Phase 2 Package Summaries

June 23, 2015

EMUSTF

Package H - PJM

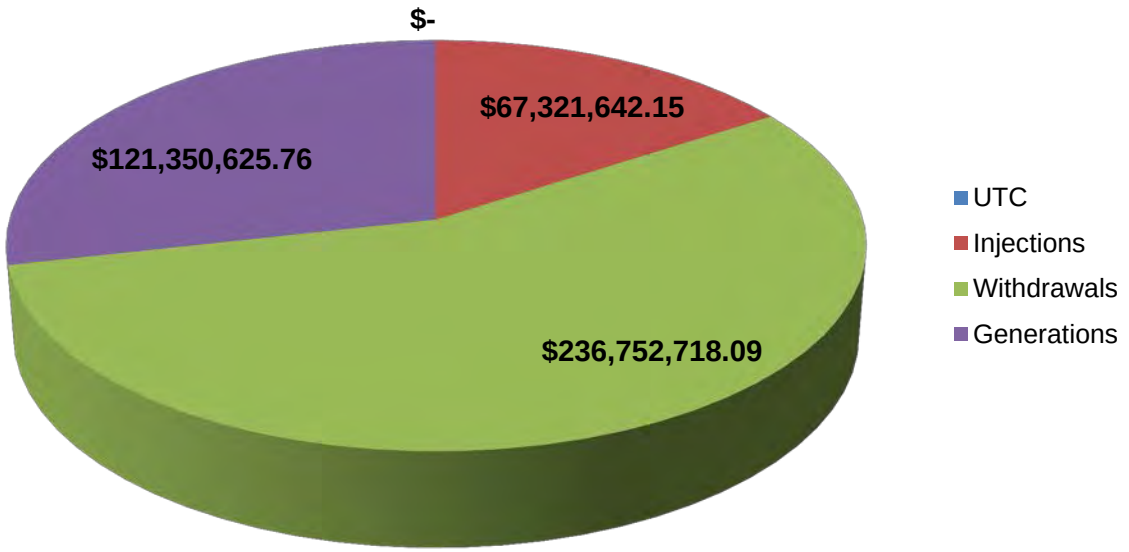
- Focused on Balancing Operating Reserve Uplift Methodology
  - UTCs are allocated a share of BOR charges as a deviation
    - Cleared UTCs impact dispatch and commitment for constraint control
    - Treated in same manner as incs/decs
  - Eliminate ability of IBTs to offset deviations
    - IBTs do not impact dispatch or commitment
    - No specific BOR deviation charge
  - Uplift allocation to load remains the same
- Calculations done from Jan 1, 2014 – May 31, 2015

Package H - Assumptions

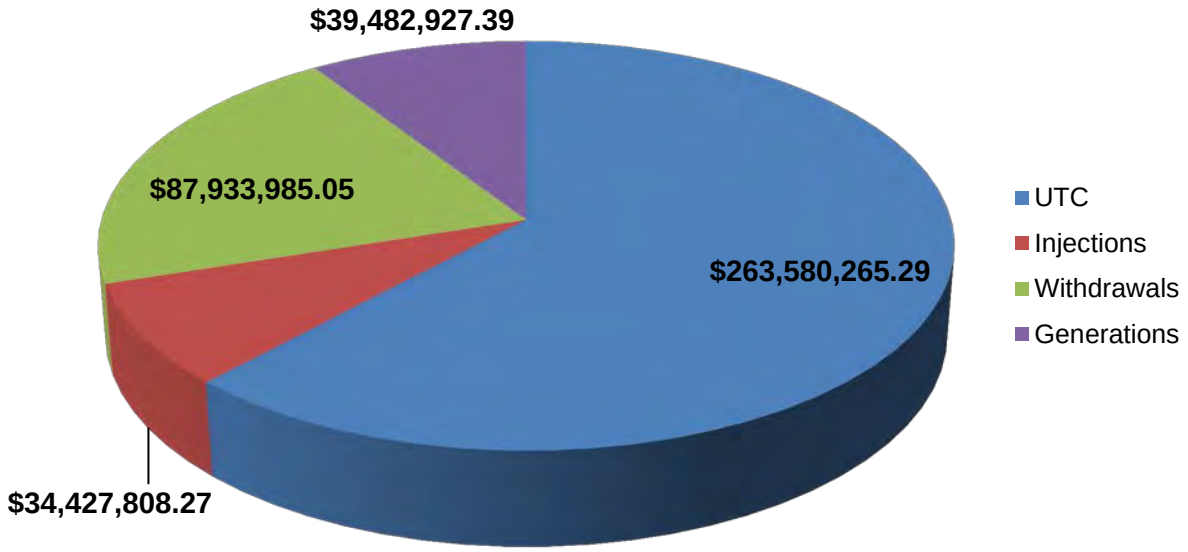
- UTCs are allocated a share of BOR charges as a deviation
  - How UTCs were included in estimated rates
    - ½ of UTC cleared MW assigned to source location
    - ½ of UTC cleared MW assigned to sink location
    - Source/sink mapped to regions (note east/west regions also included in RTO deviations) - http://www.pjm.com/~/media/markets-ops/energy/op-reserves/bor-hubs-zones-interfaces-aggregates-posting.ashx
- Eliminate ability of IBTs to offset deviations
    - Participants can recalculate deviations without IBTs using MSRS Operating Reserve Deviation Summary report

