

Interface Pricing

MISO-PJM Joint and
Common Market
Meeting

August 20, 2015

Overview

- Purpose
 - Present MISO's recent analysis and preliminary observations
- Key Takeaways
 - MISO's current analysis is focusing on RT price volatility, revenue imbalance and non-M2M impact
 - Both solutions reduce transaction incentives compare to the status quo method
 - Sign reversal shows incentive in the opposite direction under PJM's method for certain constraints
 - Revenue imbalance exists when PJM's method is implemented without commercial flow based M2M process
 - MISO suggests joint analysis to further evaluate the two solutions for transaction impact on PJM's non-M2M IROL interface

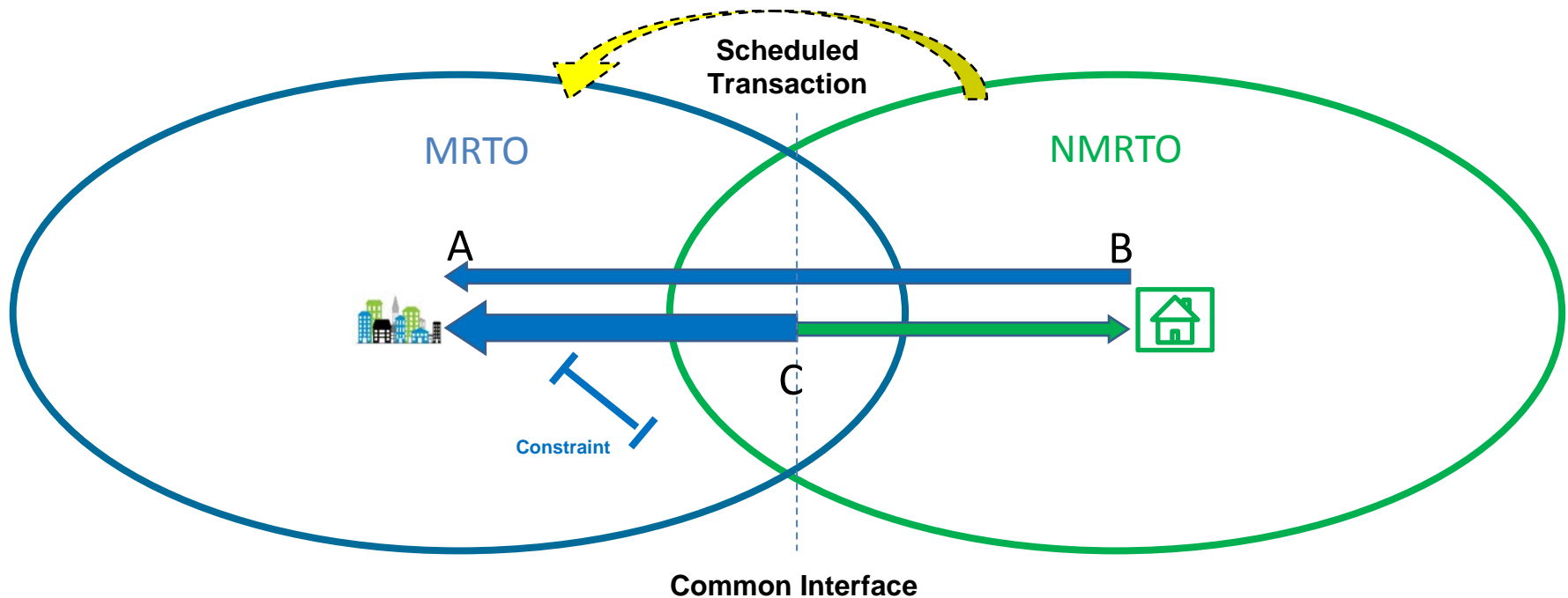
MISO Analysis Overview

- Real Time Price Volatility Analysis
 - Use RT data to evaluate magnitude of price volatility of the interface prices under IMM's proposal vs PJM's approach
- Revenue Imbalance Analysis
 - Identify net congestion settlement for IMM's proposal vs. PJM's approach
 - Explain the DA forecast variability's impact on revenue imbalance
- Non M2M constraint impact
 - MISO proposed a joint analysis to be used to establish a reference case for the impact of MISO's transaction on AEP-DOM and evaluate the performance of the 2 solutions

