

Market-to-Market Coordination with PJM *Examples*

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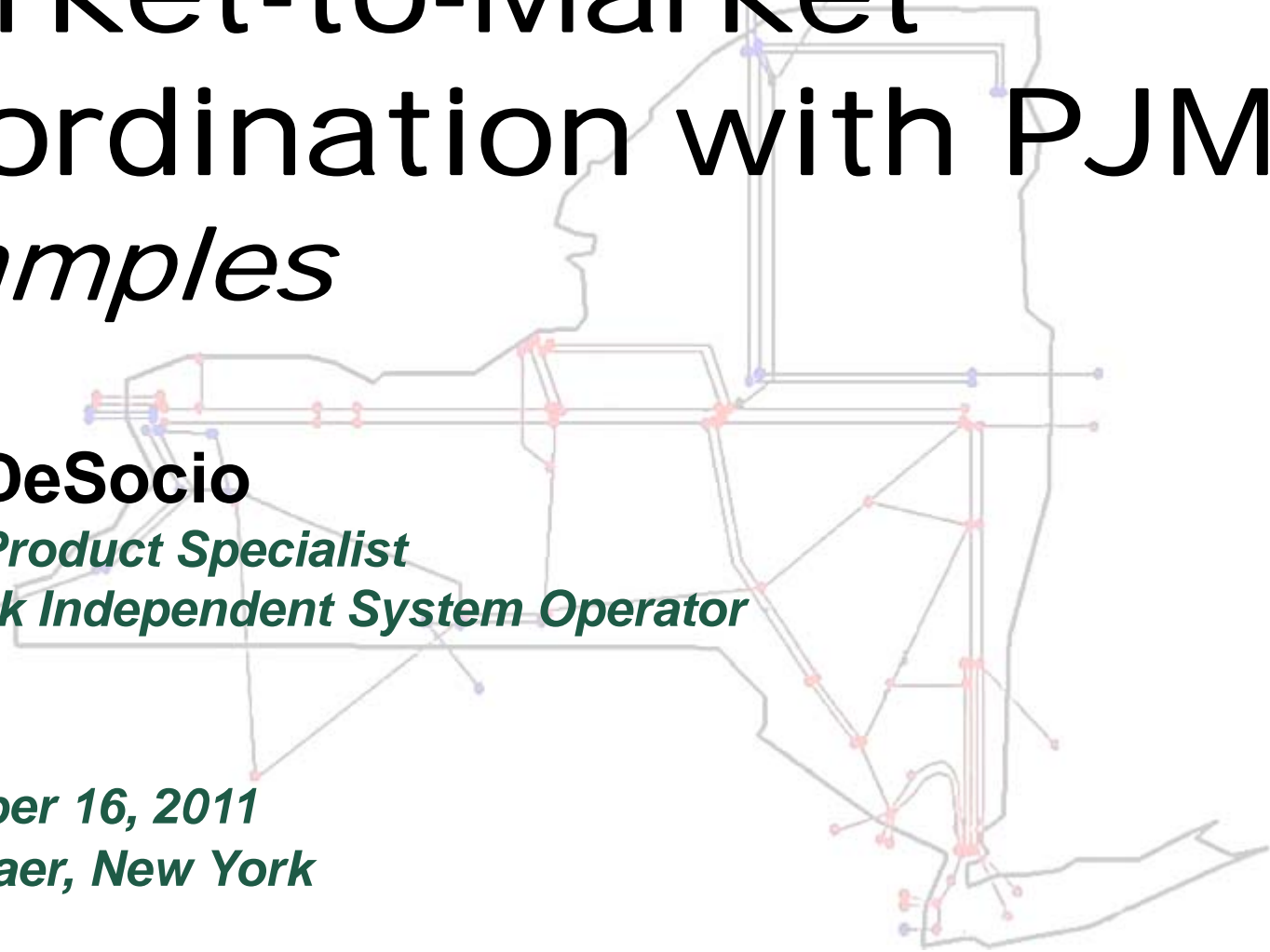
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New York Independent System Operator

MIWG

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Rensselaer, New York



Agenda

- ◆ Refresher – Key Concepts
- ◆ M2M Coordination Example
- ◆ M2M Settlement Example 1 – PJM over its entitlement
- ◆ M2M Settlement Example 3 – PJM under its entitlement

Key Concepts

Real Time / Market-to-Market Coordination

- A mechanism for NYISO and PJM to provide more cost effective management of constraints from a larger pool of resources

