Joint and Common Market

FUTURE M2M ENHANCEMENTS

Background

- MISO and PJM are pursuing two enhancements to Market to Market in 2019

- Implementation of Power Swings software
    - Used to mitigate power swings when the Non-Monitoring RTO (NMRTO) has significant impact on M2M flowgates
    - MISO and SPP implemented similar software in 2018

- Removal of constraint relaxation logic on M2M flowgates
    - MISO implemented Transmission Constraint Demand Curves in 2013
    - PJM implemented Transmission Constraint Penalty Factors in 2019

Power Swings Mitigation

- MISO and PJM to implement similar Power Swings software that MISO and SPP developed in 2016, and put into production in January 2018

- Software has two main features:
  - Enhanced Shadow Price Override
    - Typically used when NMRTO has fast moving generation
    - When MRTO stops binding, the NMRTO continues to bind for a fixed period gradually releasing constrained market flow
  - Physical Flow Control Exchange
    - Designed for flowgates where the NMRTO has significant market flow impacts
    - NMRTO would control to physical flow, and MRTO would control their market flows to a target determined by the NMRTO
    - MISO and PJM have implemented this on some flowgates without software by swapping ownership

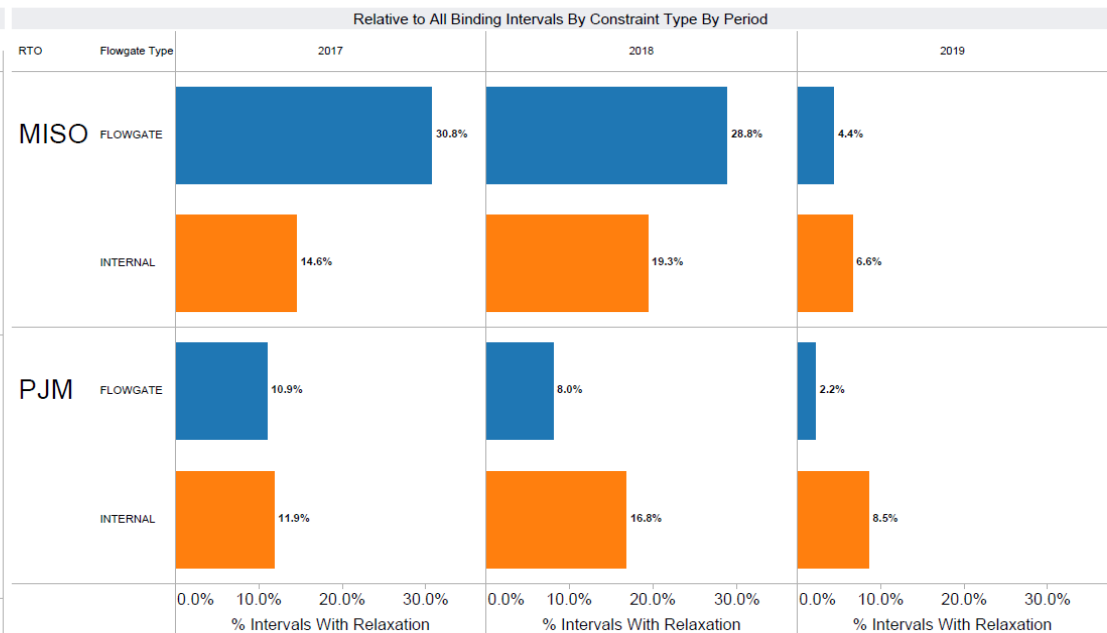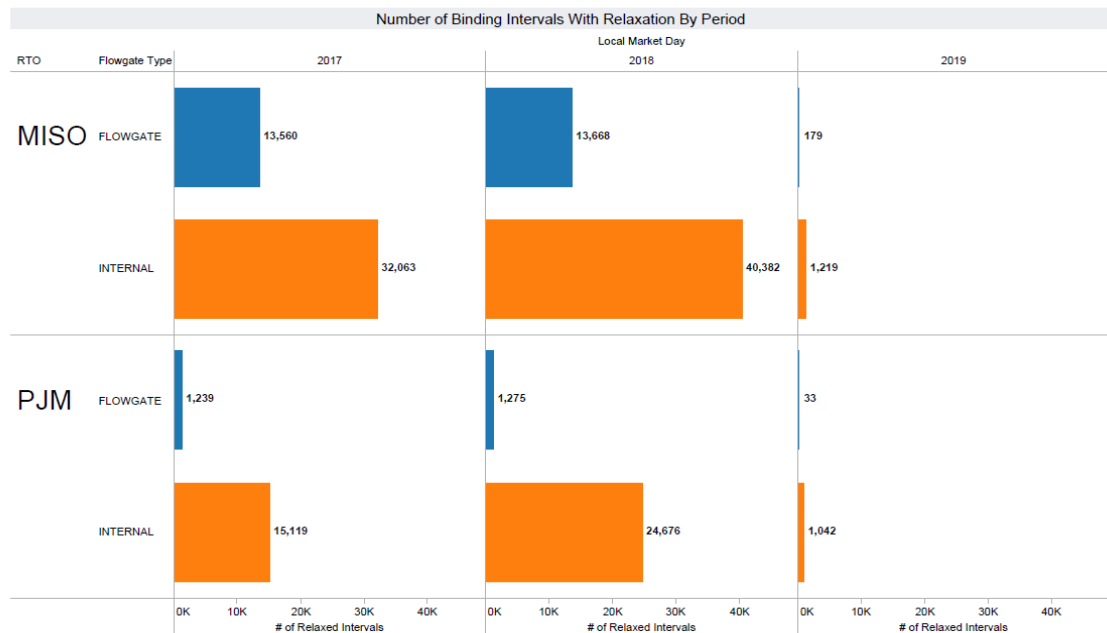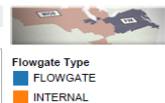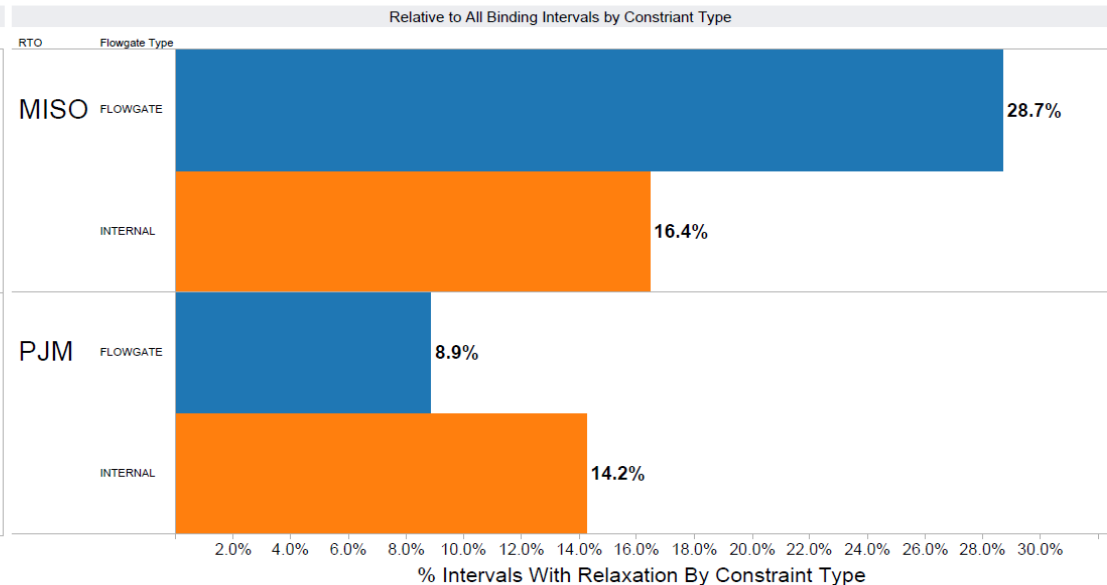- Enhancement will require JOA changes

Constraint Relaxation Logic

- Constraint relaxation logic sets the shadow price based on the marginal resource less the Marginal Value Limit, even when SCED cannot control the constraint
  - When constraint relaxation is off, if SCED cannot control the constraint, the shadow price is set to the Marginal Value Limit (MVL)
  - Both MISO and PJM utilize constraint relaxation logic on M2M flowgates
  - MISO and PJM do not use constraint relaxation logic on internal constraints

- MISO and PJM plan to turn off constraint relaxation on M2M flowgates in late 2019
  - Requires logic changes in MISO and PJM systems
  - Requires Tariff/JOA changes

- Will impact shadow price for M2M flowgates, interface prices, and impact the hourly shadow price used in M2M settlements

Impacts of Constraint Relaxation Removal

- Stakeholders have raised concerns to MISO and PJM with this change
  - Change will increase the Shadow Price for M2M Flowgates in both the MISO and PJM markets
  - Increased Shadow Price will increase M2M payments