Price Volatility

Transaction Incentive Conceptual Illustration

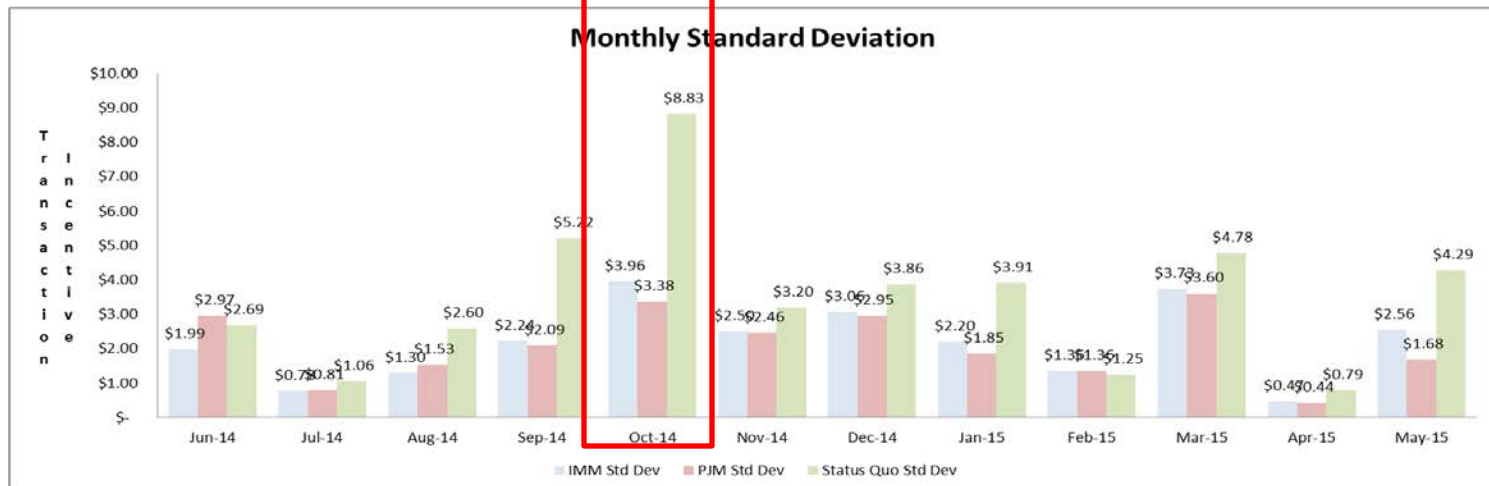
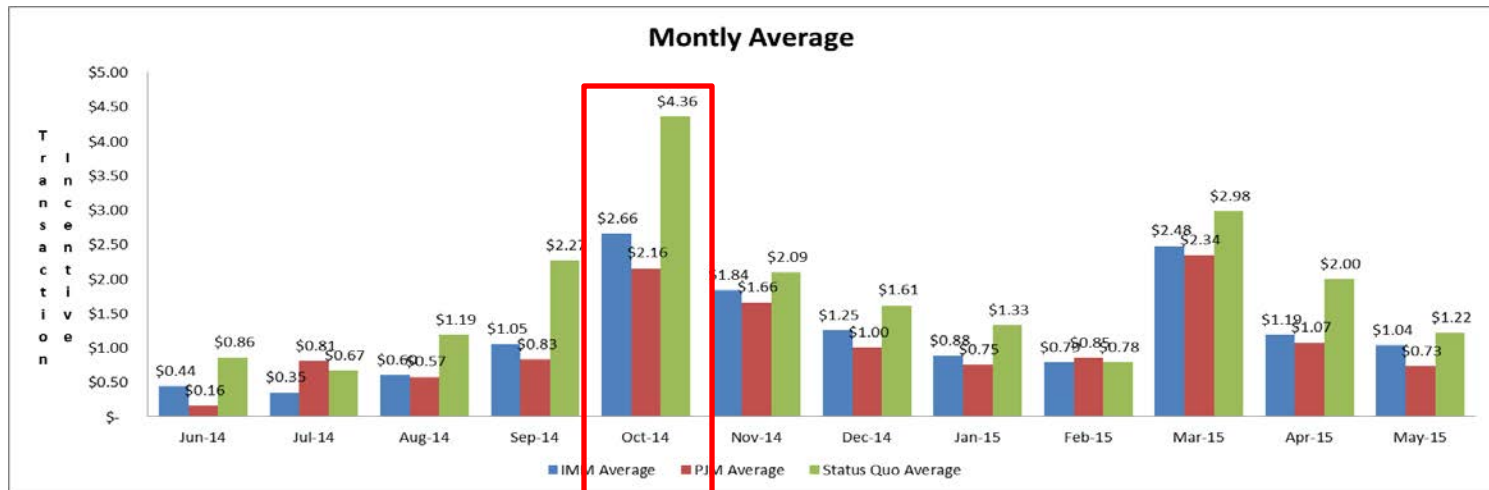
IMM's Method = $\$Shadow\ Price_{MRTO} * Shift\ Factor_{B \rightarrow A}$



PJM's Method = $(\$Shadow\ Price_{MRTO} * Shift\ Factor_{C \rightarrow A}) - (\$Shadow\ Price_{NMRTO} * Shift\ Factor_{C \rightarrow B})$