Package H Results

Current Uplift Allocation (Deviations only)



Package H Allocation (Deviations only)



Daily Rates – Current and Package H

Current

Statistic	RTO Deviations	East Adder	West Adde
Maximum	41.072	12.487	3.136
Minimum	0.010	0.000	0.000
Average	1.920	0.258	0.100
Median	0.815	0.006	0.000
Standard Deviation	4.123	1.096	0.316

Package H

Statistic	RTO Deviations	East Adder	West Adde
Maximum	12.731	3.287	0.923
Minimum	0.002	0.000	0.000
Average	0.601	0.072	0.029
Median	0.223	0.002	0.000
Standard Deviation	1.360	0.280	0.087

Package H Minus RTO (% change)

Statistic	RTO Deviations	East Adder	West Adde
Maximum	-40.8%	0.0%	0.0%
Minimum	-89.2%	-84.5%	-92.6%
Average	-68.4%	-37.6%	-18.9%
Median	-63.9%	-51.7%	0.0%
Standard Deviation	14.3%	34.1%	32.4%

Package H Summary

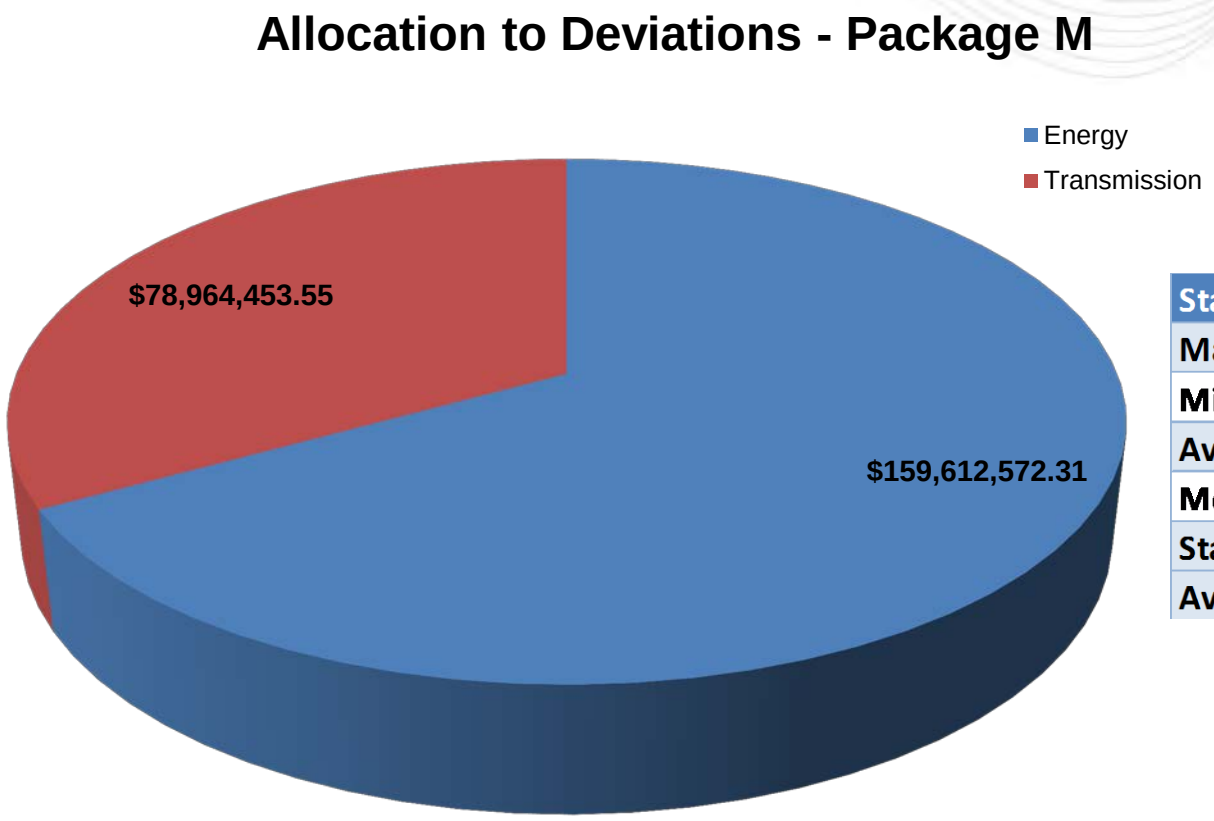
- Rates are all reduced due to introduction of additional deviations
- Significant shift in costs to UTC deviations due to extremely high volumes
  - Only allocated 1x charge as a single transaction
  - No presumptions made on volume changes due to an uplift allocation
- Removing IBT netting increases deviations

