Energy Scheduling Issues

MIC

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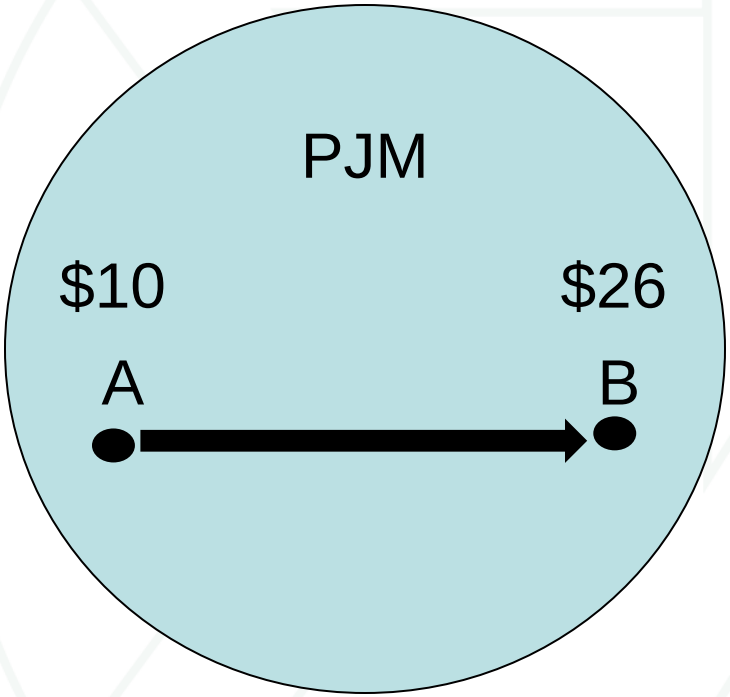
Monitoring Analytics

Topics

- **Interface Pricing Issue**
- **Sham Scheduling**
- **Scheduled vs Actual**

Interface Pricing

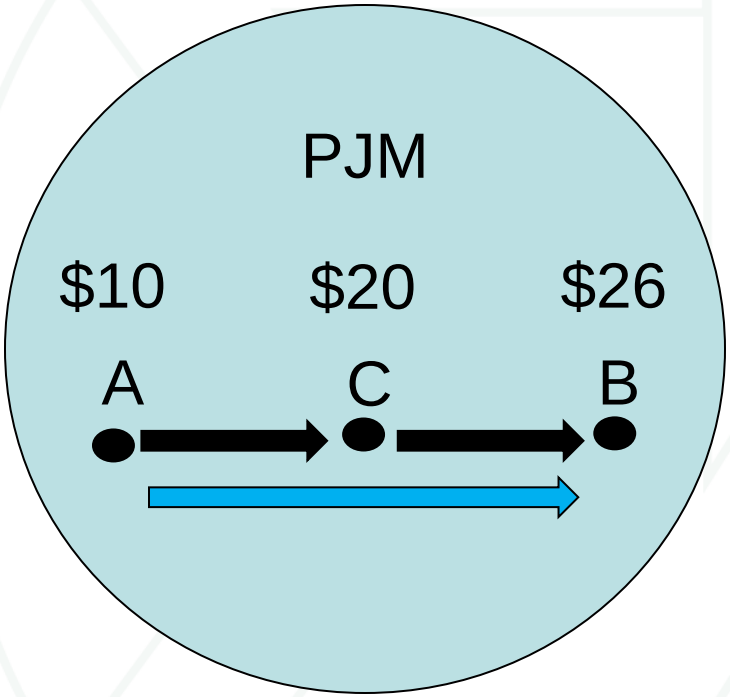
Buy from Bus A, sell to Bus B



Get paid $26
Buy at $10
Pay congestion between B and A ($26 - $10 = $16)
Net Settlement is:
$26 - $10 - $16 = $0

Interface Pricing

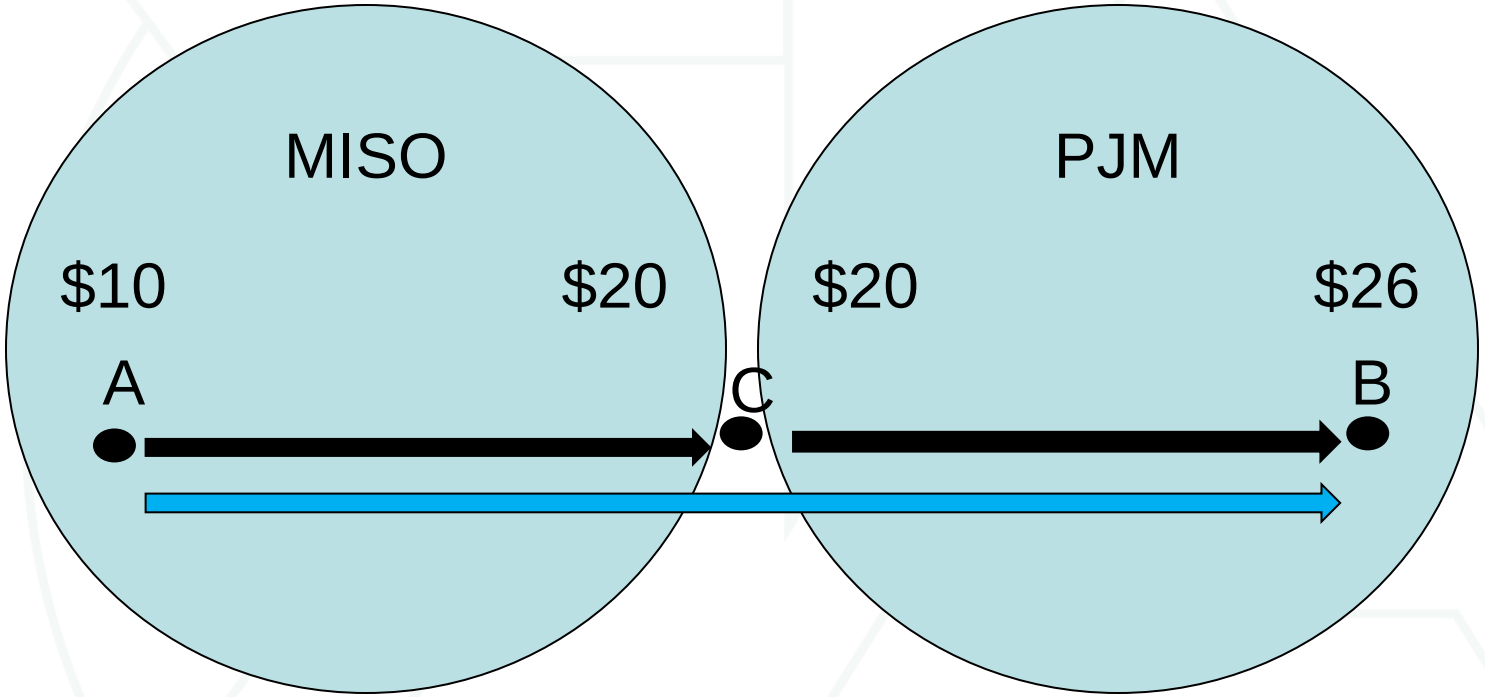
Buy from Bus A, Sell to Bus C then
Buy from Bus C, Sell to Bus B