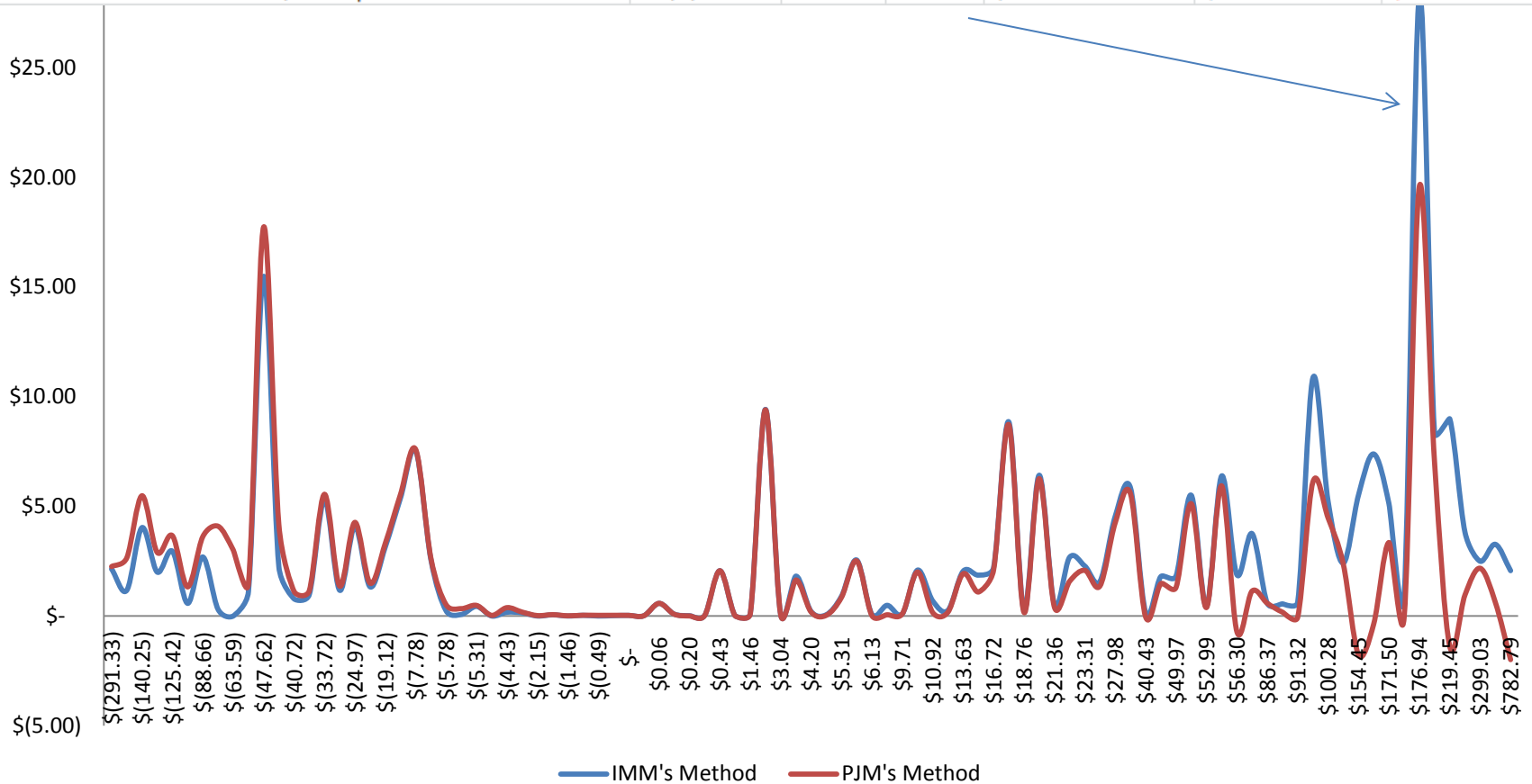
- What happens when $\$Shadow\ Price_{MRTO} = \$Shadow\ Price_{NMRTO}$
- What happens when $\$Shadow\ Price_{MRTO} \neq \$Shadow\ Price_{NMRTO}$

