Coordinated Transaction Scheduling (CTS) between NYISO & PJM
Second Joint Meeting

Joint NYISO-PJM Meeting

February 20, 2013

Hosted by PJM

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CTS Background

- **The objective of CTS is to improve interchange scheduling efficiency.**
- **This presentation provides more information about the market design for CTS between the PJM and NYISO market.**
- **The proposal is to add options for transactions: Market Participants would have the option to use either the existing economic evaluation process (LBMP Bid/Offer) or CTS (CTS Interface Bid/Offers). Both scheduling mechanisms (LBMP Bid/Offers and CTS Interface Bids) would coexist.**
- **All intra-hour scheduling of external transactions will be accelerated by 15-minutes**
- **The plan is to implement in 2014.**

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Proposed Stakeholder Meetings and Agendas

- **Today**
  - ***Review proposed concept***
  - ***Numerical Examples***
  - ***Expanded data analysis***
  - ***Description of PJM and NYISO stakeholder timelines/processes***
- **April 2 at NYISO's Krey Corporate Center in Rensselaer**
  - ***More details on the design***
  - ***Transmission reservations and ATC in PJM***
  - ***Fees and charges and Balancing Operating Reserve (BOR) impact***
  - ***Price formation***
  - ***Settlements***
- **June 25th at PJM's CTC in Valley Forge**
  - ***Final proposal and additional details as required***
  - ***Data transparency***
  - ***List of Expected Tariff Revisions – PJM & NYISO***
  - ***Q&A on proposal***

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DRAFT – FOR DISCUSSION PURPOSES ONLY

PROPOSAL

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Proposal Summary

- **Bidding: Multiple bidding/scheduling options:**
  - ***Hourly evaluations of traditional wheel-through transactions (existing)***
  - ***Intra-hour evaluations of traditional LBMP Bid/Offers (existing)***
  - ***Intra-hour evaluations of CTS Interface Bid/Offers (new).***
- **Bidding: Intra-hour LBMP Bids and Intra-hour CTS Interface Bids may have up to four distinct bid $/MW pairs, one for each 15-minute scheduling interval of the hour.**
- **Scheduling: Intra-hour schedules established 15-minutes sooner than current intra-hour scheduling process.**
- **Scheduling: CTS Interface bids will be scheduled based on the projected price difference between PJM and NYISO at the interface.**

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Incorporate PJM's Supply Curve

- **In Real Time, NYISO will use the PJM's proxy bus process and resulting real-time and look-ahead prices to determine which CTS Interface bids should be scheduled.**
  - ***The NYISO economic evaluation would schedule CTS Interface bids/offers that would be in the money given the projected prices at the interface.***
  - ***In practice, that means that each CTS Interface bidder identifies the price difference between PJM and NYISO's projected prices above which the transaction is willing to flow.***
  - ***To accomplish this evaluation, the CTS Interface bid/offer will be converted into a traditional LBMP bid (by adding/subtracting the CTS Interface bid/offer to PJM's projected proxy bus price) for consideration in NYISO's current economic scheduling software along with other, non-CTS Interface bids***

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Bidding

- **Market Participants provide one of three types of bids at the common NYISO/PJM interfaces:**
  - ***Hourly evaluations of traditional wheel-through transactions (existing)***
  - ***Intra-hour evaluations of traditional LBMP Bid/Offers (existing)***
  - ***Intra-hour evaluations of CTS Interface Bid/Offers (new).***
- **CTS interface bids/offers allow schedules to depend the price differences projected by PJM and NYISO instead of relying on the marketer's assumptions about market conditions in the neighboring control area to provide an LBMP bid/offer.**
- **Interface bids will be evaluated every 15 minutes.**

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Bidding (cont)