Monitoring RTO (MRTO)

- The RTO that has the primary responsibility for monitoring and control of a coordinated Flowgate

Non-Monitoring RTO (NMRTO)

- The RTO that does not have the primary responsibility for monitoring and control of a Flowgate, but does have resources that impact the Flowgate

Key Concepts

Market Flow

- The flow in MW on a Flowgate that is caused by all real-time control actions to serve load in the RTO footprint

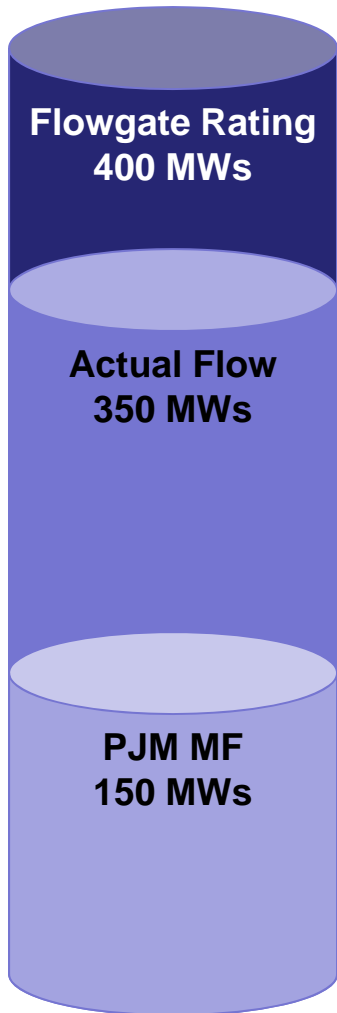
M2M Flowgate

- A Flowgate that may be significantly impacted by the dispatch of generation serving load in an adjacent market

Entitlements

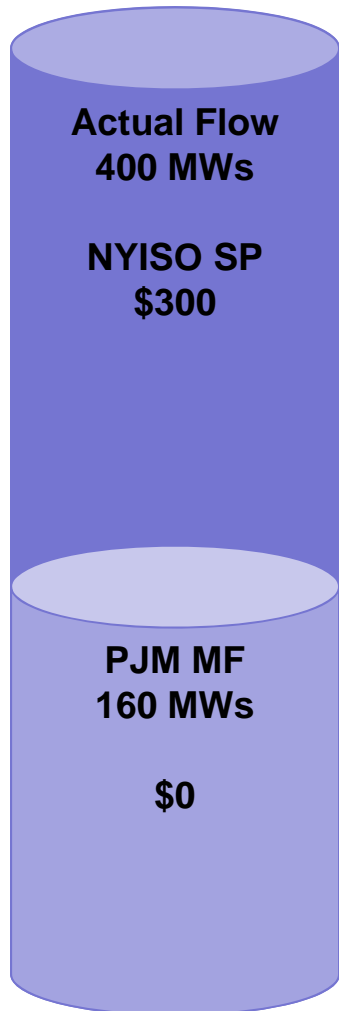
- Predetermined MW amount that a market entity is entitled to per Flowgate based on its historical impacts to that Flowgate. In the M2M process, real time usage is compared to entitlement to determine settlement

M2M Coordination Example



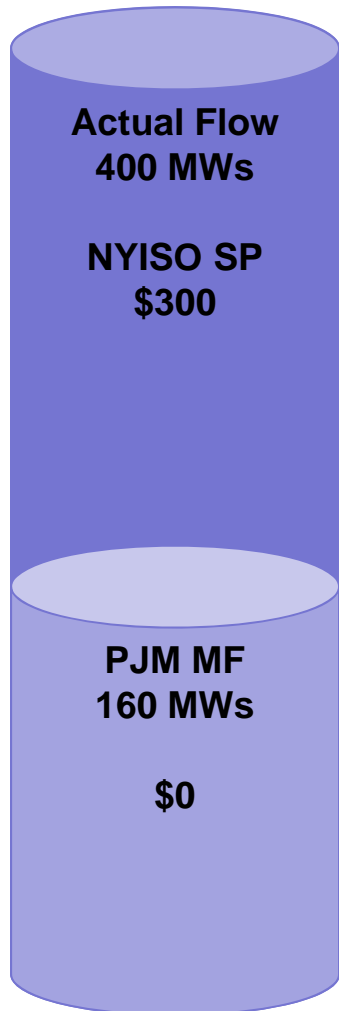
- ◆ **Initial Conditions**
- ◆ **A NYISO M2M Flowgate is being monitored in real-time**
 - **NYISO is the MRTO**
 - **PJM is the NMRTO**
 - **M2M Flowgate Rating = 400 MWs**
 - **Actual Flow = 350 MWs**
 - **PJM Market Flow = 150 MWs**
 - **M2M Flowgate is not constrained**

