FTR Forfeiture Rule

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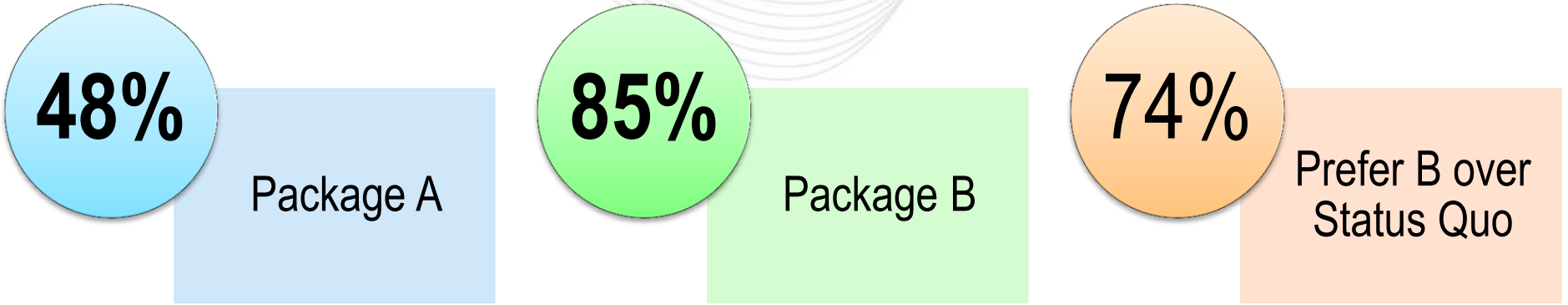
FTR Forfeiture Rule Background

- FTR Forfeiture Rule Changes issue charge approved in March 2018 (MIC)
  - Review the current FTR Forfeiture Rule and propose changes to allow market participants to more effectively manage their FTR portfolios
  - The FTR Forfeiture Rule is intended to deter market participants from using virtual transactions to create congestion that benefits their FTR positions
- Key discussion areas:
  - Impacts from January 2017 FERC directive and following PJM compliance filing
  - Accounting for loop flow impacts on market-to-market coordinated flowgates
  - Alternatives to the $0.01 threshold for determining constraint-to-FTR impact & forfeiture amount

November MIC Voting Results



- Package B received majority support; majority prefer B over status quo
- Package A does not include a modification to the “penny test”
- Both Package A and B include modification to virtual test on M2M flowgates
- Internal Market Monitor recommends status quo
- Original 2017 PJM Compliance filing not formally accepted by FERC to-date

Package Matrix

Design Components	Status Quo	Package A Modifications	Package B Modifications	Reasoning
Virtual Test - M2M Constraints (FFE)	Affiliate net virtual flow >= 10% of DA constraint binding limit	Affiliate net virtual flow >= 10% of DA constraint binding limit, including loop flow impacts	Affiliate net virtual flow >= 10% of DA constraint binding limit, including loop flow impacts	Remove inconsistency between how coordinated market-to-market flow gates are handled by the FTR Forfeiture Rule versus internal constraints
FTR Impact Test - Internal PJM Constraints	Constraint has at least 0.01$ impact on FTR path value	Status Quo	FTR flows greater than or equal to 10% across constraint	$0.01 impact test is overly punitive; not clearly ordered by FERC directive
FTR Impact Test - M2M Constraints (FFE)	Constraint has at least 0.01$ impact on FTR path value	Status Quo	FTR flows greater than or equal to 10% across constraint	$0.01 impact test is overly punitive; not clearly ordered by FERC directive
Implementation	N/A	Q1 2019	Q1 2019	N/A

Applicable Tariff/OA Revisions

OATT Attachment K - Appendix Section 5.2.1 (d)

- *For purposes of section 5.2.1(c), a binding constraint shall be considered if* the difference between the shift factors at the Financial Transmission Right delivery and receipt buses across the binding constraint exceeds ten percent and is in the direction that increases the value of the FTR . ~~the binding constraint has a $0.01 or greater impact on the absolute value of the difference between the Financial Transmission Right delivery and receipt buses.~~