- **Proposed design:**
  - ***All Bids/offers will continue to be provided no later than 75 minutes before the market hour.***
  - ***Intra-hour LBMP Bids and Intra-hour CTS Interface Bids may have up to four distinct bid $/MW pairs, one for each 15-minute scheduling interval of the market hour.***
    - **Participants who do not want to be price sensitive can use their bids/offers to make their transactions appear more like price takers.**

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Maintaining the Existing Bid Window

- **The existence of uncertainty about market conditions in both control areas has led to concerns that the 75 minute ahead bid window is too far in advance of the economic evaluation.**
- **Interface bids allow schedules to depend on price differentials instead of relying on the Marketer's assumptions about market conditions in the neighboring control area to inform an LBMP bid/offer.**
- **Interface bids will be evaluated15 minutes in advance of the scheduling period.**
- **Participants may provide a distinct bid $/MW pair for each 15-minute scheduling interval.**
- **We believe this scheduling flexibility substantially addresses the impact of uncertainty and that there is little, to be gained by a shorter bid window.**
  - ***We want to get Participant input on what determines the price differential they are willing to accept.***
- **The 75 min bid window allows for the consolidated input of <u>all</u> relevant bid/offer information for the forward looking energy and ancillary service co-optimization. This provides least-bid cost as well as consistent schedules and prices, and minimizes uplift and needed market power & manipulation protections.**

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Maintaining the Existing Bid Window (cont)

- **The NYISO has considered a rolling 75 minute close prior to each 15 minute scheduling period**
  - ***Unable to accommodate a rolling 75 minute close because it would need to apply to all types of customers (to efficiently schedule the "look ahead" there needs to be a variety of resources available and their near-term offers need to be locked)***
    - **There are also concerns of significant software performance degradation because it would be a four-fold increase in the number of bids/offers that need to be handled on a daily basis**
  - ***It is not apparent that there are meaningful incremental benefits to market efficiency with a rolling 75 minute close.***
  - ***Would also conflict with the NERC tagging requirement during Transmission Loading Relief (TLR) events when all next-hour information must be available by forty-minutes prior to the operating hour.***
- **Therefore, this proposal allows a distinct bid $/MW pair for each 15-minute scheduling interval but they will still be subject to the existing 75 minute ahead bidding window.**

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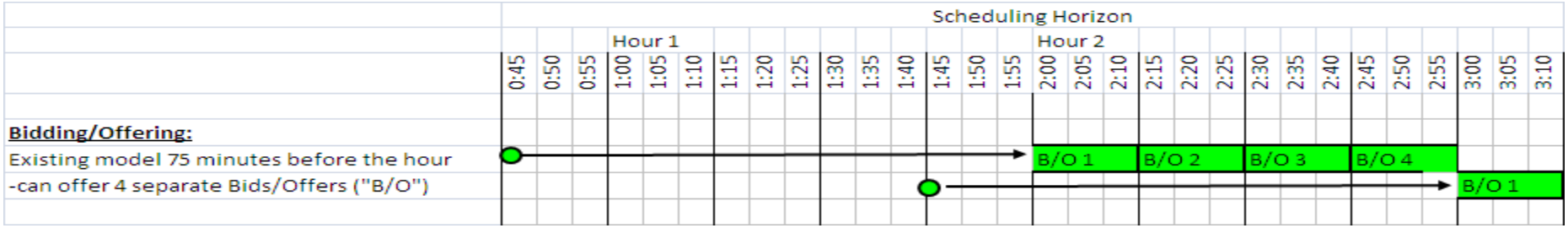
Bidding Time Line



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PJM Transmission and Ramp Reservations

- **Current PJM Timing Requirements (Transmission Service):**
  - ***Hourly Transmission Service***
    - **Earliest Request 08:00 day-ahead (09:00 Spot-In)**
    - **Latest Request 0 minutes ahead**
    - **Provider Response within 15 minutes (automated – done in seconds)**
    - **Customer Confirmation within 15 minutes**
    - **Automated "Release" or "Annulment" of Spot-In service (30 minutes after 'queued' if no valid Tag)**
      - Assumes same day request. Day ahead requests annulled within 2 hours of queue
  - ***Aligns with NAESB Wholesale Electric Quadrant (WEQ) 001-4.13***