Get paid $26
Buy at $10
Net position at C is zero:
Settlement = $0
Pay congestion between B and A
($26 - $10 = $16)
Net settlement is:
$26 - $10 - $16 = $0

Interface Pricing

Buy from Bus A in MISO, sell to Bus B in PJM

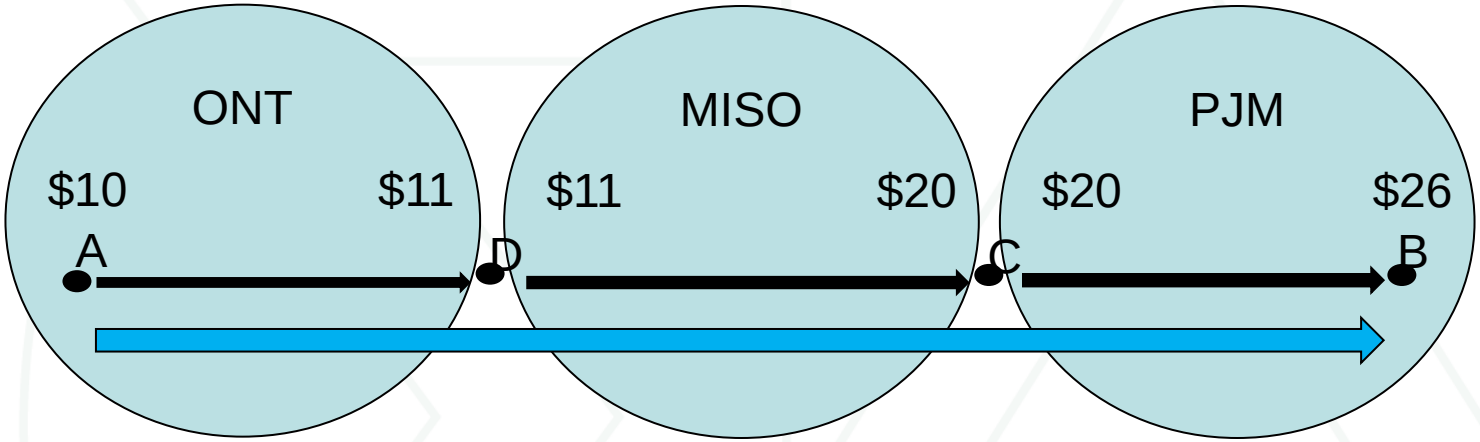


Get paid $26
Buy at $10
Net position at C is zero:
Settlement = $0

Pay PJM congestion between B and C
($26 - $20 = $6)
Pay MISO congestion between C and A
($20 - $10 = $10)
Total Congestion between B and A is:
$6 + $10 = $16
Net settlement is:
$26 - $10 - $16 = $0

Interface Pricing

Buy from Bus A in ONT, sell to Bus B in PJM

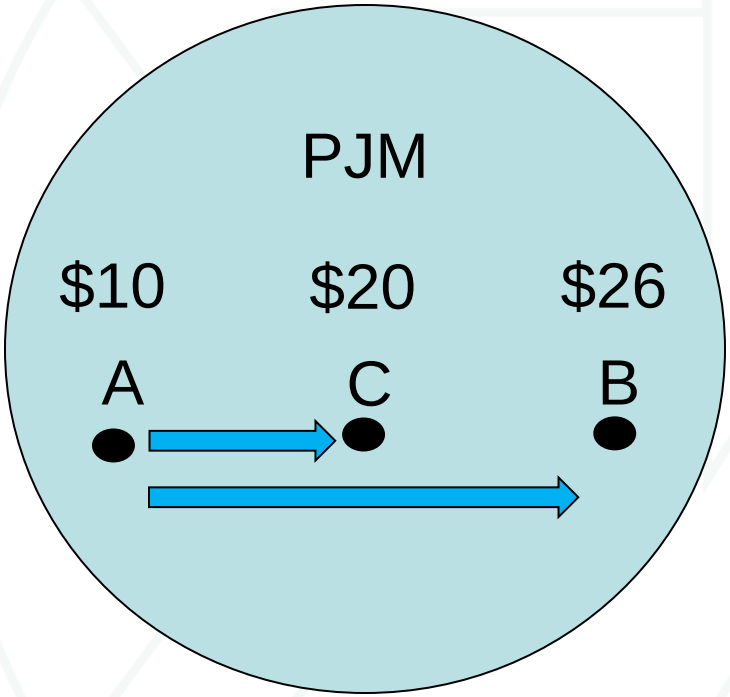


Get paid $26
Buy at $10
Net position at C is zero:
Settlement = $0
Net position at D is zero:
Settlement = $0

Pay PJM congestion between B and C
($26 - $20 = $6)
Pay MISO congestion between C and D
($20 - $11 = $9)
Pay ONT congestion between D and A
($11 - $10 = $1)
Total Congestion between A and B is:
$6 + $9 + $1 = $16
Net settlement is:
$26 - $10 - $16 = $0