Volatility of Transaction Incentive



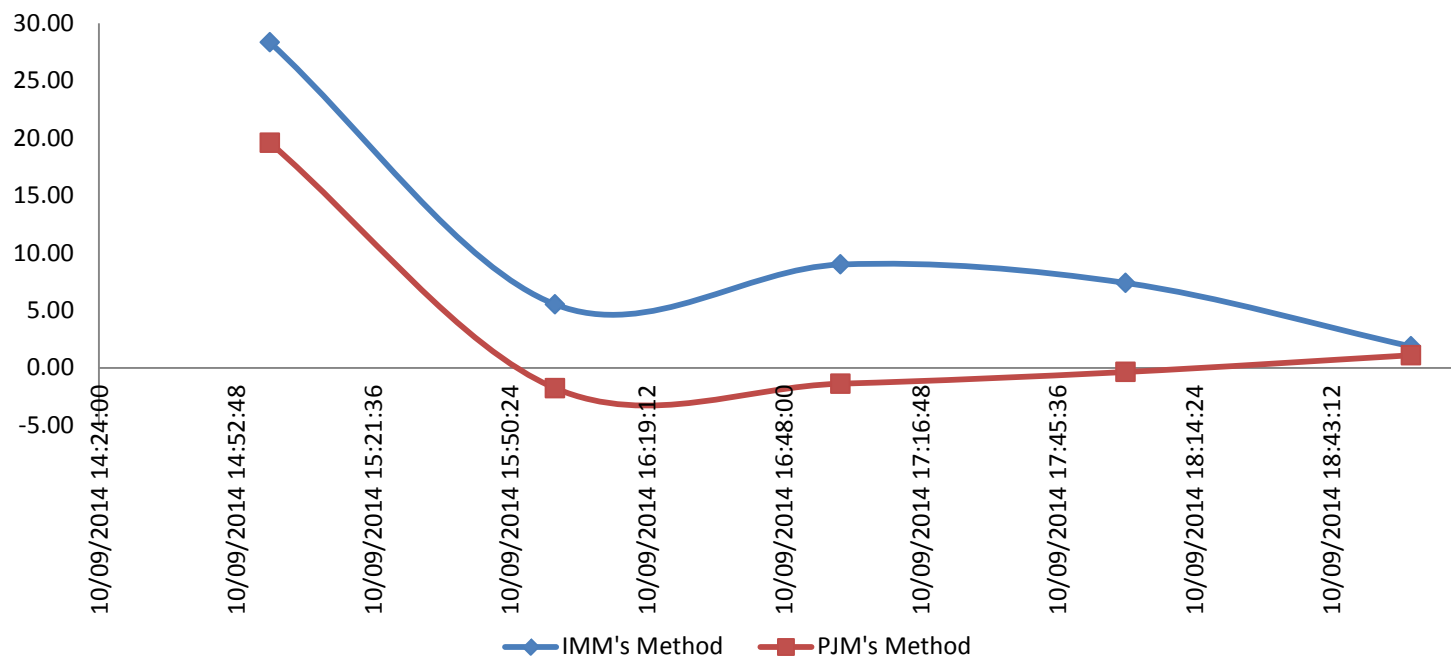
Oct 2014

Constraint Name	Date/Time Star	MISO SP	PJM SP	Shadow Price Delta	IMM's Method	PJM's Method
Breed-Wheatland 345 kV line l/o Rockport-Jefferson 765 kV line	10/9/14 15:00	1048.64	871.7	\$ 176.94	\$ 28.33	\$ 19.60