M2M Coordination Example



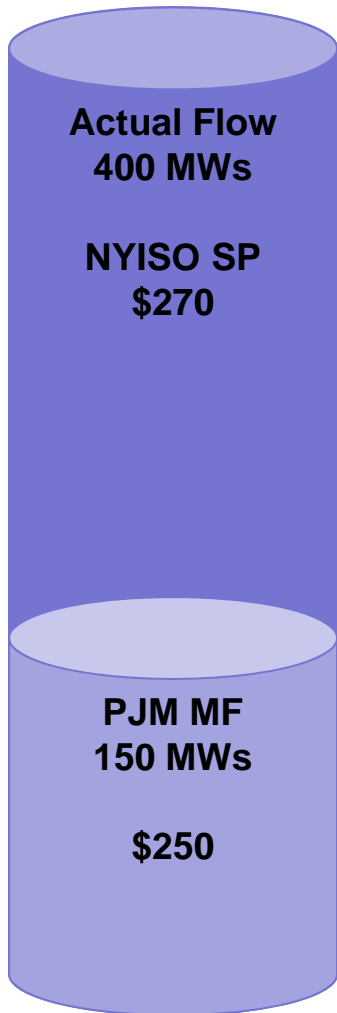
- ◆ **Step 1**
- ◆ **NYISO M2M Flowgate becomes constrained**
 - M2M Flowgate Rating = 400 MWs
 - Actual Flow = 400 MWs
 - PJM Market Flow = 160 MWs
- ◆ **NYISO calculates a shadow price of \$300 based on its redispatch for the M2M Flowgate**

M2M Coordination Example



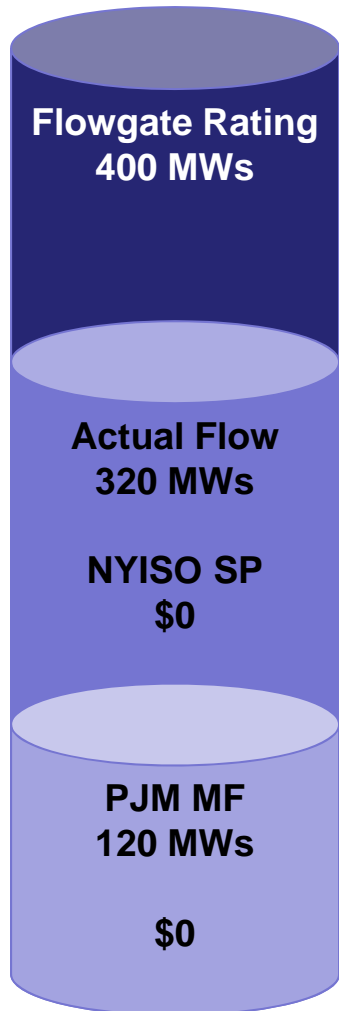
- ◆ **Step 2**
- ◆ **NYISO M2M Flowgate is constrained**
 - Actual Flow = 400 MWs
 - PJM Market Flow = 160 MWs
 - NYISO shadow price = \$300
- ◆ **NYISO requests PJM to redispatch for the M2M Flowgate**
 - NYISO electronically sends the \$300 shadow cost
 - NYISO verbally confirms that PJM is able to enter into M2M with NYISO for this M2M Flowgate
- ◆ **PJM begins redispatching for this M2M Flowgate**
- ◆ **M2M Settlements Begin**