Interface Pricing

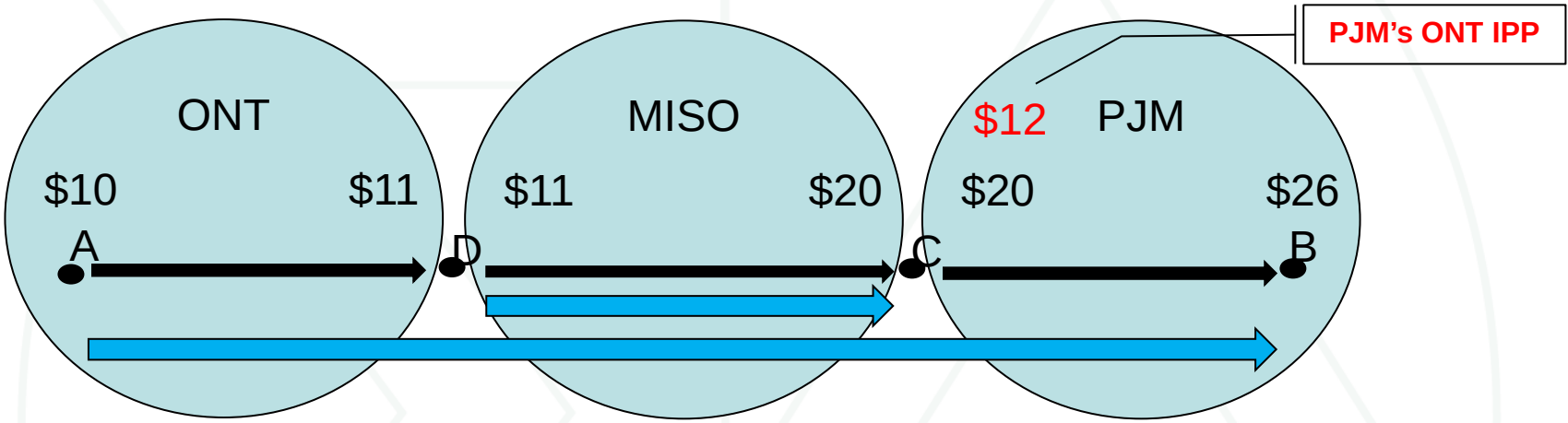
Buy from Bus A, Sell to Bus C then
Buy from Bus C, Sell to Bus B



Get paid $26
Buy at $10
Pay congestion between C and A
($20 - $10= $10)
Pay congestion between B and A
($26 - $10 = $16)
Total Congestion between A and B is:
$10 + $16 = $26
Net settlement is:
$26 - $10 - $26 = -$10

Interface Pricing

Buy from Bus A in ONT, sell to Bus B in PJM



Get paid $26
Buy at $10
Net position at C is zero:
Settlement = $0
Net position at D is zero:
Settlement = $0

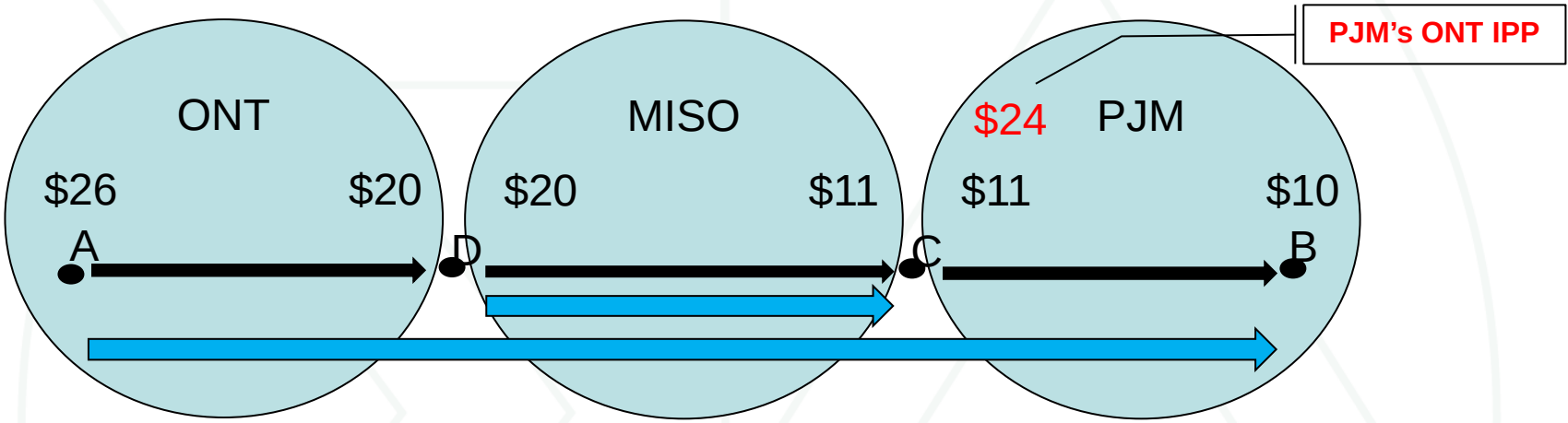
Pay PJM congestion between B and A
($26 - $12 = $14)
Pay MISO congestion between C and D
($20 - $11 = $9)
Pay ONT congestion between D and A
($11 - $10 = $1)
Total Congestion between A and B is:
$14 + $9 + $1 = $24
Net settlement = $26 - $10 - $24 = -$8

Interface Pricing

- **The current Interface Pricing rules do not reflect how an LMP market should operate when a non-contiguous interface is used.**
- **Market participants may double pay for congestion through MISO.**

Interface Pricing

Buy from Bus A in ONT, sell to Bus B in PJM



Get paid $10
Buy at $26
Net position at C is zero:
Settlement = $0
Net position at D is zero:
Settlement = $0

Pay PJM congestion between B and A
($10 - $24 = -$14)
Pay MISO congestion between C and D
($11 - $20 = -$9)
Pay ONT congestion between D and A
($20 - $26 = -$6)
Total Congestion between A and B is:
-$14 + -$9 + -$6 = -$29
Net settlement = $10 - $26 - (-$29) = $13