- The FTR Forfeiture rule is implemented as follows in hours where the difference in Locational Marginal Prices in the Day-ahead Energy Market between such delivery and receipt buses is greater than the difference in Locational Marginal Prices between such delivery and receipt buses in the Real-time Energy Market and where the Effective FTR Holder's net MW position between such delivery and receipt buses is positive:
  - An Effective FTR Holder's virtual transaction portfolio net flow is greater of 10% of the physical limit of the Day-ahead binding constraint or 0.1MW, or such other threshold as determined by PJM, as described below; and
  - The difference between the shift factors at the Financial Transmission Right delivery and receipt buses across the Day-ahead binding constraint exceeds ten percent and is in the direction that increases the value of the FTR ~~The Day-ahead binding constraint has a $0.01 or greater effect (i.e. the product of the constraint's shadow price times the shift factor) on the absolute value of the difference between the Financial Transmission Right delivery and receipt buses~~

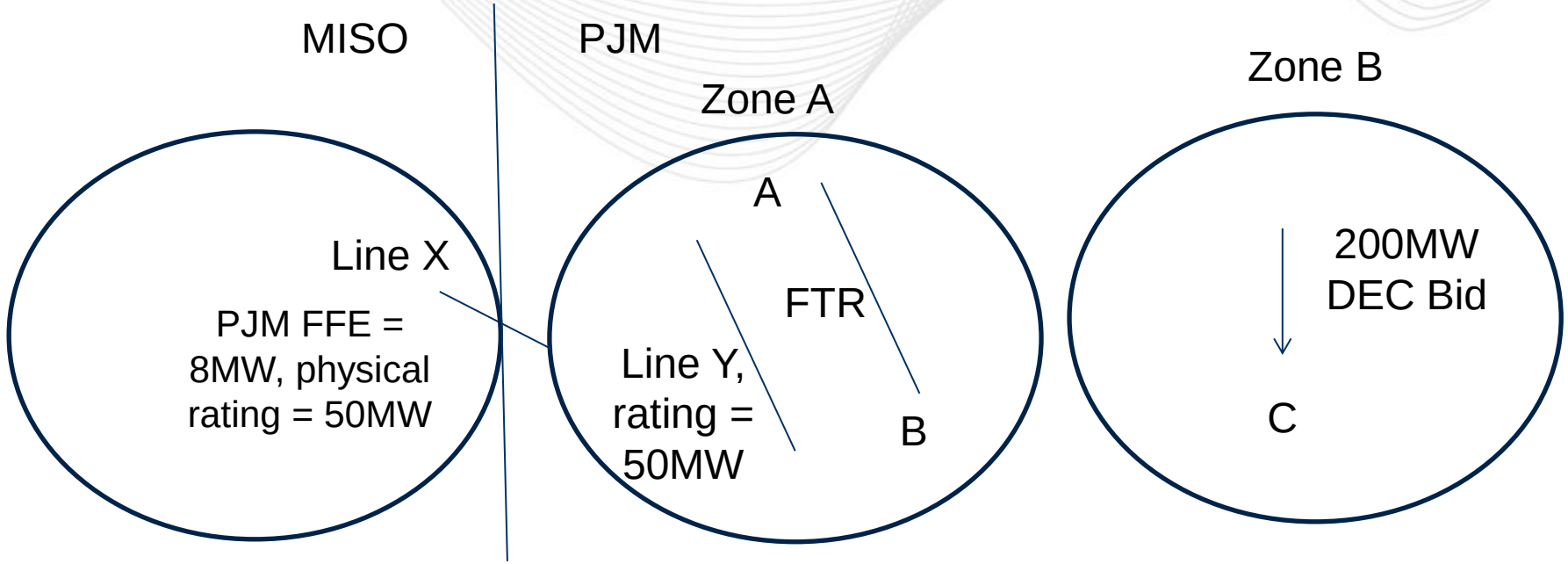
Next Steps

- Vote Package B at December 20th MRC meeting
- Endorse changes to OA/OATT at January MC meeting
- Q1/Q2 2019 implementation date