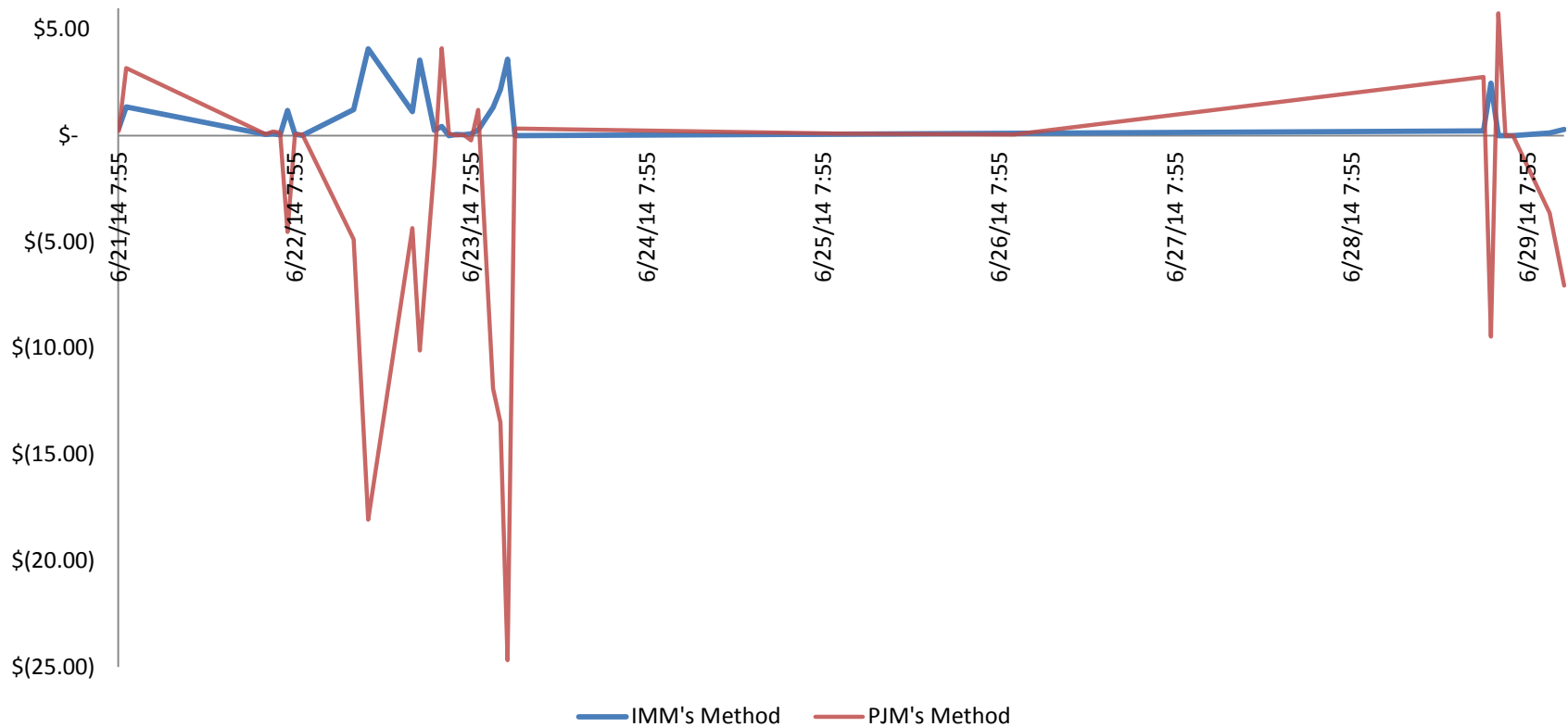


Breed-Wheatland Constraint for 10/09/2014

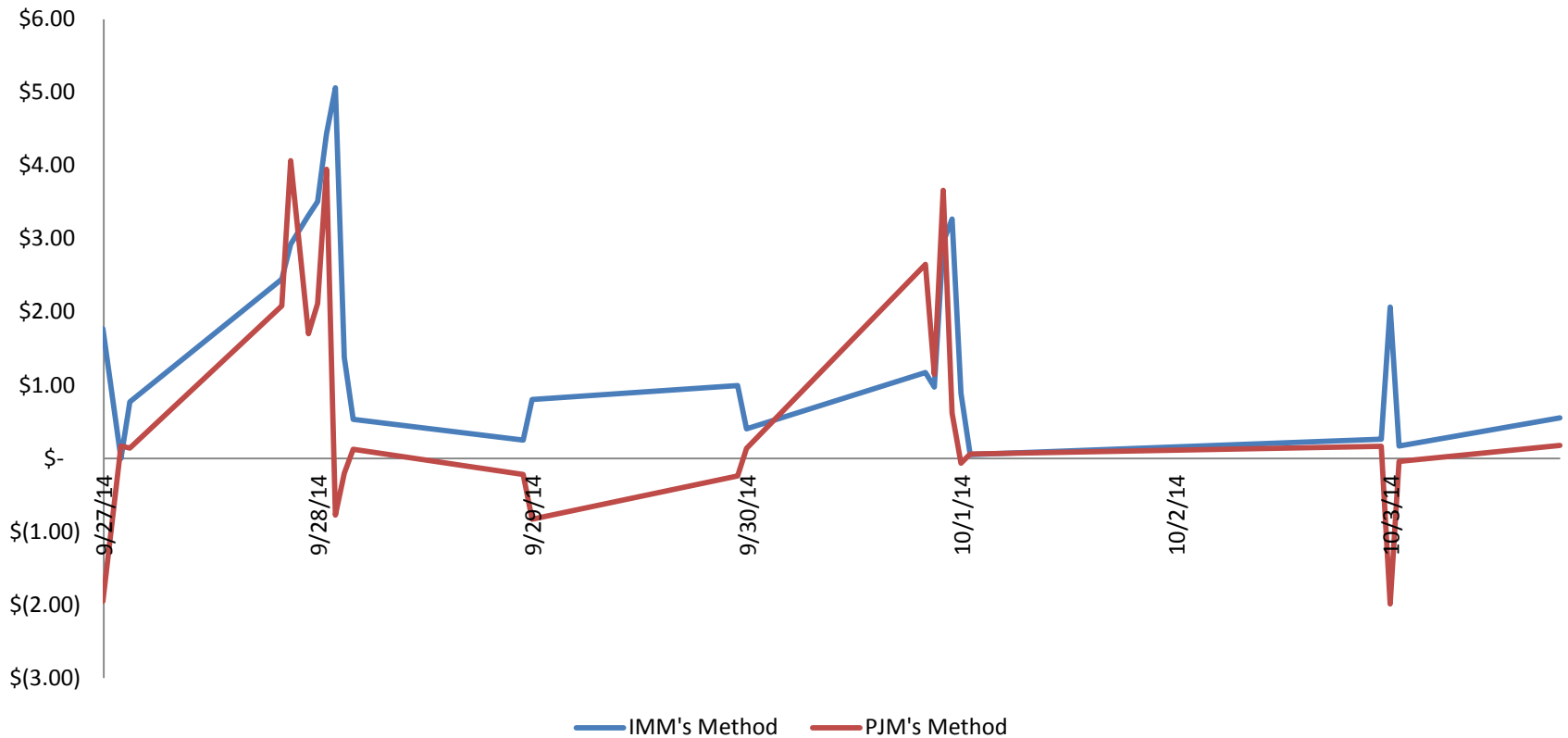
Constraint Name	Date/Time Stamp (Eastern)	MISO SP	PJM SP	Price Delta	IMM's Method	PJM's Method
Breed-Wheatland 345 kV line I/o Rockport-Jefferson 765 kV line	10/09/2014 15:00:00	1048.64	871.7	176.94	28.33	19.60
Breed-Wheatland 345 kV line I/o Rockport-Jefferson 765 kV line	10/09/2014 16:00:00	221.51	67.06	154.45	5.52	-1.78
Breed-Wheatland 345 kV line I/o Rockport-Jefferson 765 kV line	10/09/2014 17:00:00	364.98	145.53	219.45	8.99	-1.38
Breed-Wheatland 345 kV line I/o Rockport-Jefferson 765 kV line	10/09/2014 18:00:00	299.56	135.46	164.1	7.39	-0.36
Breed-Wheatland 345 kV line I/o Rockport-Jefferson 765 kV line	10/09/2014 19:00:00	64.01	47.68	16.33	1.86	1.09



Benton Harbor - Palisade Constraint Transaction Incentives in June 2014



Roxana-Praxair Constraint Transaction Incentives in end of September - early October 2014



Real Time Price Volatility – Preliminary Observations

- Both solutions reduce transaction incentives compare to the status quo method
- Sign reversal shows incentive in the opposite direction under PJM's method for certain constraints
- Information available in appendix
 - More standard deviation analysis is in [Appendix A](#)
 - More sign reversal data is available in [Appendix B](#)

Price Volatility– Potential Next Steps

- Evaluate PJM's constraints to attain comprehensive sampling
- Perform similar analysis for DA price volatility on selected constraints
- Identify the performance trend between the 2 methods

Revenue Imbalance

Congestion Revenue Imbalance

- Assume constraint binds in both Day-Ahead and Real-Time markets, i.e., the flow is equal to the limit
- MISO constraint revenue can be summarized as the following
 - RT Balancing Congestion Settlement =
 $(\text{Binding DA Limit} - \text{RT Market Settlement Flow}) * \text{RT Shadow Price}$
 - M2M Settlement =
 $(\text{RT M2M Market Flow} - \text{FFE}) * \text{RT Shadow Price}^1$
 - Net RT Congestion Settlement =
 $\text{RT Balancing Congestion Settlement} + \text{M2M Settlement}$

¹{IF RT Market Flow > FFE then PJM RT Shadow Price, else MISO RT Shadow Price}

Case Analysis Setup

- Analyzed one RT single interval UDS case
- Michigan_City_Laporte_138_flo_wilton_cntr_dumont
- Time: 6/12/2015 20:30