Interface Pricing

- **If constraint is in the opposite direction, market participants may receive more than the value of congestion through MISO.**
  - **The excess payments come from the congestion bucket of dollars which supports FTR funding.**

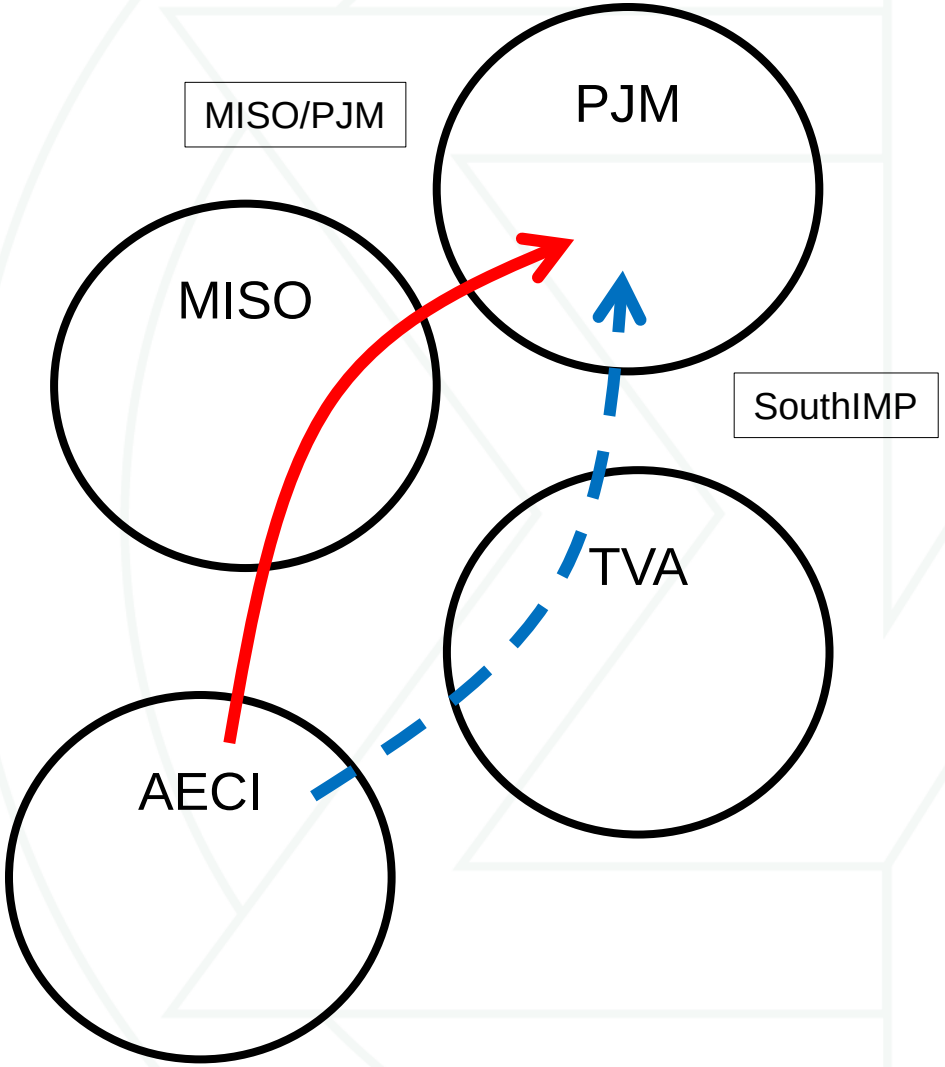
Topics

- **Interface Pricing Issue**
- **Sham Scheduling**
- **Scheduled vs Actual**

Sham Scheduling

- **Transactions can be scheduled to an interface based on a contract transmission path.**
- **Pricing points are developed and applied based on the electrical impact of the external power source on PJM tie lines, regardless of contract transmission path.**
- **PJM establishes prices for transactions with external balancing authorities by assigning interface pricing points to individual balancing authorities based on the Generation Control Area (source) and Load Control Area (sink) as specified on the NERC Tag.**