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PJM Transmission and Ramp Reservations (cont)

- **Current PJM Timing Requirements (Ramp Reservations and Energy Scheduling):**
  - ***Ramp Reservations and Expirations***
    - **Latest request 30 minutes ahead**
    - **Pending status maintained**
      - 10 minutes if queued within 1 hour of start-time
      - 15 minutes if 1 hour < queued < 4 hours
  - ***Hourly Energy Scheduling***
    - **No earliest submittal requirement**
    - **Latest Schedule 20 minutes ahead**
  - ***Aligns with NAESB WEQ 004-D and NERC INT-006-3***

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Scheduling

- **Real Time scheduling determination.**
  - ***Looking to maintain NYISO's economic schedule market design & potentially leverage existing NYISO software capabilities and look ahead features.***
  - ***Looking to maintain PJM's market evaluation, leverage PJM's existing software and minimize any build out the software.***
- **No changes expected to Day Ahead Scheduling**
  - ***As the Real Time market outcomes change we expect existing/proposed arbitrage mechanisms to be effective in arbitraging the Day Ahead and Real Time markets.***

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Scheduling Process

- **Proposing to set schedules every 15 minutes for the period of time 30 to 45 minutes out from when the system information is gathered by the dispatch software ("initialization").**
  - ***This is referred to as "First Time Step"***
  - ***The current intra-hour scheduling of LBMP bids/offers with PJM sets schedules 45 to 60 minutes from initialization ("Second Time Step").***
- **Implications**
  - ***Wheel-though transactions will continue to only be scheduled hourly (They will be the only transactions with hourly scheduling at the NYISO/PJM interfaces)***

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Scheduling Process (cont)

- **The scheduling process will leverage PJM's existing Intermediate Term Security Constrained Economic Dispatch (IT SCED) that has a 2 hour look-ahead period.**
- **The most recently available information on prices from IT SCED will be used by the Real Time Commitment (RTC) in the "first time step" as well as in the advisory schedules.**
- **Each RTC will also provide information on expected schedules to PJM and that information will be used in subsequent IT SCED runs.**