[See appendix for more information](#)

PJM's Method without Commercial Flow will Cause Revenue Imbalance Issue

	IMM's Method	PJM's Method without Commercial Flow	Modified PJM's Method without Commercial Flow*
Estimated FFE + Calculation Bias included in DA limit	✓	✓	✓
Estimated RT Transaction Impact included in DA limit			✓
RT Balancing Congestion Settlement	-10,120	1,291	-10,120
M2M Settlement	10,120	10,120	10,120
Net Congestion Settlement for Constraint	0	11,411	0

* Modification of DA binding limit to include transaction impact

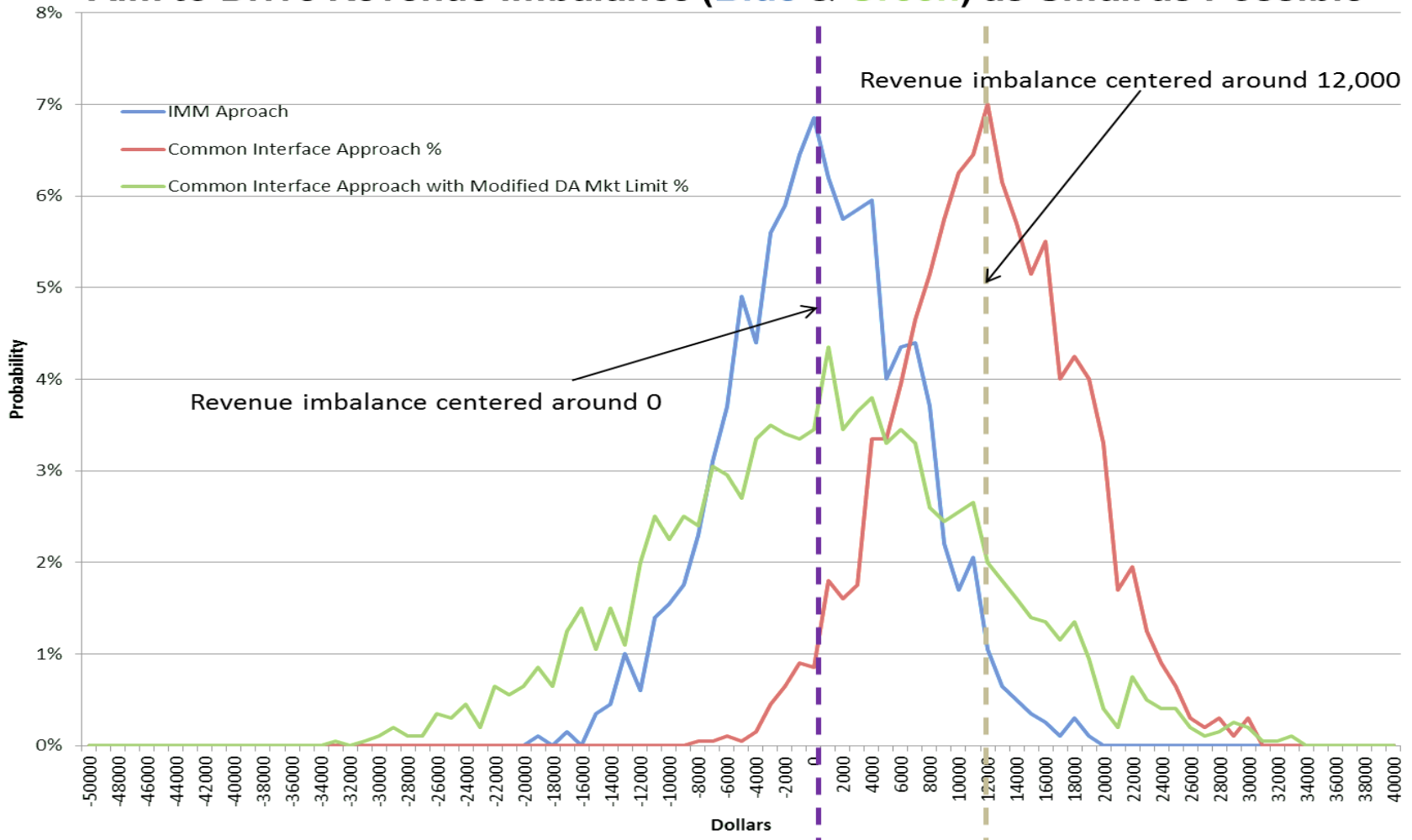
Revenue Imbalance Results Summary

- IMM approach
 - The RT balancing congestion settlement is perfectly offset by the M2M settlement
- PJM approach
 - MISO would have received large amount of M2M payment from PJM
- Modified PJM approach
 - The RT balancing congestion settlement is perfectly offset by the M2M settlement

DA Forecast Variability Study

- Analyzed the Michigan City -- LaPorte constraint with the DA forecast variability for the following parameters
 - DA forecast of RT FFE
 - RT transaction flow
- Using statistical simulation to investigate the RT revenue imbalance issue
 - Fix all the other variables in the RT market, vary only MISO DA forecast of RT FFE and RT transaction flow
 - Assume a normal distribution for these two variables
 - Create 2000 scenarios with different MISO DA forecast of RT FFE and RT transaction flow
 - Calculated net congestion settlement for constraint values using these three methods for all 2000 scenarios