Sham Scheduling



Least Cost Transmission Path:
AECI-MISO-PJM

Scheduled Flows are at the MISO Interface

Actual Flows are at the SouthIMP Interface

Import pricing point from AECI:SouthIMP

Transaction is paid the SouthIMP LMP

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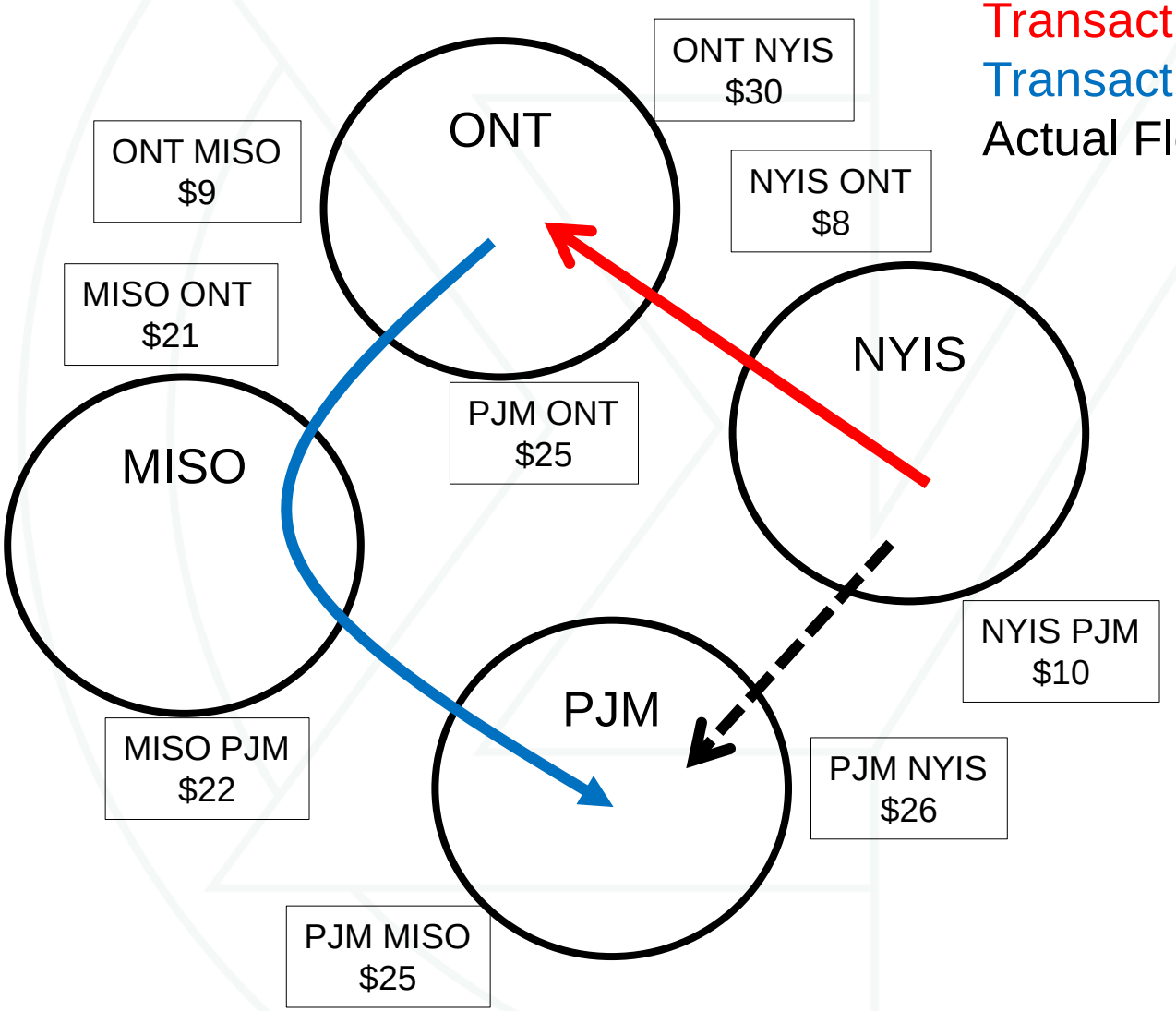
Sham Scheduling

- **The current approach will correctly identify the interface pricing point only if the market participant provides the complete path in the eTag.**
- **This approach will not correctly identify the interface pricing point if the market participant breaks the transaction into portions, each with a separate eTag (Sham Scheduling). The result of such behavior can be incorrect pricing of transactions, pricing of transactions not consistent with the power flow.**

NYIS-ONT with ONT-PJM

Transaction 1: NYIS-ONT
Transaction 2: ONT-MISO-PJM
Actual Flow: NYIS-PJM



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NYIS-ONT with ONT-PJM

Transaction 1:

NYIS: Pay $8 for export to ONT

ONT: Receive $30 for import from NYIS

TOTAL: - $8 + $30 = $22

Transaction 2:

ONT: Pay $9 for export to MISO

MISO: Receive $21 for import from ONT

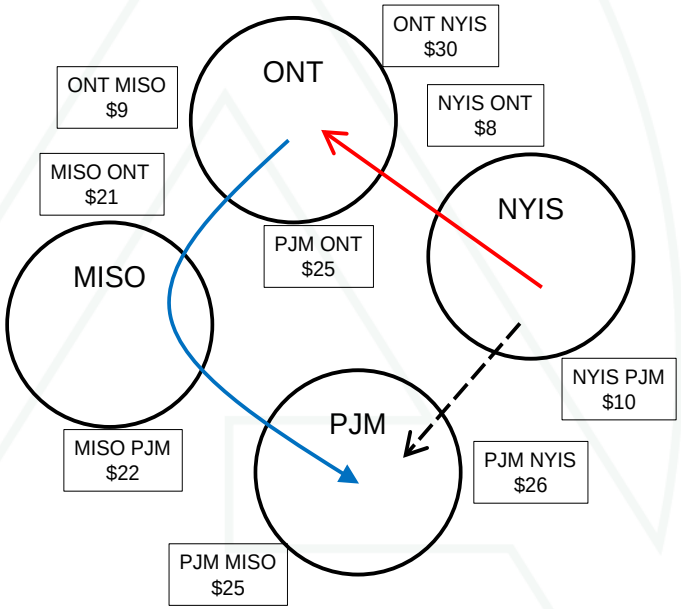
MISO: Pay $22 for export to PJM

PJM: receive $25 for import from ONT

TOTAL: - $9 + $21 - $22 + $25 = $15

TOTAL for Both Transactions:

$22 + $15 = $37



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NYIS-ONT with ONT-PJM

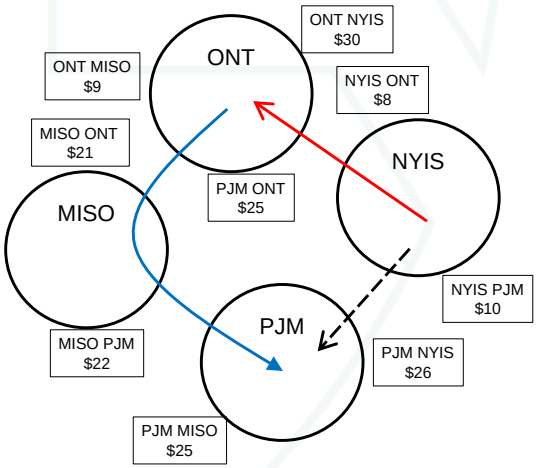
The resulting interchange is an import to PJM from NYIS. Without Sham Scheduling, the settlement would be:

NYIS: Pay $10 for export to PJM

PJM: Receive $26 for import from NYIS

TOTAL: - $10 + $26 = $16

- **Scheduled flows do not match actual flows.**
- **Same effects on loop flows as those paths banned by the NYISO in 2008.**
- **Only additional transmission charges in ONT**
  - **Already pay for the NYIS transmission to ONT**
  - **No MISO charge: RTOR**
  - **No PJM charge: SPOT_IN**