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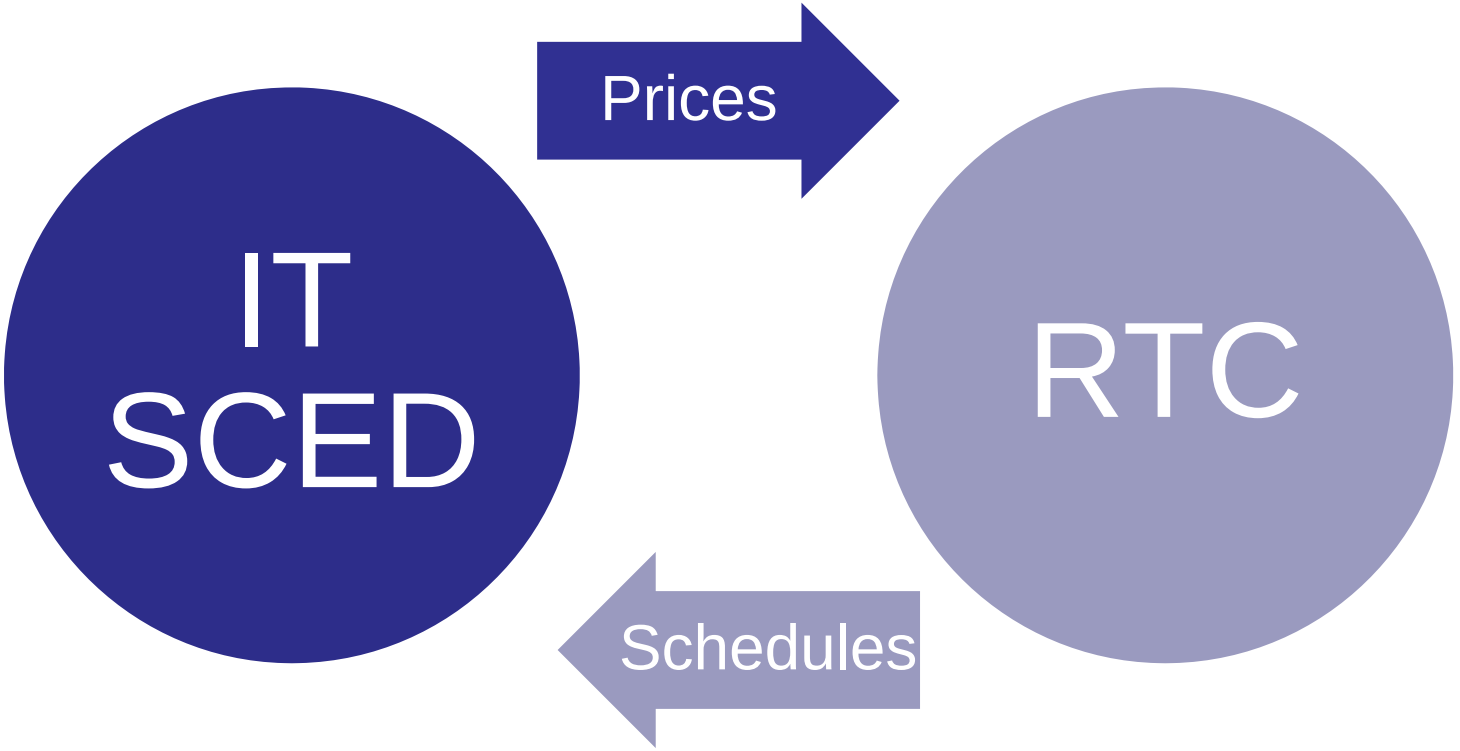
How it will work



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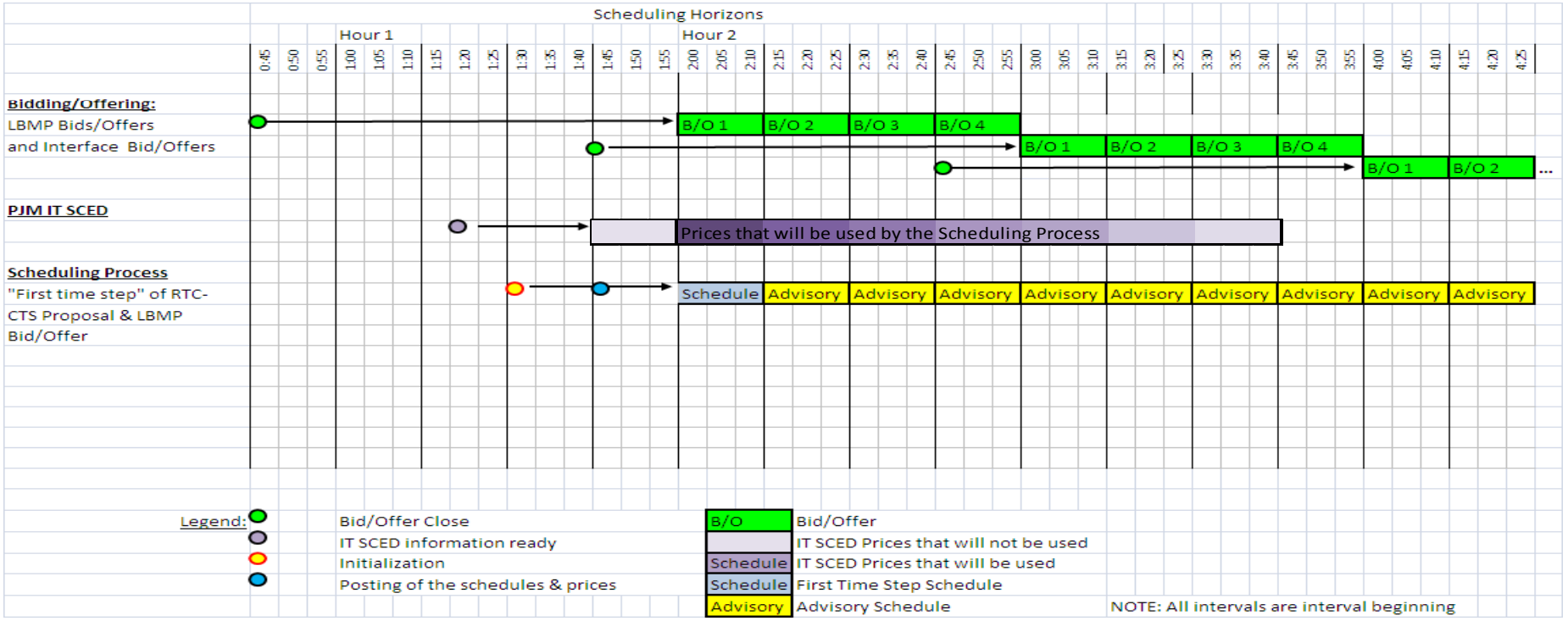
More details on how it will work:



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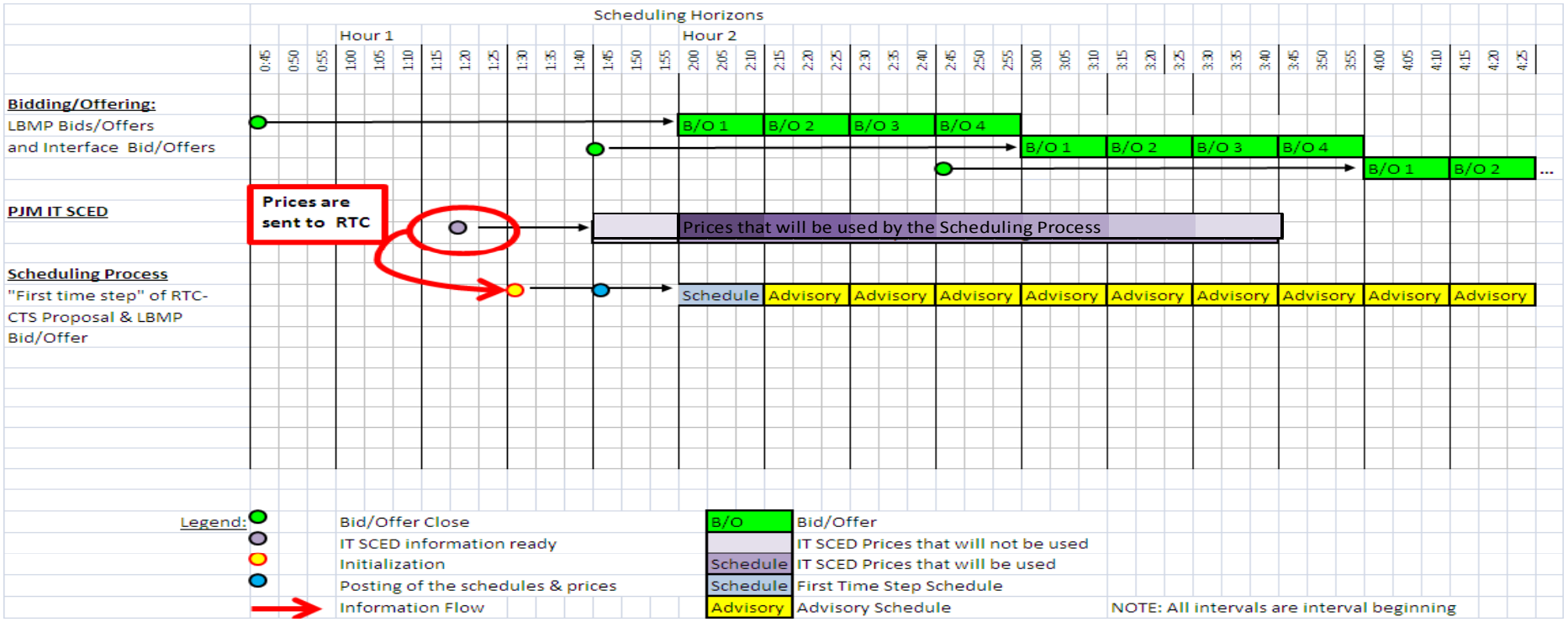
More details on how it will work(cont):