Aim to Drive Revenue Imbalance (Blue & Green) as Small as Possible



DA Forecast Variability Study – Analysis Results

- Both the IMM Approach and Common Interface Approach with modified DA binding limit could resolve the revenue imbalance issue
 - The common interface approach without accounting for RT transaction impacts in the DA binding limit has a significant revenue imbalance issue
 - The IMM approach appears more centralized around 0 while the common interface approach with modified DA binding limit appears to have fatter tails which indicate a larger probability of values on the tails

Non-M2M constraint impact

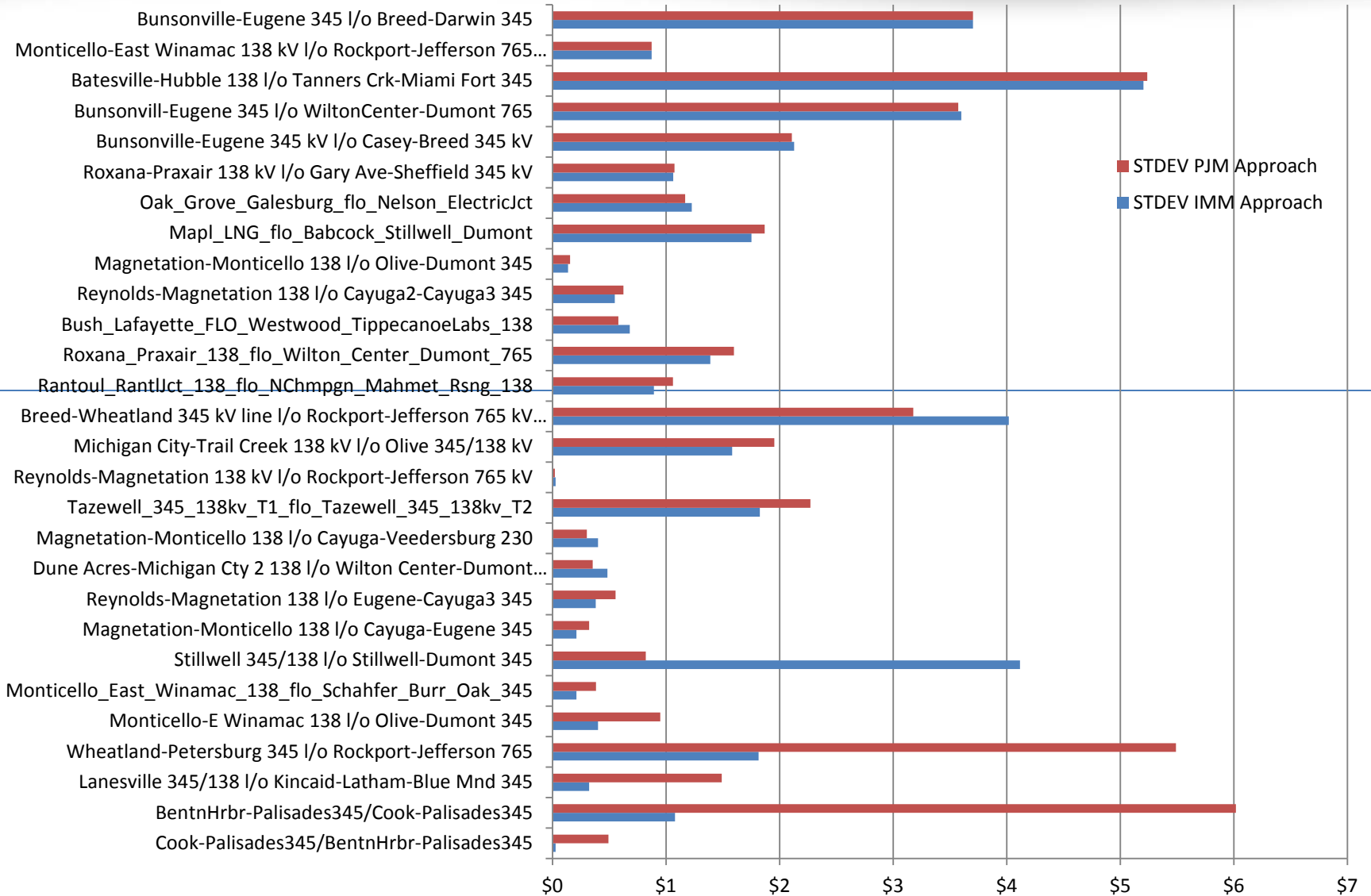
Proposed Framework for joint AEP-DOM Analysis

- Purpose:
 - To establish a reference for MISO transaction's impact on AEP-DOM (framework layout in [Appendix D](#))
 - To investigate the shift factor differences between the IMM and PJM's methods for the AEP-DOM constraint
- Next Step
 - Coordinate with PJM to evaluate the proposed joint analysis
 - Develop a work plan for the joint analysis