M2M Coordination Example



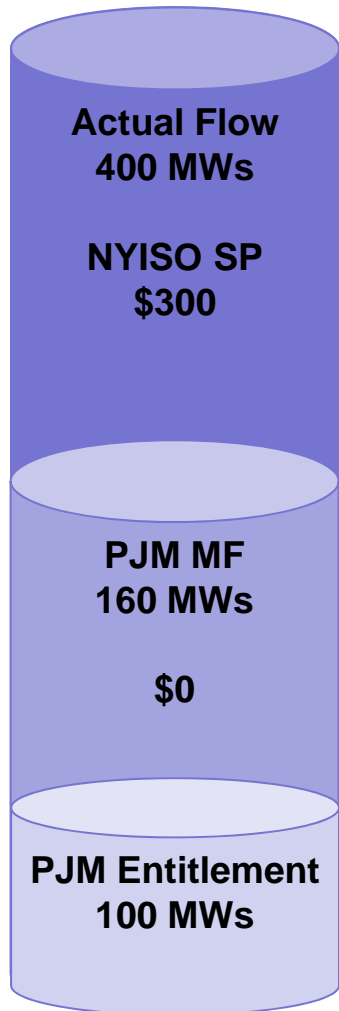
- ◆ **Step 3 – this step iterates until M2M ends**
- ◆ **PJM redispatches for this M2M Flowgate**
 - PJM shadow price = \$250
 - PJM Market Flow = 150 MWs
- ◆ **NYISO M2M Flowgate is still constrained**
 - NYISO continues to redispatch
 - Actual Flow = 400 MWs
 - NYISO shadow price = \$270
- ◆ **Automatically, the M2M software continues to update PJM with the latest M2M Flowgate data**
 - NYISO electronically sends the \$270 shadow cost

M2M Coordination Example



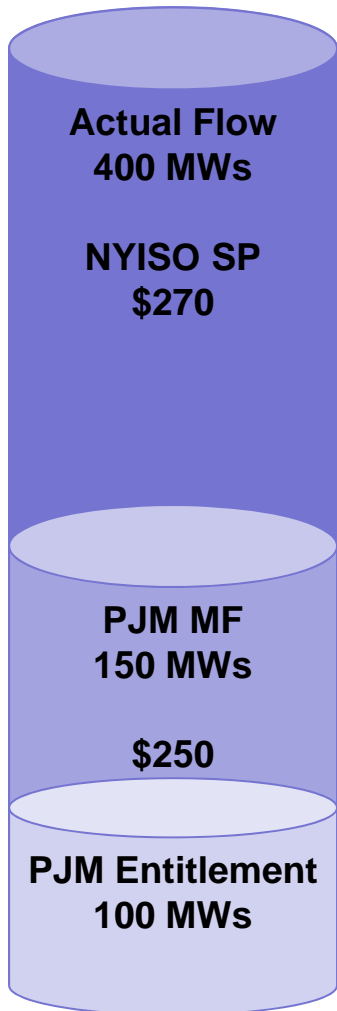
- ◆ **M2M Coordination Process continues until the M2M Flowgate is no longer constrained**
- ◆ **M2M Settlements End**

M2M Settlement Example 1



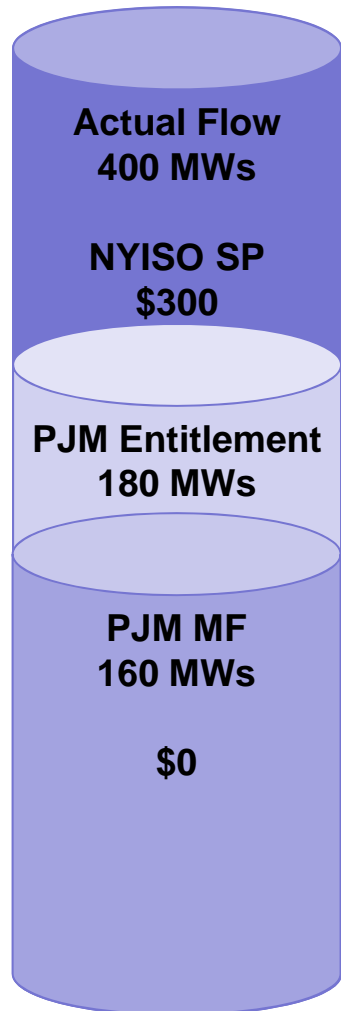
- ◆ **NYISO M2M Flowgate is constrained**
 - Actual Flow = 400 MWs
 - PJM Market Flow = 160 MWs
 - NYISO shadow price = \$300
- ◆ **PJM begins redispatching for this M2M Flowgate**
- ◆ **M2M Settlements Begin**
 - PJM Entitlement = 100 MWs
 - PJM is over its entitlement
 - PJM pays $(160 \text{ MWs} - 100 \text{ MWs}) \times \300 or \$18,000.00