Appendix

- **Convergence Test** – DA cLmp > RT cLMP for FTR path
  - Determines Hour where DA congestion is greater than RT along a path
- **Virtual Test** – Net virtual activity across all affiliates must be greater than or equal to 10% of DA constraint limit
  - Determines Constraints virtual flow is significantly impacting
- **FTR Impact Test** – (dfax*Shadow Price)FTR Sink – (dfax*Shadow Price)FTR Source >= $0.01
  - Determines FTR paths (direction accounted for counter flow)
- **FTR Forfeiture** – DA Value – FTR Cost

Review: Illustrative Example



Step 3: If step 2 meets threshold, determine if DA Constraints X and Y increase the FTR value from A-B ($0.01)

Step 1: Determine if FTR Path A-B is more congested DA vs. RT

Step 2: Determine impact on DA Constraints X and Y from Virtual transaction at bus C (10% of limit)

Line X and Line Y have different limits due to DA m2m loop flow methodology vs. DA internal loop flow methodology

Flow Perspective

- The total flow across any constraint has two components:
  - Market Flow – flow from internal PJM resources
  - Loop Flow – flow from external resources
- Therefore, a constraint can only bind as a result of both Market Flow and Loop Flow impacts
- This is straight-forward for internal PJM facilities but a little less clear for coordinated market-to-market flow gates
  - FTR Forfeiture rule potentially is inconsistent due to the binding limits being utilized

Flow Perspective – PJM Internal

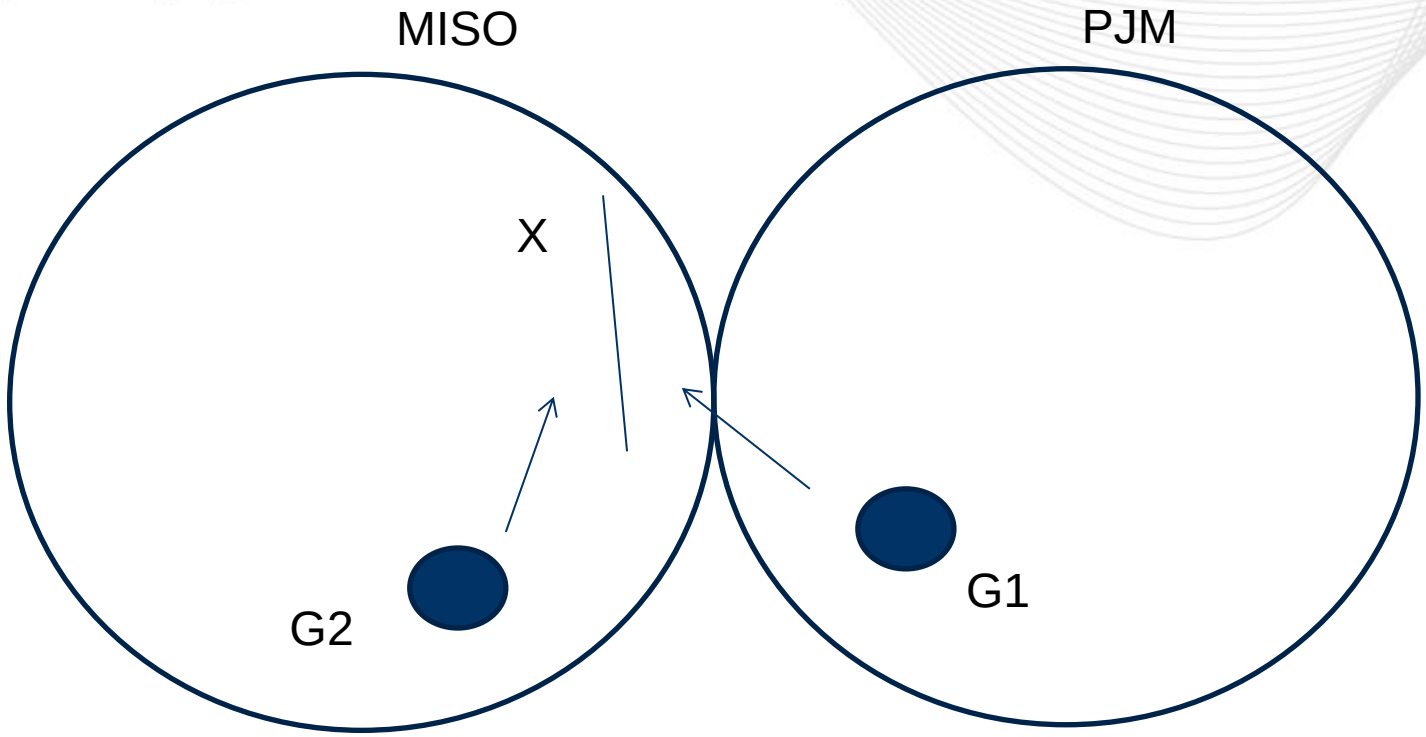
- The DA market model incorporates Loop Flow impacts by modeling fixed injections and withdrawals at specific locations along PJM borders, similar to the FTR model
  - Based on historical, average inadvertent interchange
  - Impossible to predict RT LF impacts on a specific facility
- Loop Flow impacts are inherently captured in the total flow and binding limit when a constraint binds in the DA market
  - Market Flow + Loop Flow = Total Flow = Binding Limit used in Forfeiture code
  - Loop Flow impacts for internal facilities are assumed to be minimal, otherwise the facility would qualify for market-to-market coordination