Contacts

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Appendix



Appendix B: Sign Reversal Statistics

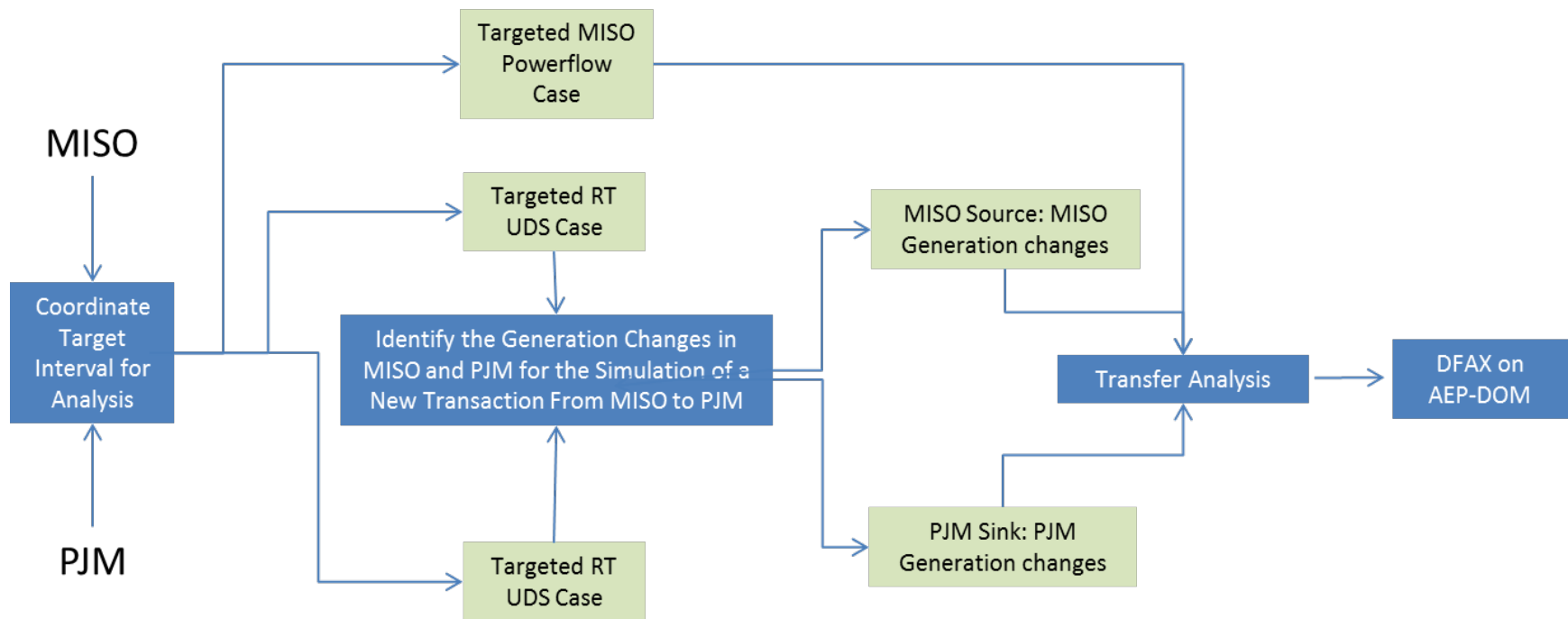
Constraint Name	Hour of Sign Reversal	Total Hours Binding	% of operation
Stillwell 345/138 I/o Stillwell-Dumont 345	2	2	100%
Cook-Palisades345/BentnHrbr-Palisades345	4	5	80%
BentnHrbr-Palisades345/Cook-Palisades345	22	40	55%
Magnetation-Monticello 138 I/o Cayuga-Eugene 345	1	2	50%
Roxana_Praxair_138_flo_Wilton_Center_Dumont_765	13	32	41%
Rantoul_RantlJct_138_flo_NChmpgn_Mahmet_Rsng_138	15	37	41%
Breed-Wheatland 345 kV line I/o Rockport-Jefferson 765 kV line	103	287	36%
Monticello-E Winamac 138 I/o Olive-Dumont 345	24	69	35%
Lanesville 345/138 I/o Kincaid-Latham-Blue Mnd 345	4	16	25%
Magnetation-Monticello 138 I/o Olive-Dumont 345	8	34	24%
Michigan City-Trail Creek 138 kV I/o Olive 345/138 kV	5	24	21%
Wheatland-Petersburg 345 I/o Rockport-Jefferson 765	2	10	20%
Monticello_East_Winamac_138_flo_Schahfer_Burr_Oak_345	17	97	18%
Reynolds-Magnetation 138 I/o Cayuga2-Cayuga3 345	13	75	17%
Reynolds-Magnetation 138 I/o Eugene-Cayuga3 345	4	36	11%
Batesville-Hubble 138 I/o Tanners Crk-Miami Fort 345	1	15	7%
Oak_Grove_Galesburg_flo_Nelson_ElectricJct	59	1012	6%
Bush_Lafayette_FLO_Westwood_TippecanoeLabs_138	1	20	5%
OAKGROVE_GALESBURG161_flo_STERLING_STL_NELSON345	1	190	1%
Bunsonville-Eugene 345 kV I/o Casey-Breed 345 kV	2	481	0%

Appendix C: Case Setup for Revenue Imbalance

- Analyzed one RT single interval UDS case
- Michigan_City_Laporte_138_flo_wilton_cntr_dumont
- Time: 6/12/2015 20:30
 - PJM RT SP: -388.88
 - MISO RT SP: -320.25
 - MISO RT Market Flow: -47.60
 - MISO RT Market Settlement Flow: -56.40
 - MISO RT Transaction Settlement Flow: 35.63
 - MISO RT FFE: -16
- DA Market FFE Limit/Flow = $-16+(-56.4-(-47.6)) = -24.8$
- DA Market Common Limit/Flow = $-24.8+35.63 = 10.83$

[Return to main presentation](#)

Appendix D: Proposed Framework for joint AEP-DOM Analysis



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