M2M Settlement Example 1



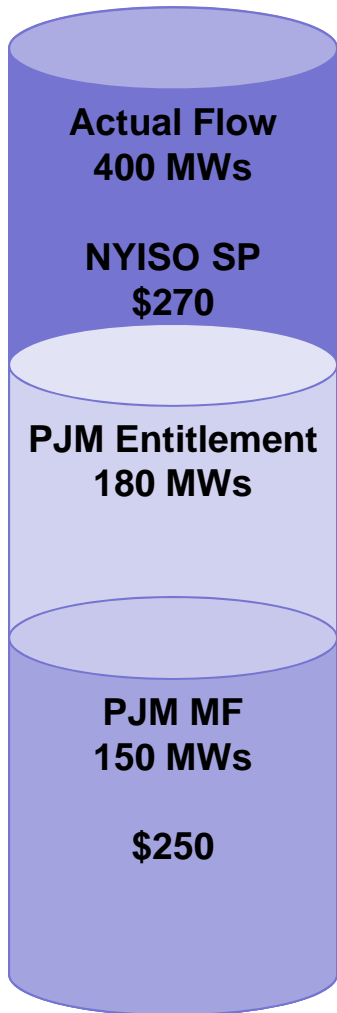
- ◆ **PJM redispatches for this M2M Flowgate**
 - PJM shadow price = \$250
 - PJM Market Flow = 150 MWs
- ◆ **NYISO M2M Flowgate is still constrained**
 - NYISO continues to redispatch
 - Actual Flow = 400 MWs
 - NYISO shadow price = \$270
- ◆ **M2M Settlement**
 - PJM Entitlement = 100 MWs
 - PJM is over its entitlement
 - PJM pays $(150 \text{ MWs} - 100 \text{ MWs}) * \270 or \$13,500.00

M2M Settlement Example 2



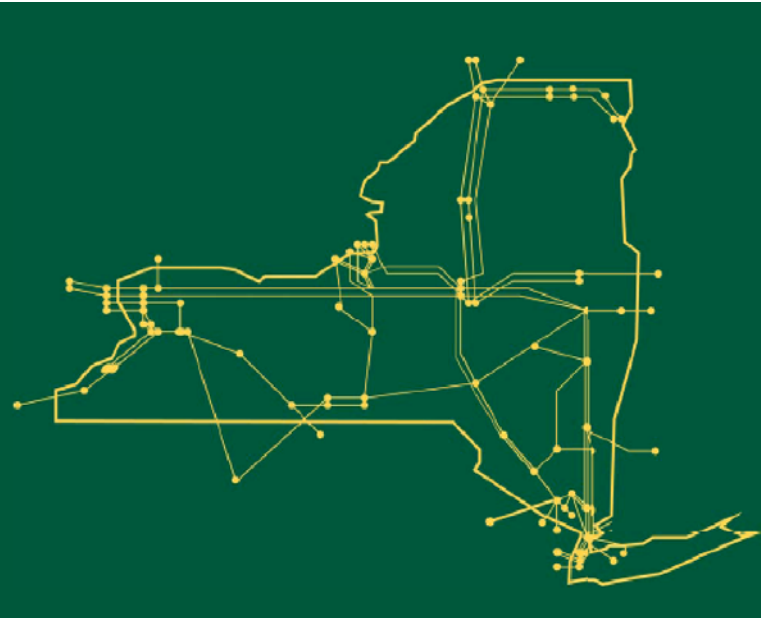
- ◆ **NYISO M2M Flowgate is constrained**
 - Actual Flow = 400 MWs
 - PJM Market Flow = 160 MWs
 - NYISO shadow price = \$300
- ◆ **PJM begins redispatching for this M2M Flowgate**
- ◆ **M2M Settlements Begin**
 - PJM Entitlement = 180 MWs
 - PJM is under its entitlement
 - NY pays $(180 \text{ MWs} - 160 \text{ MWs}) * \0 or \$0.00

M2M Settlement Example 2



- ◆ **PJM redispatches for this M2M Flowgate**
 - PJM shadow price = \$250
 - PJM Market Flow = 150 MWs
- ◆ **NYISO M2M Flowgate is still constrained**
 - NYISO continues to redispatch
 - Actual Flow = 400 MWs
 - NYISO shadow price = \$270
- ◆ **M2M Settlement**
 - PJM Entitlement = 180 MWs
 - PJM is under its entitlement
 - NY pays $(180 \text{ MWs} - 150 \text{ MWs}) * \250 or \$7,500.00

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