserve Credit ($)	DA Load (MWh)	DA Operating Reserve Exports (MWh)	Total PJM DA Load Plus Exports (MWh)	DA Operating Reserve Charge ($)	Bal Operating Reserve for Reliability Charge ($)	Bal Operating Reserve for Deviations Charge ($)	Bal Operating Reserve Charge ($)	Bal Operating Reserve Local Constraint Charge ($)	Version
6													
7	End of Report												

Data Granularity: Daily

Frequency: Updated daily

Supporting Calculations

DA Operating Reserve Charge (1370.01) = Total PJM DA Operating Reserve Credit (1370.11) * ((DA Load (3000.37) + DA Operating Reserve Exports (1370.12)) / Total PJM DA Load Plus Exports (1370.13))

Bal Operating Reserve for Reliability Charge (1375.36) = Sum of the following columns from the Regional Balancing Operating Reserve Charge Summary: RTO Bal OpRes for Reliability Charge (1375.41) + East Bal OpRes for Reliability Charge (1375.45) + West Bal OpRes for Reliability Charge (1375.49)

MSRS Operating Reserve Deviation Summary

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	Operating Reserve Deviation Summary																		
2	Customer .	PJM Interc	Report Cre	########															
3	Start Date:	6/5/2009	End Date:	6/5/2009															
4	4000.01	4000.02	4000.05	4000.06	4000.77	4000.78	4000.79	4000.8	1365.16	1365.17	1365.18	1365.19	1365.2	1375.21	1375.22	1375.23	1375.24	1375.25	1375.26
5	Customer ID	Customer Code	EPT Hour Ending	GMT Hour Ending	Bal Operating Reserve Location Name	Bal Operating Reserve Location ID	Location Type	Bal Operating Reserve Region Name	DA Increment Offers (MWh)	DA Operating Reserve Imports (MWh)	DA Internal Bilateral Purchases (MWh)	DA Operating Reserve Injection (MWh)	RT Operating Reserve Imports (MWh)	RT Internal Bilateral Purchases (MWh)	RT Operating Reserve Injection (MWh)	Operating Reserve Injection Deviation (MWh)	DA Decrement Bids (MWh)	DA Demand Bids (MWh)	DA Load Response Bids (MWh)
6																			
7	End of Report																		

	T	U	V	W	X	Y	Z	AA	AB	AC	AD
	1375.27	1375.28	1375.29	3000.38	1375.3	1375.31	1375.32	1375.33	1375.34	1375.35	4000.07
	DA Operating Reserve Exports (MWh)	DA Internal Bilateral Sales (MWh)	DA Operating Reserve Withdrawal (MWh)	RT Load (MWh)	RT Operating Reserve Exports (MWh)	RT Internal Bilateral Sales (MWh)	RT Operating Reserve Withdrawal (MWh)	Operating Reserve Withdrawal Deviation (MWh)	Operating Reserve Generator Deviation (MWh)	Locational Total Deviation	Version

Data Granularity: Hourly

Frequency: Updated daily

This report displays the customer account's hourly generator deviation and also provides the hourly values for the components used in calculating withdrawal and injection deviation MWh which are used in calculating the Balancing Operating Reserve Charge. These values are displayed by balancing operating reserve location.

MSRS Operating Reserve Deviation Summary

Supporting Calculations

- DA Operating Reserve Injection (1365.19) = DA Increment Offers (1365.16) + DA Operating Reserve Imports (1365.17) + DA Internal Bilateral Purchases (1365.18)
- RT Operating Reserve Injection (1375.22) = RT Operating Reserve Imports (1365.20) + RT Internal Bilateral Purchases (1375.21)
- Operating Reserve Injection Deviation (1375.23) = ABS | (RT Operating Reserve Injection (1375.22) - DA Operating Reserve Injection (1365.19) |
- DA Operating Reserve Withdrawal (1375.29) = DA Decrement Bids (1375.24) + DA Demand Bids (1375.25) + DA Load Response Bids (1375.26) + DA Operating Reserve Exports (1375.27) + DA Internal Bilateral Sales (1375.28)
- RT Operating Reserve Withdrawal (1375.32) = RT Load (3000.38) + RT Operating Reserve Exports (1375.30) + RT Internal Bilateral Sales (1375.31)
- Operating Reserve Withdrawal Deviation (1375.33) = ABS | (RT Operating Reserve Withdrawal (1375.32) - DA Operating Reserve Withdrawal (1375.29) |
- Operating Reserve Generator Deviation (1375.44) = SUM(Supplier Netted Deviation MWh from Operating Reserve Generator Deviations report) for all supplier netted groups that fall within the transmission zone displayed.
    - Please note that the Supplier Netted Deviation MWh value appears on the Operating Reserve Generator Deviations report for each generator that belongs to the supplier netted group. In order to properly recalculate the Operating Reserve Generator Deviation at the customer account-level, the Supplier Netted Deviation MWh should only be added once for each group, rather than once for each generator.
- Locational Total Deviation (1375.35) = Operating Reserve Injection Deviation (1375.23) + Operating Reserve Withdrawal Deviation (1375.33) + Operating Reserve Generator Deviation (1375.34)

MSRS Operating Reserve Transaction Credits

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O
1	Operating Reserve Transaction Credits														
2	Customer .	PJM Interc	Report Cre	#########											
3	Start Date:	####	End Date:	####											
4	4000.01	4000.02	4000.04	4000.09	4000.21	4000.22	3000.75	2370.12	2370.13	2370.14	3000.76	2375.15	2375.16	2375.17	4000.07
5	Customer ID	Customer Code	Date	Transaction ID	Sink PNODE Name	Sink PNODE ID	DA Transaction MWh	DA Offer ($)	DA Revenue ($)	DA Operating Reserve Transaction Credit ($)	RT Transaction MWh	RT Offer ($)	Bal Revenue ($)	Bal Operating Reserve Transaction Credit ($)	Version
6	End of Report														

Data Granularity: Daily

Frequency: Updated daily

This report displays the customer account's daily Day-ahead and Balancing Operating Reserve Transaction Credit for each transaction that received a day-ahead and / or balancing credit.