- Focused on additional netting to minimize uplift exposure
  - Split BOR charge deviations into separate energy and transmission buckets
    - Energy Bucket
      - Uplift paid to resources committed economically for energy
      - Per market participant, determine a system-wide net position for energy as difference between DA and RT net energy position
      - Market participant purchases and sales netted on an RTO-wide basis to calculate system-wide net position
      - Allocate any difference a pro-rata share of energy uplift costs

- Transmission Bucket
  - Uplift paid to resources committed to control transmission constraints
  - Per market participant, determine a nodal net position for energy as difference between DA and RT net energy position on a nodal basis
  - Market participant purchases and sales netted on a nodal basis to calculate a nodal net energy position
  - Allocate any difference a pro-rata share of transmission uplift costs

- Energy Bucket
  - Participants can determine their system wide net position for energy using the MSRS Spot Market Energy Charge Summary report.
  - System wide net position = Absolute value of (RT Net Interchange – DA Net Interchange) summed for all hours in the day
- Transmission Bucket
  - Participants can determine their nodal net position using their MSRS DA and RT Energy Transaction reports.
    - Net all DA injections using sink and DA withdrawals using source at a location
    - Net all RT injections using sink and RT withdrawals using source at a location
    - Nodal net position = Absolute value of (RT nodal net position – DA nodal net position) at each unique location.
    - Sum of nodal net position across all locations and hours in the day can be used to estimate allocation of charges.

Package M Allocation to Energy and Transmission Deviations



Statistic	Energy Rate	Transmission Rate
Maximum	11.984	1.596
Minimum	0.000	0.000
Average	0.642	0.042
Median	0.226	0.004
Standard Deviation	1.370	0.138
Average Daily Deviations	400,318.0	2,911,627.3