Flow Perspective – M2M Coordinated

- A market-to-market flow gate is coordinated if it is expected to bind in both PJM market and external market
  - Significant Loop Flow impacts
- PJM DA Market Operations must operate MISO-monitored coordinated flow gates to the allowable firm flow entitlement (FFE) and PJM-monitored coordinated flow gates to the facility rating minus MISO FFE, per the PJM-MISO Joint Operating Agreement
- This means DA must operate market-to-market flow gates strictly on Market Flow
  - Market Flow ~~+ Loop Flow~~ = Total Flow = Binding Limit used in Forfeiture Code
  - Loop Flow is dropped from this equation for the Forfeiture calculation

- Total costs for congestion on coordinated market-to-market flow gates consists of PJM costs and non PJM costs
  - PJM costs result from Market Flow plus M2M payments
  - Non-PJM costs result from Loop flow component (M2M congestion)
- External Areas contribute to the total congestion because the same constraint is binding in both areas
  - Should the FTR holder cost impact on total congestion be considered or just PJM market congestion?

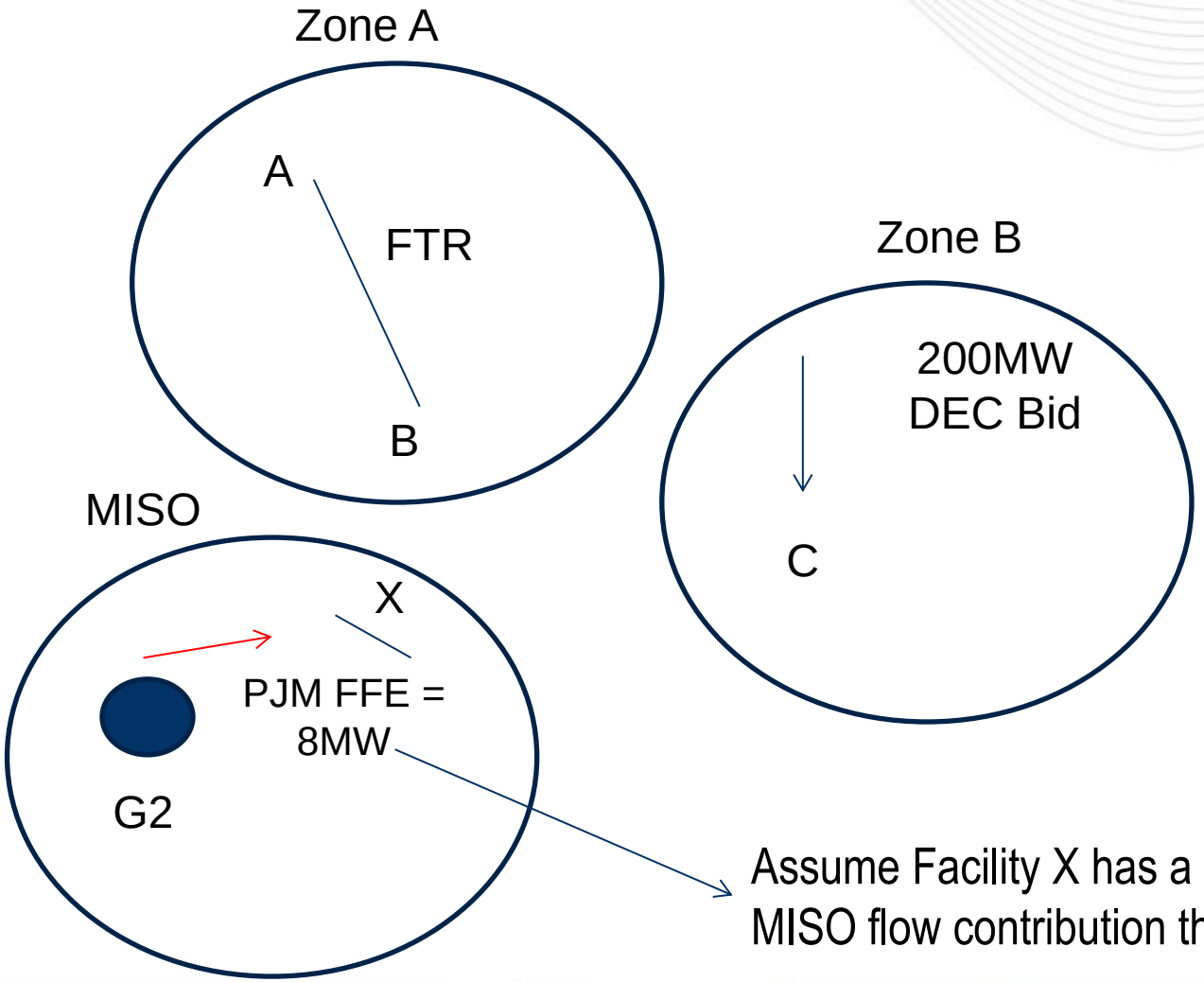
Example



Facility X rating = 100 MW
PJM FFE = 40 MW
MISO Flow = 60 MW

- Flow gate X is congested in the PJM DA Market
- The rating is the FFE (miso owned)
- Since this is a coordinated FG, it is also assumed this constraint is binding in the MISO DA market
- That flow will be the rating – PJM FFE, or “Loop Flow”
- There may be M2M payments associated with this FG
- Consider the Total Flow (MF+LF) for the forfeiture virtual impact test?
  - 100MW, not 40MW

M2M Flowgate Virtual Test Hypothetical Example



- Virtual Test determines if Decrement Bid at point C significantly impacts flow gate X (DA constraint)
- "Significantly" is determined to be greater than or equal to 10% of DA binding limit
- 10% impact for this flow gate would be 0.8MWs or roughly 0.4% dfax given 200MW dec bid

Considerations

- Adjust the FTR Forfeiture rule to include Loop Flow impacts in the coordinated market-to-market flowgate DA binding limit
  - Loop Flow contributes to the total congestion
  - Use facility rating (MF + LF) for all coordinated M2M flowgates
  - Align with how internal constraints are handled by the forfeiture calculation
- Adjust the FTR Forfeiture rule to exclude Loop Flow impacts on internal constraints
  - Again, relatively small by definition but would be consistent with m2m flowgates
- Status Quo