- MISO and PJM reviewed the binding history of both internal constraints and M2M flowgates from 2016 until present
  - Detailed analysis provided on the next slides
  - Constraint Relaxation occurred 29% of the time on MISO owned M2M FGs, and 16% of time on internal constraints in the MISO UDS
  - Constraint Relaxation occurred 9% of the time on PJM owned M2M FGs, and 14% of time on internal constraints in the PJM SCED

- MISO and PJM plan to continue to use a Shadow Price Limit of $2000 on M2M flowgates

Constraint Relaxation By Constraint Type - February 1, 2017 to February 1, 2019

Number of Binding Intervals With Relaxation

RTO	Flowgate Type	
MISO	FLOWGATE	27,407
	INTERNAL	73,664
PJM	FLOWGATE	2,547
	INTERNAL	40,837

# of Relaxed Intervals

Relative to All Binding Intervals by Constraint Type

Flowgate Type
- FLOWGATE (blue)
- INTERNAL (orange)

RTO	Flowgate Type	
MISO	FLOWGATE	28.7%
	INTERNAL	16.4%
PJM	FLOWGATE	8.9%
	INTERNAL	14.2%

% Intervals With Relaxation By Constraint Type

Number of Binding Intervals With Relaxation By Period

Local Market Day

RTO	Flowgate Type	2017	2018	2019
MISO	FLOWGATE	13,560	13,668	179
	INTERNAL	32,063	40,382	1,219
PJM	FLOWGATE	1,239	1,275	33
	INTERNAL	15,119	24,676	1,042

# of Relaxed Intervals

Relative to All Binding Intervals By Constraint Type By Period

RTO	Flowgate Type	2017	2018	2019
MISO	FLOWGATE	30.8%	28.8%	4.4%
	INTERNAL	14.6%	19.3%	6.6%
PJM	FLOWGATE	10.9%	8.0%	2.2%
	INTERNAL	11.9%	16.8%	8.5%

% Intervals With Relaxation

The left hand side shows the total number of instances in which a constraint was relaxed in PJM's RTSCED or MISO's UDS engine.