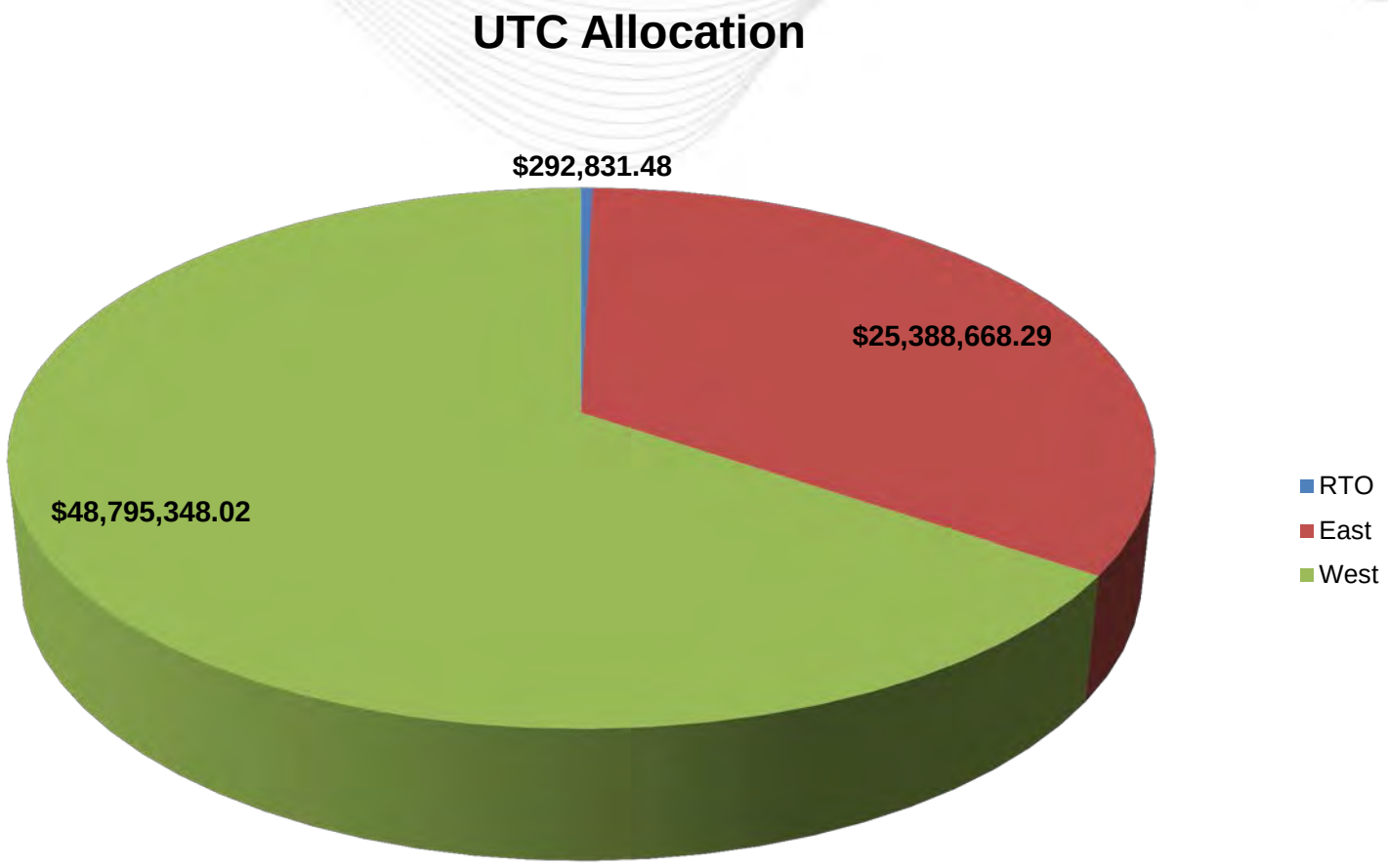
Package M Summary

- 2/3 of charges allocated across RTO-wide supply/demand deviations
- 1/3 of charges allocated to nodal deviations
- Rates are low but the number of deviations are high

- Less charges allocated than today
- Shift in allocation of LOC costs to loads either RTO-wide or zonally depending on scenario
  - About $220 M over this period

- Focused on balanced approach between load and generation for cost allocation
  - UTCs should be charged Operating Reserves
    - Each cleared MW charged $0.15/MWh
    - Charges netted against Balancing OR in applicable East, West or RTO region
    - UTCs that source and sink entirely within East or West region will offset charges in the respective region prior to offsetting RTO charges

Package L – UTC Allocation



- Unit Commitment: Economics and Reliability
  - Units initially committed for reliability, must meet criteria to be reclassified as economic to receive OR credits

Minimum Run-time of Unit	Number of intervals necessary where LMP>offer to be reclassified as economic and allocated towards deviations. There are twelve intervals in each hour.
<= 3 hours	Six 5-minute intervals over commitment period
>3 hours	Eighteen 5-minute intervals over commitment period

* Note estimate did not utilize 5 minute interval data

- Eliminate ability of IBTs to offset deviations

Package L – Charge Changes

	Current		Package L	
Column1	Deviation	Reliability	Deviations (no UTCs)	Reliability2
RTO	$ 425,424,986.00	$459,601,998.71	$ 322,814,124.96	$566,999,601.43
East	$ 24,232,277.40	$ 9,205,239.94	$ 14,838,638.75	$ 16,402,638.32
West	$ 9,652,017.79	$ 3,934,597.94	$ 3,119,051.61	$ 7,877,062.70
Total	$ 459,309,281.19	$472,741,836.59	$ 340,771,815.32	$591,279,302.45

- Charges netted against DA OR in applicable East, West or RTO region
  - How UTCs were assigned to regions to determine reduction in deviation charges to allocate
    - ½ of UTC cleared MW assigned to source location
    - ½ of UTC cleared MW assigned to sink location
    - Source/sink mapped to regions (note east/west regions also included in RTO deviations) - http://www.pjm.com/~/media/markets-ops/energy/op-reserves/bor-hubs-zones-interfaces-aggregates-posting.ashx
- Eliminate ability of IBTs to offset deviations
    - Participants can recalculate deviations without IBTs using MSRS Operating Reserve Deviation Summary report

Package L Summary

- $74 M collected from UTCs at $.15 per MWh
- Directly allocated to regional and then RTO deviations charges
- 122 days where the UTC allocation collects more money than is allocated to deviations
  - Totals a $12 M surplus that is unallocated in this data
- Change in reliability/deviation logic shifts ~ $110 M from deviation allocation to reliability allocation

Next Steps

- PJM will provide the daily level data for each package once it is ready for posting

- Aiming to get this posted by the end of this week – June 26, 2015