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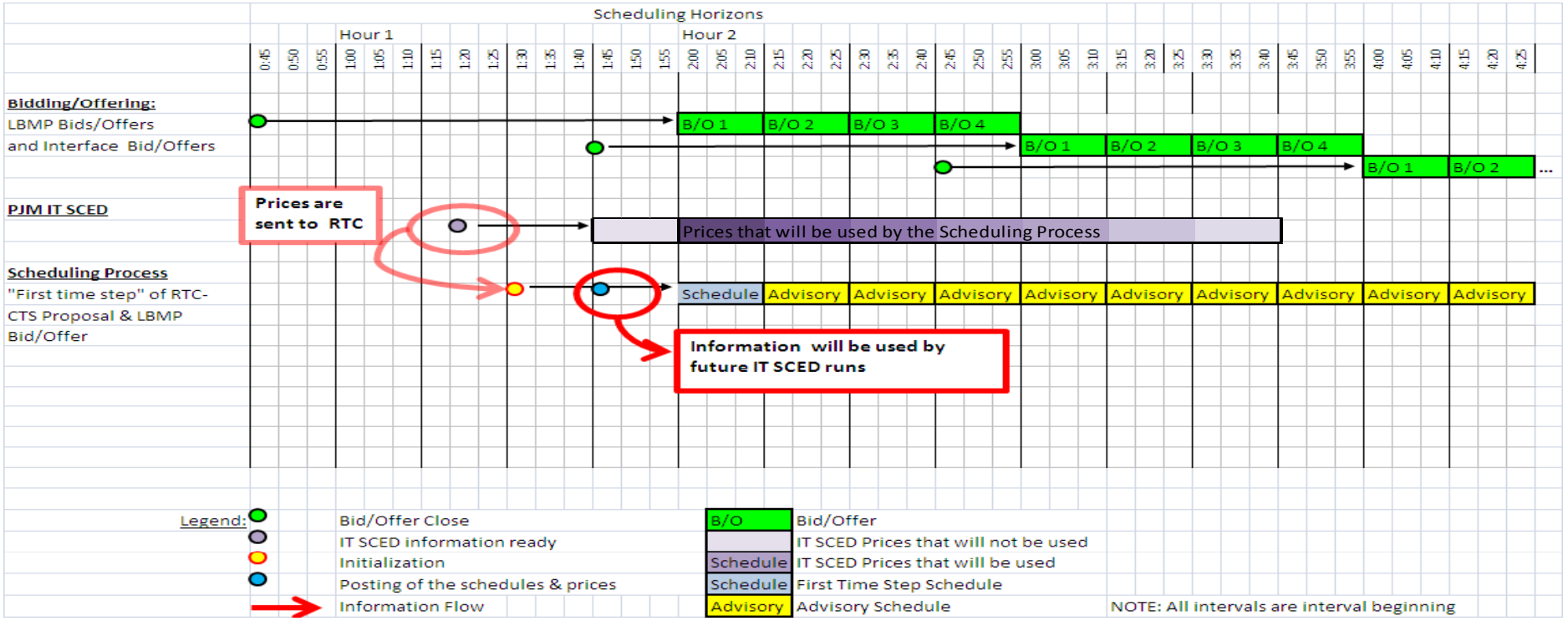
More details on how it will work(cont):