The top left graph shows total instances over the February 1, 2017 and February 1, 2019 when constraint relaxation was removed for internal constraints.
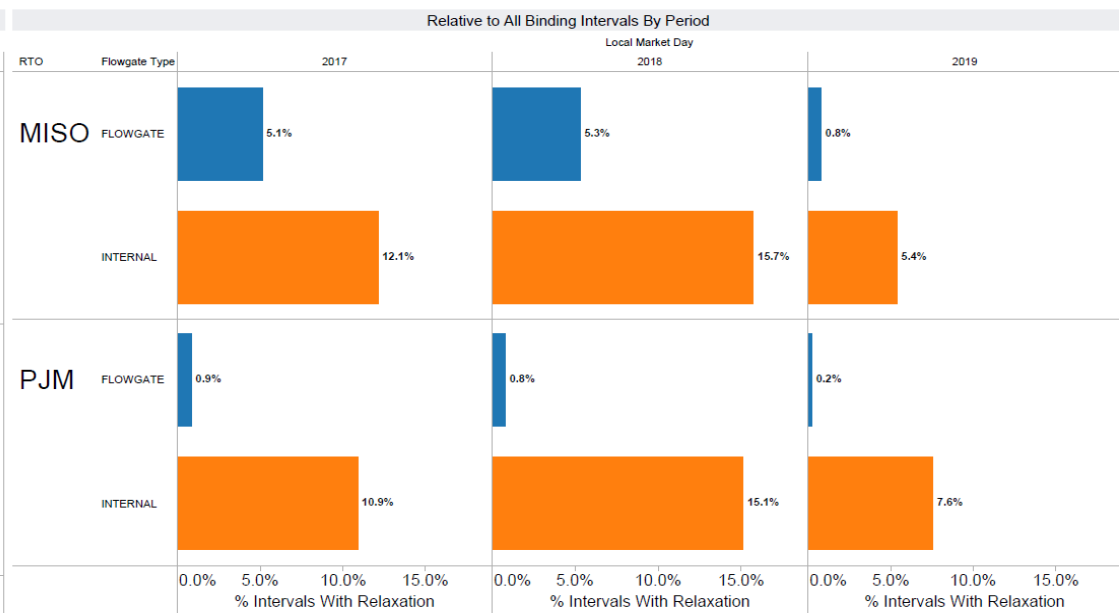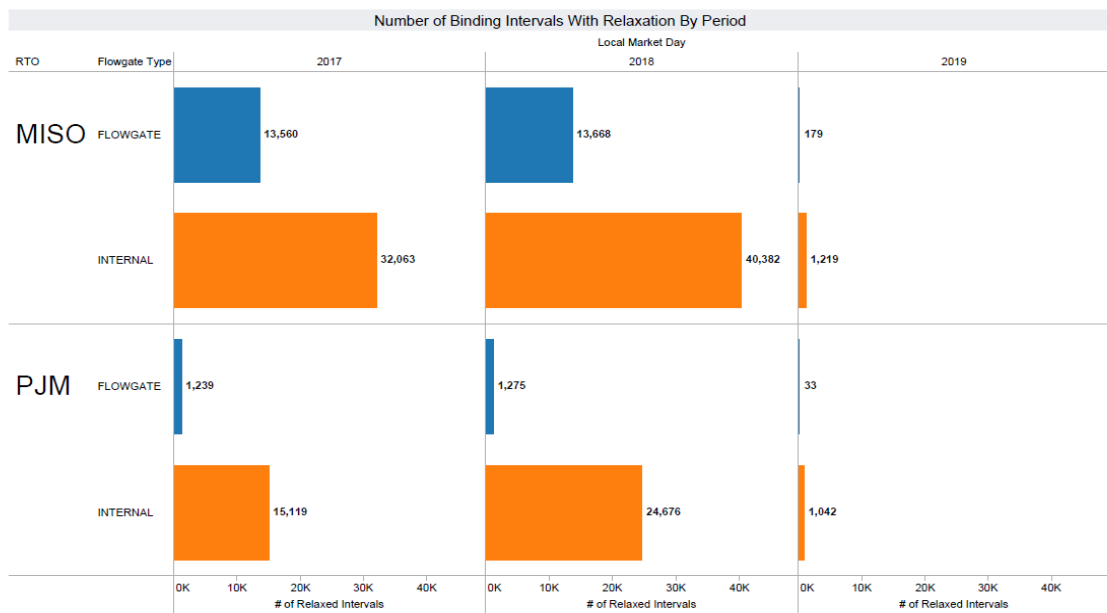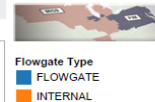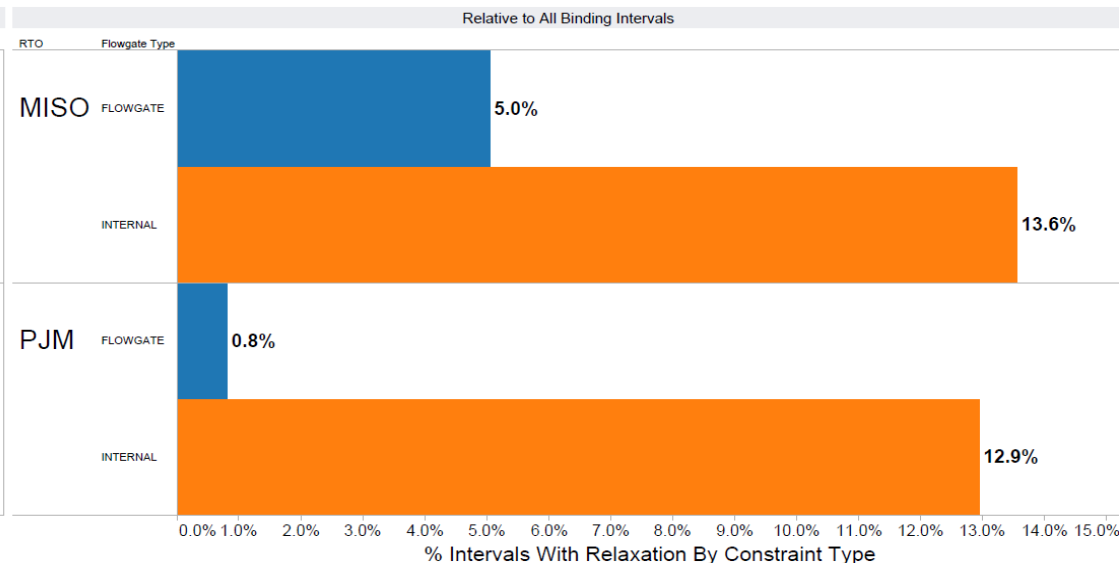
The bottom left graph shows the total instances for each year.

