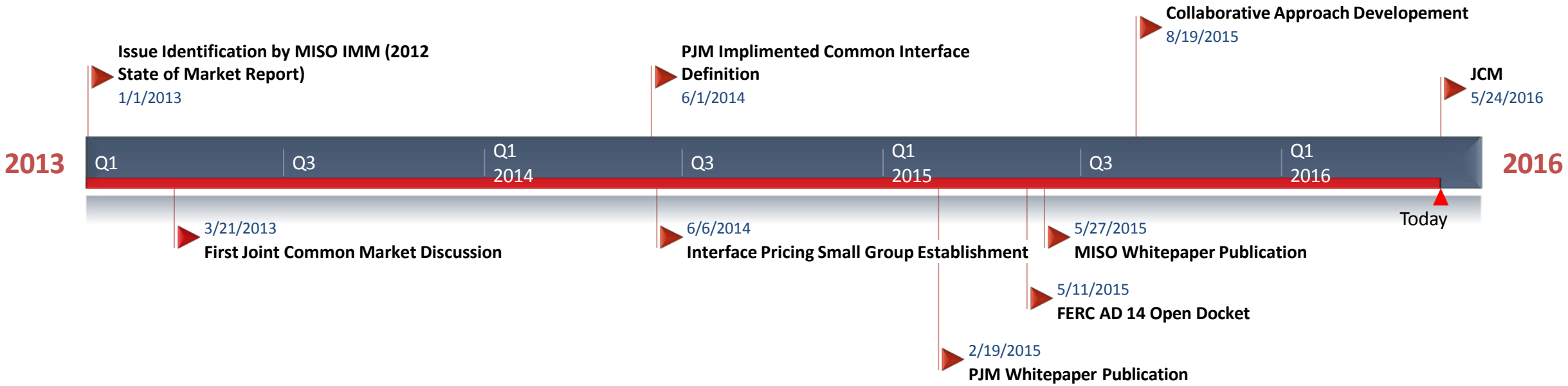
Joint Common Market

MISO-PJM Interface Pricing Update

History


Issue Identification by MISO IMM (2012 State of Market Report)
1/1/2013
PJM Implimented Common Interface Definition
6/1/2014
Collaborative Approach Developement
8/19/2015
JCM
5/24/2016
2013
Q1
Q3
Q1 2014
Q3
Q1 2015
Q3
Q1 2016
2016
Today
3/21/2013
First Joint Common Market Discussion
6/6/2014
Interface Pricing Small Group Establishment
5/27/2015
MISO Whitepaper Publication
5/11/2015
FERC AD 14 Open Docket
2/19/2015
PJM Whitepaper Publication

Interface Pricing Solution Proposals

Long Term Solutions		Short Term Solutions		
MISO IMM's Original Proposal	PJM's Original Proposal	Collaborative Approach	Modified Collaborative Approach	MISO IMM's MISO Incremental Proposal
Centroid to Centroid Approach NMRTO excludes transaction's impact on the constraint	Common interface definition Commercial flow proposal	Common interface definition Modify FTR and DA limits, if needed, to reflect transaction's impact PJM's commitment for modeling expansion	Common interface definition for M2M constraints and PJM Non M2M constraints MISO adopts centroid to centroid interface definition for MISO Non M2M constraints Modify FTR and DA limits, if needed, to reflect transaction's impact PJM's commitment for modeling expansion	MISO adopts centroid to centroid interface definition MISO excludes transaction's impact on PJM constraints PJM preserves 10 bus common interface definition

Decision Context

- Difference between the long term solutions and short terms are small, so we would like to seek incremental improvement as soon as possible
  - From all analysis, over payment due to inefficient interface price signal is still prevalent in status quo
  - From all analysis, we have observed improvement of price efficiency following the first half of 2014
  - The improved price efficiency could be instigated by
    - Decreased gas prices as compared to gas prices seen during the polar vertex
    - PJM's incremental improvement by implementing common interface in June 2014

Key Factors to the Decision Making

Key factor 1: The unintended consequence for MISO's Non Market-to-Market (M2M) constraint is less than previously anticipated

- The price inefficiency on MISO's Non M2M constraint is fractional compare to the inefficiency observed on M2M constraints
- More measures have been put in place to further mitigate this concern
  - Additional M2M FG coordination effort
  - Regular monitoring and coordinate reviews
  - Further enhancement available to improve price efficiency for MISO's Non M2M constraints

Key Factors to the Decision Making

Key factor 2: Both RTOs agree this approach resolves the interface pricing issue and can be implemented in the near future