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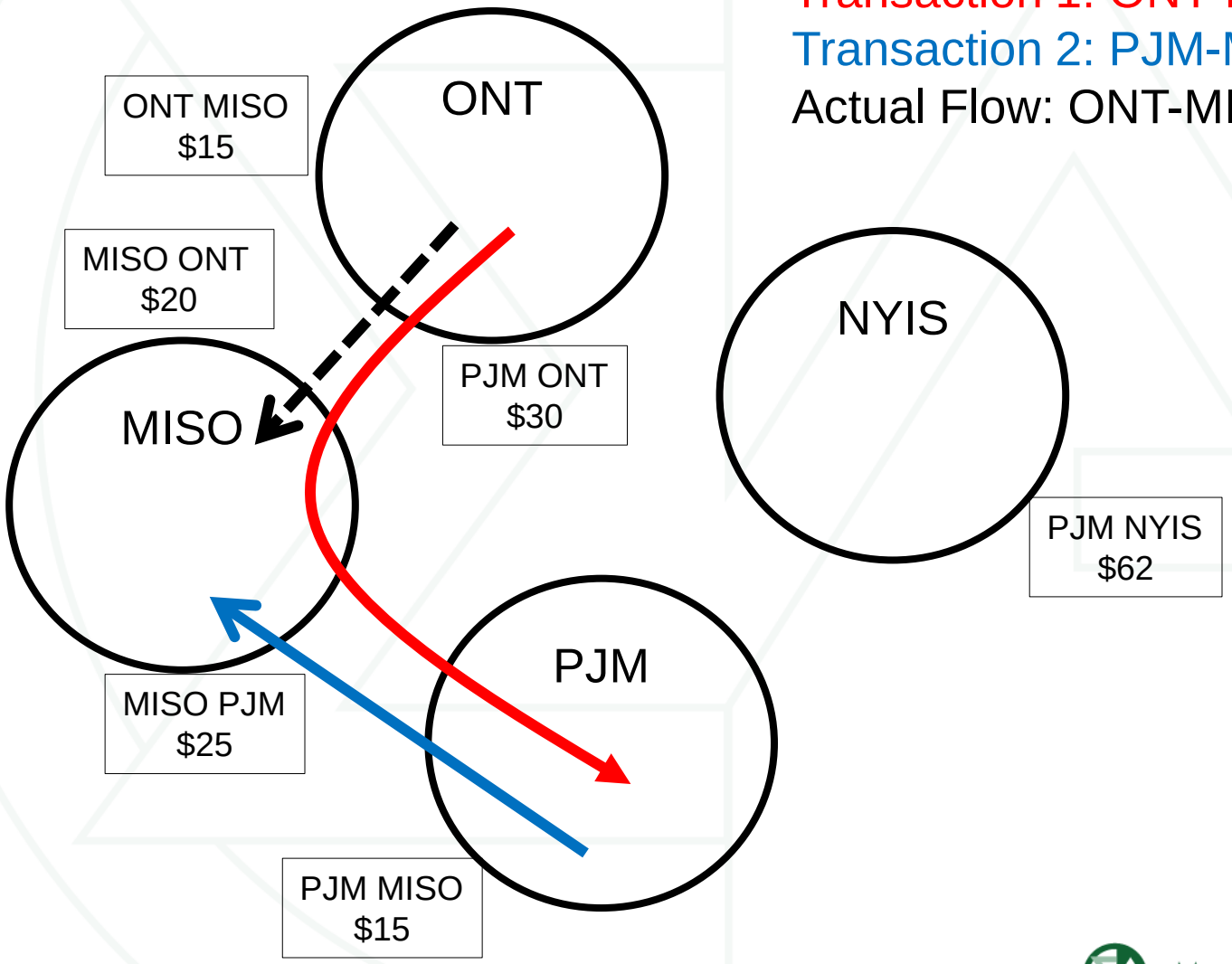
ONT-MISO-PJM with PJM-MISO

Transaction 1: ONT-MISO-PJM
Transaction 2: PJM-MISO
Actual Flow: ONT-MISO



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ONT-MISO-PJM with PJM-MISO

Transaction 1:

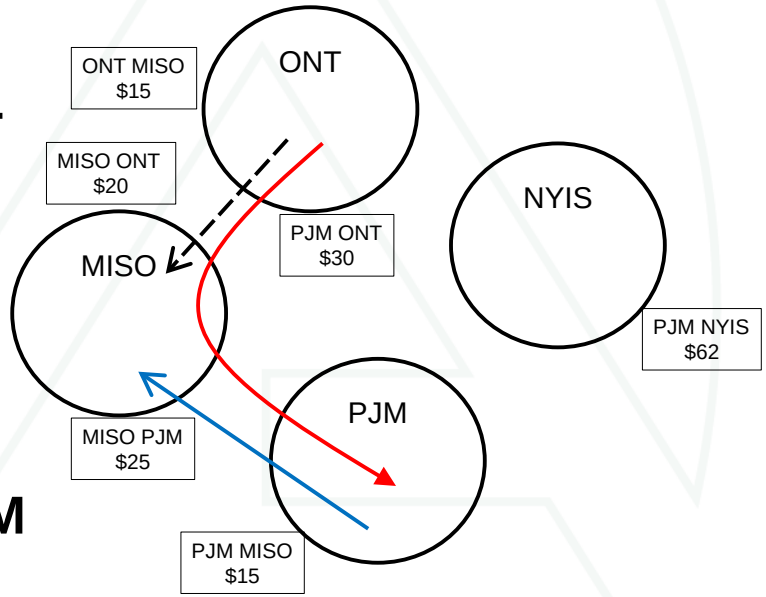
- **ONT: Pay $15 for export to MISO**
- **MISO: Receive $20 for import from ONT**
- **MISO: Pay $25 for export to PJM**
- **PJM: Receive $30 for import from ONT**
- **TOTAL: -$15 + $20 - $25 + $30 = $10**

Transaction 2:

- **PJM: Pay $15 for export to MISO**
- **MISO: Receive $25 for import from PJM**
- **TOTAL: -$15 + $25 = $10**

TOTAL for Both Transactions:

- **$10 + $10 = $20**



Monitoring Analytics

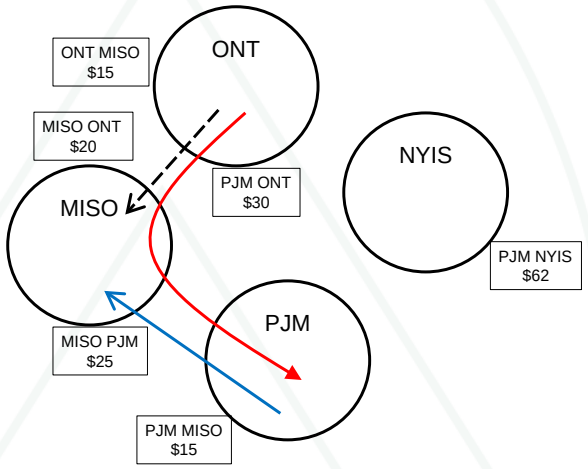
ONT-MISO-PJM with PJM-MISO

The resulting interchange is an import to MISO from ONT. Without Sham Scheduling, the settlement would be:

ONT: Pay $15 for export to MISO

MISO: Receive $20 for import from ONT

TOTAL: -$15 + $20 = $5



- **Scheduled flows do not match actual flows**
- **No change in generation in PJM, yet settlements occur**
  - **Similar to Southeast / Southwest interface issue, where market participants took advantage of price differences at interfaces**
- **No additional transmission charges**
  - **Already pay for the ONT-MISO transmission**
  - **No MISO charge either way: SPOT_IN or RTOR**
  - **No PJM charge: RTOR**

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ONT-MISO-PJM with PJM-MISO

Price Difference Range	Number of Hours ONT > MISO	One Market Participant, 50 MW Transaction in each hour	One Market Participant, 100 MW Transaction in each hour	Five Market Particpants, 50 MW Transaction in each hour
$0 - $10	6,582	$1,202,985.50	$2,405,971.00	$6,014,927.50
$10 - $20	1,062	$736,169.50	$1,472,339.00	$3,680,847.50
$20 - $30	300	$363,306.50	$726,613.00	$1,816,532.50
$30 - $40	96	$165,357.50	$330,715.00	$826,787.50
$40 - $50	45	$100,494.50	$200,989.00	$502,472.50
$50 - $60	27	$73,428.00	$146,856.00	$367,140.00
$60 - $70	6	$18,914.00	$37,828.00	$94,570.00
$70 - $80	8	$29,833.00	$59,666.00	$149,165.00
$80 - $90	2	$8,420.50	$16,841.00	$42,102.50
$90 - $100	1	$4,625.00	$9,250.00	$23,125.00
$100 - $150	4	$24,114.50	$48,229.00	$120,572.50
$150 - $200	1	$7,624.50	$15,249.00	$38,122.50
$200 - $250	3	$31,922.00	$63,844.00	$159,610.00
> $250	0	$0.00	$0.00	$0.00
Total	8,137	$2,767,195.00	$5,534,390.00	$13,835,975.00

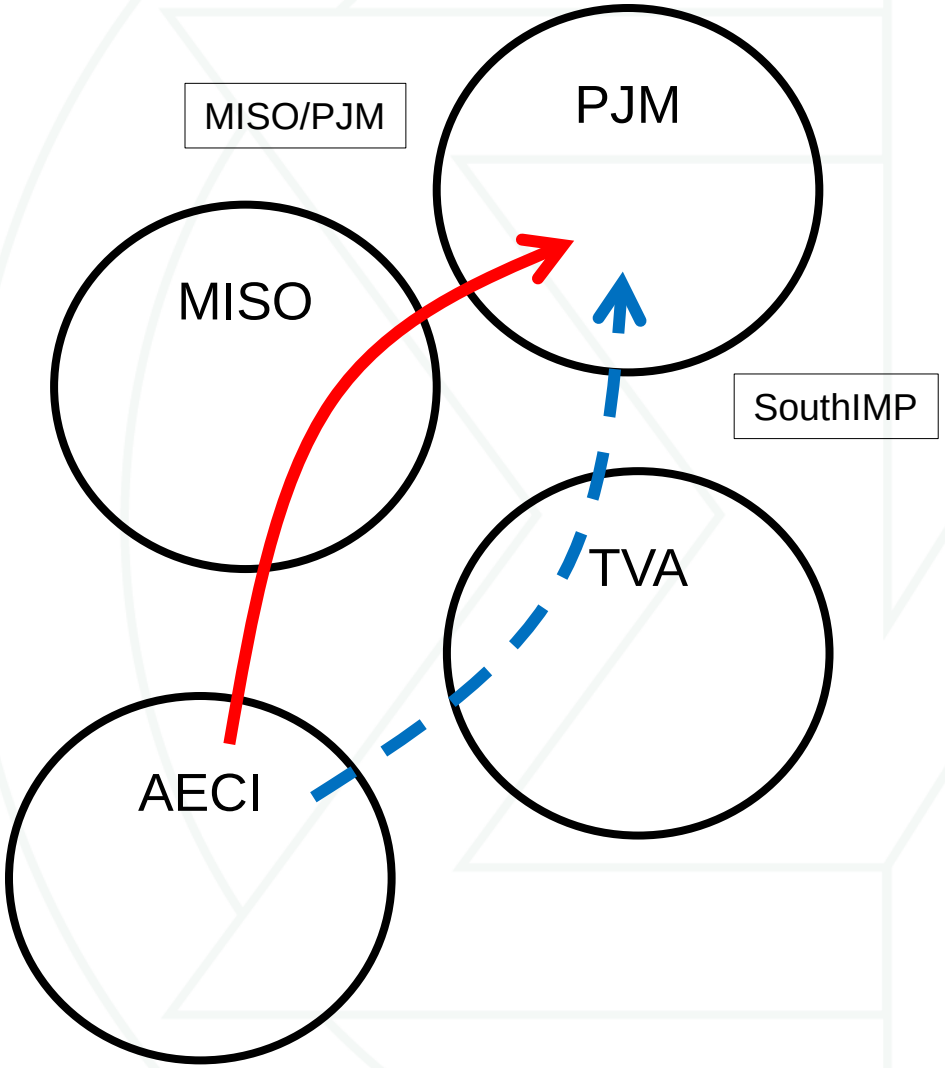
Topics

- **Interface Pricing Issue**
- **Sham Scheduling**
- **Scheduled vs Actual**

Schedule vs. Actual

- **The current interface pricing methodology does not provide PJM's Real-Time Market software applications an accurate forecast of the expected actual flows at its interfaces.**
- **Not having an accurate forecast may result in a less than optimal economic dispatch solution.**