Supporting Calculations

DA Operating Reserve Transaction Credit (2370.14) = MAX (DA Offer (2370.12) - DA Revenue (2370.13), 0)

Bal Operating Reserve Transaction Credit (2375.17) = MAX (RT Offer (2375.15) - Bal Revenue (2375.16) - DA Revenue (2370.13) - DA Operating Reserve Transaction Credit (2370.14), 0)

MSRS Regional Balancing Operating Reserve Charge Summary

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	Regional Balancing Operating Reserve Charge Summary													
2	Customer .	PJM Interc	Report Cre	##########										
3	Start Date:	4/15/2009	End Date:	4/15/2009										
4	4000.01	4000.02	4000.04	1375.38	1375.39	1375.4	1375.41	1375.42	1375.43	1375.44	1375.45	1375.46	1375.47	1375.48
5	Customer ID	Customer Code	Date	Total RTO BalOpRes for Reliability Credit ($)	PJM RT Load plus Exports (MWh)	Total PJM RT Load plus Exports (MWh)	RTO Bal OpRes for Reliability Charge ($)	Total East Bal OpRes for Reliability Credit ($)	East RT Load plus Exports (MWh)	Total East RT Load plus Exports (MWh)	East Bal OpRes for Reliability Charge ($)	Total West Bal OpRes for Reliability Credit ($)	West RT Load plus Exports (MWh)	Total West RT Load plus Exports (MWh)
6	1234	PALCO	4/15/2009	0	12685.48	2191347	0	0	12260.48	1182494	0	0	425	1008853
7	End of Report													

	O	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB
	1375.49	1375.5	1375.51	1375.52	1375.53	1375.54	1375.55	1375.56	1375.57	1375.58	1375.59	1375.6	1375.61	4000.07
	West Bal OpRes for Reliability Charge ($)	Total RTO Bal OpRes for Deviations Credit ($)	PJM Deviations (MWh)	Total PJM Deviations (MWh)	RTO Bal OpRes for Deviations Charge ($)	Total East Bal OpRes for Deviations Credit ($)	East Deviations (MWh)	Total East Deviations (MWh)	East Bal OpRes for Deviations Charges ($)	Total West Bal OpRes for Deviations Credit ($)	West Deviations (MWh)	Total West Deviations (MWh)	West Bal OpRes for Deviations Charge ($)	Version
	0	578445.5	12241.43	515777.6	13728.79	14876.23	11536.43	281934.5	608.72	0	705	233200.1	0	20090401

This report displays the regional components of the customer account's daily balancing operating reserve for reliability charge and balancing operating reserve for deviations charge.

Data Granularity: Daily

Frequency: Updated daily

MSRS Regional Balancing Operating Reserve Charge Summary

Supporting Calculations

RTO Bal OpRes for Reliability Charge (1375.41) = Total RTO Bal OpRes for Reliability Credit (1375.38) * (PJM RT Load plus Exports (1375.39) / Total PJM RT Load plus Exports (1375.40))

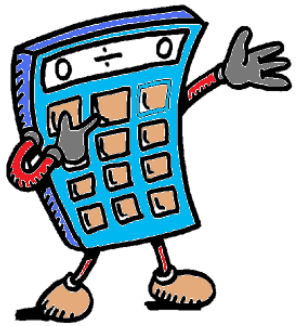
East Bal OpRes for Reliability Charge (1375.45) = Total East Bal OpRes for Reliability Credit (1375.42) * (East RT Load plus Exports (1375.43) / Total East RT Load plus Exports (1375.44))

West Bal OpRes for Reliability Charge (1375.49) = Total West Bal OpRes for Reliability Credit (1375.46) * (West RT Load plus Exports (1375.47) / Total West RT Load plus Exports (1375.48))

RTO Bal OpRes for Deviations Charge (1375.53) = Total RTO Bal OpRes for Deviations Credit (1375.50) * (PJM Deviations (1375.51) / Total PJM Deviations (1375.52))

East Bal OpRes for Deviations Charge (1375.57) = Total East Bal OpRes for Deviations Credit (1375.54) * (East Deviations (1375.55) / Total East Deviations (1375.56))

West Bal OpRes for Deviations Charge (1375.61) = Total West Bal OpRes for Deviations Credit (1375.58) * (West Deviations (1375.59) / Total West Deviations (1375.60))



Questions

Resources

- PJM Manual 11 – Scheduling Operations

http://www.pjm.com/documents/~/media/documents/manuals/m28.ashx

- PJM Manual 28 – Operating Agreement Accounting Manual

http://www.pjm.com/documents/~/media/documents/manuals/m11.ashx

- PJM Website: MSRS Reports

•http://www.pjm.com/markets-and-operations/market-settlements/msrs-reports.aspx