The right hand side shows the percentage of binding intervals with respect to each constraint class (M2M flowgate vs Internal).

The top right graph shows this percantage over the entire time period.

The bottom right graph shows these percentages by year.

Constraint Relaxation Summary - February 1, 2017 to Februay 1, 2019

Number of Binding Intervals With Relaxation

RTO	Flowgate Type	
MISO	FLOWGATE	27,407
	INTERNAL	73,664
PJM	FLOWGATE	2,547
	INTERNAL	40,837

# of Relaxed Intervals

Relative to All Binding Intervals

RTO	Flowgate Type	
MISO	FLOWGATE	5.0%
	INTERNAL	13.6%
PJM	FLOWGATE	0.8%
	INTERNAL	12.9%

Flowgate Type
- FLOWGATE
- INTERNAL

% Intervals With Relaxation By Constraint Type

Number of Binding Intervals With Relaxation By Period

Local Market Day

RTO	Flowgate Type	2017	2018	2019
MISO	FLOWGATE	13,560	13,668	179
	INTERNAL	32,063	40,382	1,219
PJM	FLOWGATE	1,239	1,275	33
	INTERNAL	15,119	24,676	1,042

# of Relaxed Intervals

Relative to All Binding Intervals By Period

Local Market Day

RTO	Flowgate Type	2017	2018	2019
MISO	FLOWGATE	5.1%	5.3%	0.8%
	INTERNAL	12.1%	15.7%	5.4%
PJM	FLOWGATE	0.9%	0.8%	0.2%
	INTERNAL	10.9%	15.1%	7.6%

% Intervals With Relaxation

The left hand side shows the total number of instances in which a constraint was relaxed in PJM's RTSCED engine.

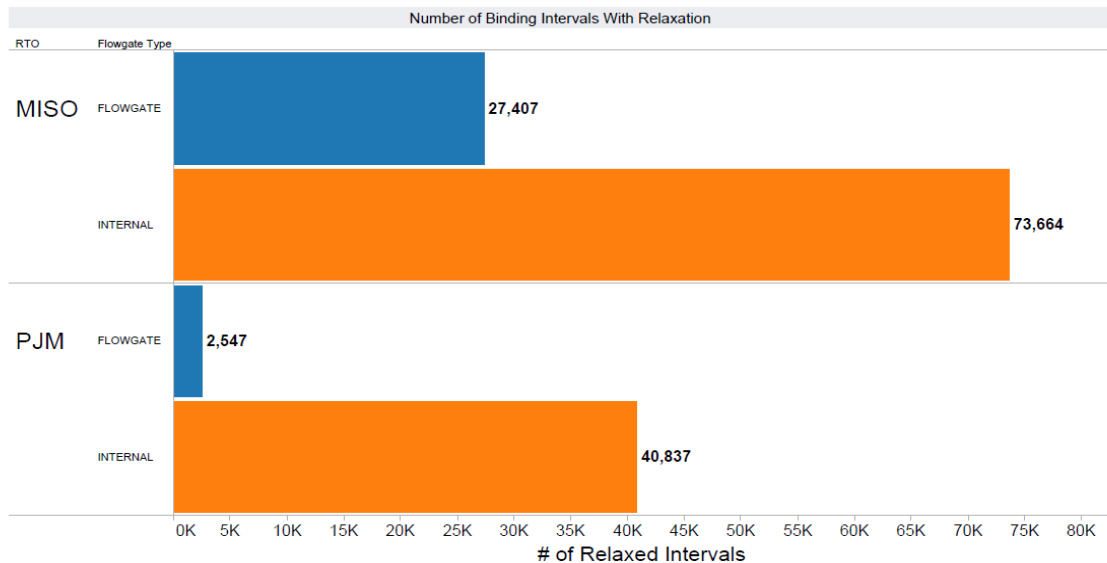The top left graph shows total instances over the February 1, 2017 to February 1, 2019 time period.

The bottom left graph shows the total instances for each year.

The right hand side shows the percentage of binding intervals with respect to <u>all constriant classes combined</u>

The top right graph shows this percantage over the entire time period.

The bottom right graph shows these percentages by year.

Tentative Timeline

Due Date	Action
Summer 2019	Proposed Tariff Changes for Power Swings and Constraint Relaxation
Next JCM	Provide Data Analysis on constraint relaxation and present JOA language changes
Fall 2019	File JOA/Tariff changes
Winter 2019	Implement constraint relaxation changes for M2M flowgates
Q1 2020	Implement Power Swings software changes

Contacts

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