- MISO incremental approach may introduce price inefficiency on PJM's M2M constraints
- Collaborative approach reduces the overpayment and holds minimal unintended consequences
- Collaborative approach is easily adaptable by both RTOs to seek incremental improvement in the near term

Coordination with MISO IMM

Analysis Differences

Parameter	MISO IMM Analysis	RTOs Joint Analysis
A. Modeling Platform	EMS model	IDC model
B. Calculation Intervals	MISO Constraints: 5 min PJM Constraints: Various	2015 Winter Analysis: Monthly Extended 2015 Analysis: Annual
C: Analysis Data Duration	1/1/2014-6/1/2015	2015 Winter Analysis: 11/1/2015-1/31/2016 Extended 2015 Analysis: 1/1/2015-1/31/2016
D: M2M Shift Factor Calculation Baseline	Reference to Reference	Baseline 1: Marginal Zone to Marginal Zone Alt. Baseline: Reference to Reference
E: MISO Component of Shift Factor Calculation for MISO Incremental	Load Centroid to Load Centroid	Load Centroid to Generation Centroid
F: M2M Congestion Cost Baseline	Only Monitoring RTO's Shadow Price	Combination of both RTOs Shadow Prices
G: Volatility Metrics	Average difference from previous interval	Standard deviation from the baseline (ideal)

MISO IMM's Concerns

- MISO IMM has raised concerns regarding the RTOs Joint Analysis
  - Baseline proposal
  - IDC model utilization
  - Analysis sample coverage
  - Metrics and criteria definition
- Recognizing the strengths of both analyses, the RTOs validated its finding by applying RTOs metrics and criteria to the more granular data from the IMM's analysis
- RTO's agree IMM concerns have either been mitigated or are not significant enough to prevent joint collaboration

RTOs' Recommendation

Implement the Collaborative Approach for the next FTR planning year (6/1/2017)

Collaborative Approach

1. Common interface definition (Existing PJM 10 bus definition)

2. Modify FTR and DA limits, if needed, to reflect transaction's impact.
   - M2M does not include transaction impacts
   - DA and RT does include Transaction impacts

RTOs' Recommendation- Post Implementation

Monitoring Process and Mitigation Options for Post Implementation

Key Concerns	Monitored Parameters	Mitigation Options / Enhancement Opportunities (Regular joint performance)
Price Signal	• Congestion transaction incentive for M2M constraints • Price signal for Non M2M constraints • Shadow price convergence for M2M constraints • Interface price volatility	• More granular common interface definition • Address volatile constraint control due to shadow price swings • Improve shadow price convergence for M2M constraints in general • Potential to capture non M2M constraint interface price impacts jointly • Continue to improve price signal for all constraints • Additional M2M FG coordination effort
Revenue Imbalance	• Uplift or FTR imbalance	• Day Ahead M2M coordination • Monitor the impact of commercial flow

Future

Next Steps:

1. Review at RTO stakeholder meetings

2. Legal review of necessary JOA or Tariff changes
   - File necessary revisions and update FERC

3. Implementation on June 1, 2017
   - Included in 2016/2017 Annual ARR/FTR processes

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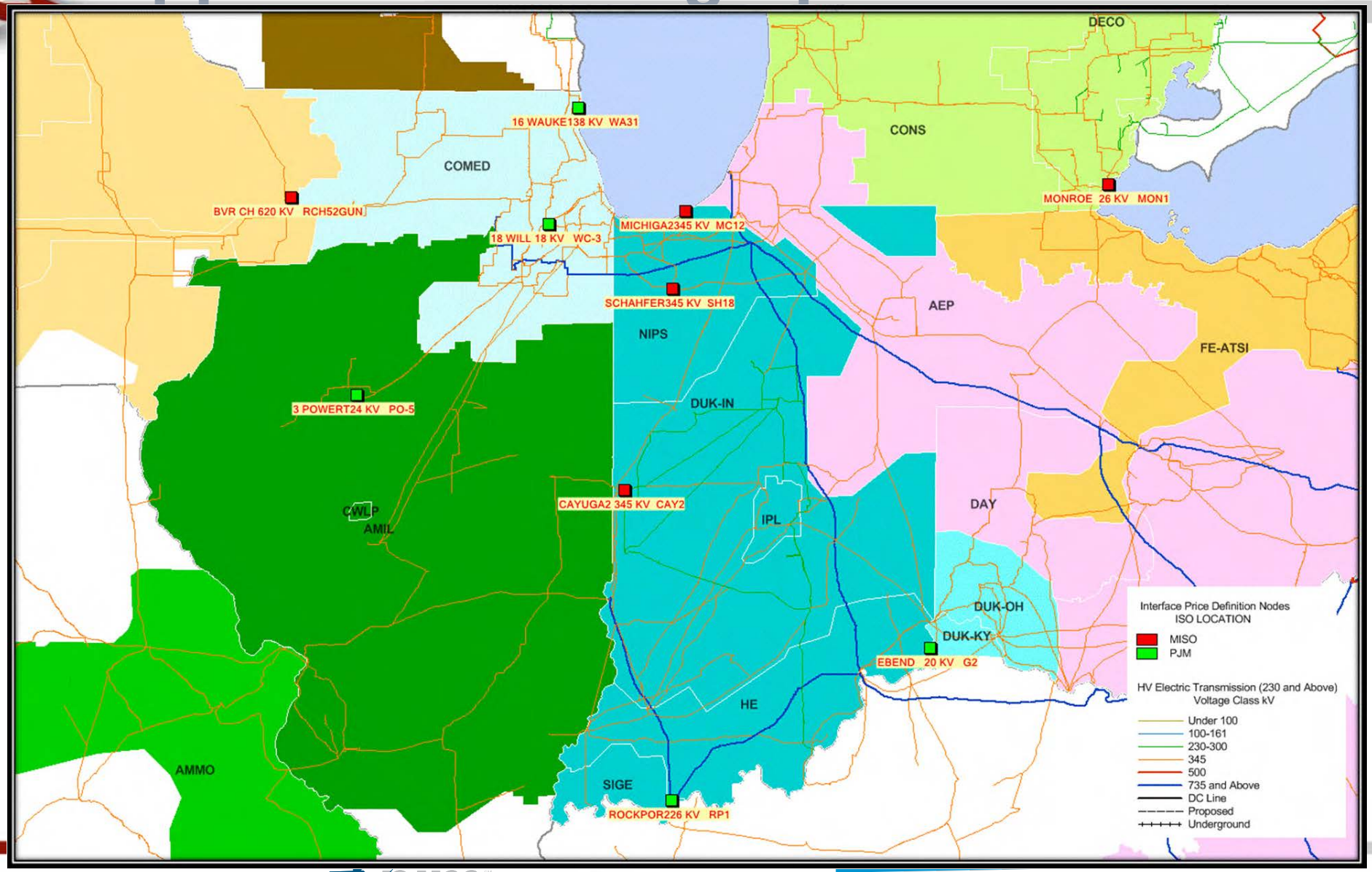
APPENDIX

Appendix A

PJM-MISO Common Interface

Generator Price Node	RTO	Weighting Factor
ROCKPOR2 26 KV RP1	PJM	0.1
18 WILL 18 KV WC-3	PJM	0.1
3 POWERT 24 KV PO-5	PJM	0.1
16 WAUKE 138 KV WA31	PJM	0.1
EBEND 20 KV G2	PJM	0.1
BVR CH 6 20 KV RCH52GUN	MISO	0.1
SCHAHFER 345 KV SH18	MISO	0.1
CAYUGA2 345 KV CAY2	MISO	0.1
MICHIGA2 345 KV MC12	MISO	0.1
MONROE 26 KV MON1	MISO	0.1

Appendix B: Geographic Location



Appendix C

RTO's Average Transaction Incentive ($/MWh) Difference from Ideal (Reference to Reference Baseline)

Real-Time Market	Status Quo	Collaborative (Common Interface)	Modified Collaborative	MISO Increm.	Preferred Approach
MISO M2M Constraints	0.27	-0.02	-0.02	0.27	Collaborative (Common Interface)
PJM M2M Constraints	2.61	0.30	0.30	1.44	Collaborative (Common Interface)
MISO Internal Constraints	0.01	0.02	0.01	0.01	Status Quo/Modified Collaborative/MISO Incremental
PJM Internal Constraints	0.15	0.15	0.15	0.15	All

Appendix D

Standard Deviation from Ideal (Reference to Reference Baseline)

Real-Time Market	Status Quo	Collaborative (Common Interface)	Modified Collaborative	MISO Increm.	Preferred Approach
MISO M2M Constraints	1.2	0.30	0.30	1.2	Collaborative (Common Interface)
PJM M2M Constraints	3.23	1.1	1.1	1.12	Collaborative (Common Interface)
MISO Internal Constraints	0.02	0.16	0.02	0.02	Status Quo/Modified Collaborative/MISO Incremental
PJM Internal Constraints	1.05	1.05	1.05	1.05	All