Schedule vs. Actual



Least Cost Transmission Path:
AECI-MISO-PJM

Scheduled Flows are at the MISO Interface

Import pricing point from AECI:
SouthIMP

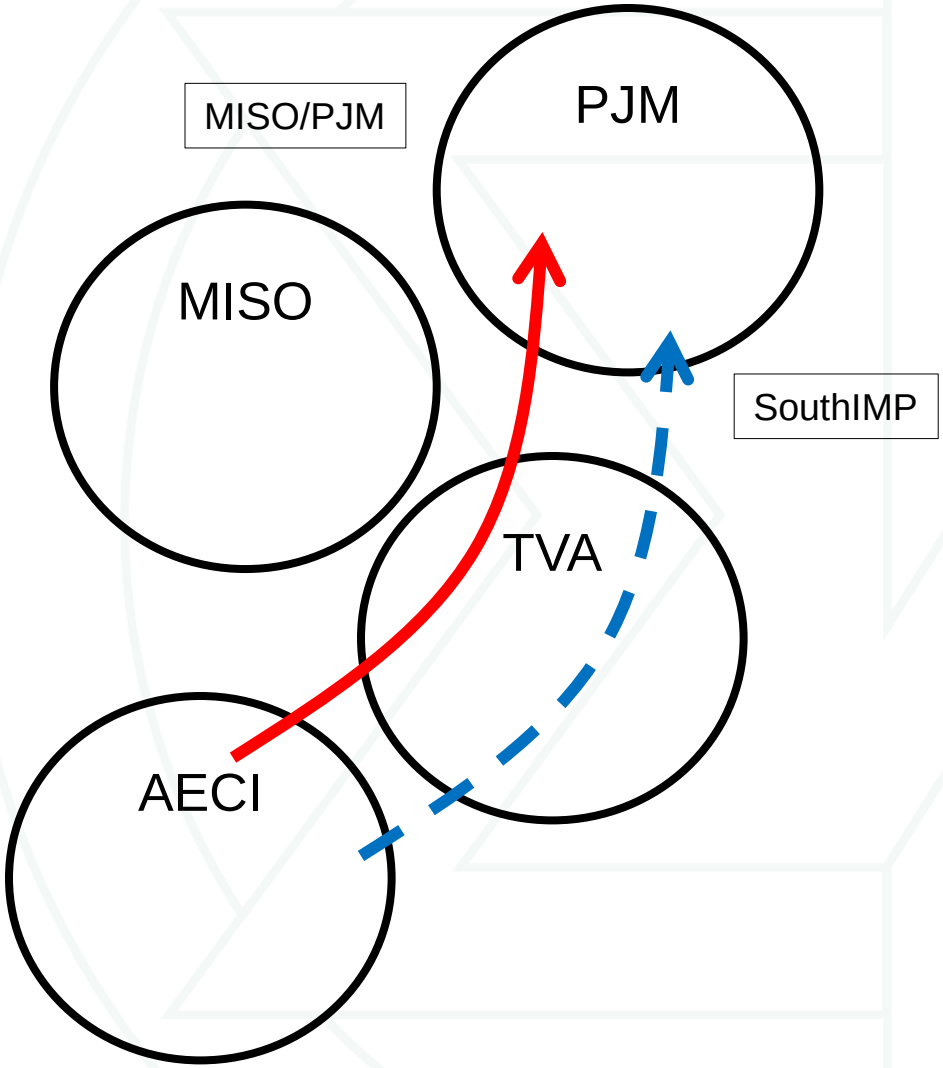
Actual Flows are at the SouthIMP Interface

Transaction is paid the SouthIMP LMP

Schedule vs. Actual

- **The transaction is priced appropriately at the SouthIMP Interface Price.**
- **The issue is the effects of mismatches between scheduled and actual flows.**
  - **PJM expects an import at the MISO Interface based on the scheduled path.**
  - **PJM sees an import at the SouthIMP Interface based on actual flows.**
  - **PJM dispatch solution may change commitment of units closer to the MISO Interface with the expectation of flows at the MISO Interface.**

Schedule vs. Actual



Required Transmission Path:

AECI-TVA-PJM

(or through any BA that is mapped to the SouthIMP interface)

Scheduled Flows are at the SouthIMP Interface

Actual Flows are at the SouthIMP Interface

Transaction is paid the SouthIMP LMP

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Schedule vs. Actual

- **The transaction is priced appropriately at the SouthIMP Interface Price.**
- **Scheduled flows match Actual Flows**
  - **PJM expects an import at the SouthIMP Interface based on the scheduled path.**
  - **PJM sees an import at the SouthIMP Interface based on actual flows.**
  - **PJM dispatch solution can change commitment for units closer to the SouthIMP Interface with the expectation of flows at the SouthIMP Interface.**
  - **Neighboring Balancing Authorities/Transmission Providers are paid for the usage of their system.**

Schedule vs. Actual

- **Impacts**
  - **PJM would have a more accurate forecast of scheduled and actual flows.**
  - **ATC would reflect actual usage of transmission system.**
  - **Balancing Authorities would have less unscheduled power flows.**
  - **Transmission providers would be paid for usage of their system.**
  - **Potential for higher transmission costs, reflective of actual flows rather than contract path flows.**

Summary

- **Non-contiguous interface pricing points can create double charges (payments) of congestion and do not reflect a well functioning market.**
- **Breaking of transactions into multiple segments can result in incorrect pricing of transactions.**
- **Allowing for contract path scheduling that is inconsistent with actual flows creates inefficiencies in unscheduled loop flows and dispatch solutions.**
- **The three issues are related, as the apparent actual schedule can be affected by breaking transactions into multiple segments.**

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