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EXAMPLES

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Examples

- **The three examples build on the same base scenario and show what happens with different prices in PJM and NY**
- **These simplifying assumptions apply to all three examples:**
  - ***There are no other costs or processes associated with scheduling transactions between PJM and NY other than those listed in the example.***
    - **Additional costs would reduce the arbitrage opportunities.**
  - ***The marketer is assumed to be purchasing in PJM at the PJM price, importing energy from PJM into NY and selling the energy in NY at the NY price.***
  - ***The settlement price in NYISO is equal to the scheduling (RTC) price***

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Base Scenario

Legacy Import/Export Scheduling(Current)*

- **PJM: The marketer schedules transmission and ramp in PJM**

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Base Scenario (2)

Legacy Import/Export Scheduling(Current)*

- **PJM: The marketer schedules transmission and ramp in PJM**
- **NYISO: The marketer enters a bid indicating a willingness to import when prices are above their offer**

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Base Scenario (3)

Legacy Import/Export Scheduling(Current)*

- **PJM: The marketer schedules transmission and ramp in PJM**
- **NYISO: The marketer enters a bid indicating a willingness to import when prices are above their offer. For example, the marketer needs $5/MWh to cover their costs and believes they can secure energy at or below $14/MWh so they are willing to schedule from PJM to NY if NY prices are greater than $19/MWh.**

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Base Scenario (4)

Legacy Import/Export Scheduling(Current)*

- **PJM: The marketer schedules transmission and ramp in PJM**
- **NYISO: The marketer enters a bid indicating a willingness to import when prices are above their offer. For example, the marketer needs $5/MWh to cover their costs and believes they can secure energy at or below $14/MWh so they are willing to schedule from PJM to NY if NY prices are greater than $19/MWh.**

Proposed CTS*

- **PJM: The marketer schedules transmission and ramp.**

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Base Scenario (5)

Legacy Import/Export Scheduling(Current)*

- **PJM: The marketer schedules transmission and ramp in PJM**
- **NYISO: The marketer enters a bid indicating a willingness to import when prices are above their offer. For example, the marketer needs $5/MWh to cover their costs and believes they can secure energy at or below $14/MWh so they are willing to schedule from PJM to NY if NY prices are greater than $19/MWh.**

Proposed CTS*

- **PJM: The marketer schedules transmission and ramp.**
- **The marketer indicates the spread they need in order to be willing to flow**

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Base Scenario (6)

Legacy Import/Export Scheduling(Current)*

- **PJM: The marketer schedules transmission and ramp in PJM**
- **NYISO: The marketer enters a bid indicating a willingness to import when prices are above their offer. For example, the marketer needs $5/MWh to cover their costs and believes they can secure energy at or below $14/MWh so they are willing to schedule from PJM to NY if NY prices are greater than $19/MWh. $19/MWh is the LBMP Bid the marketer enters today.**

Proposed CTS*

- **PJM: The marketer schedules transmission and ramp.**
- **The marketer indicates the spread they need in order to be willing to flow**
- **For example to cover their costs, not including the energy costs, the marketer needs $5/MWh. This is the CTS Interface Bid the marketer enters.**

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Example Takeaways

- **The three examples build on the same base scenario and attempt to compare and contrast the Legacy and CTS processes with different prices in PJM and NY**
- **Example 1 illustrates a scenario in which the Legacy and CTS processes result in economic transactions continuing to flow**
- **Example 2 illustrates a scenario in which the Legacy process does *not* allow economic transactions to flow, while the CTS process *allows* economic transactions to flow**
- **Example 3 illustrates a scenario in which the Legacy process *allows* *un*economic transactions to flow, while the CTS process would *not* allow *un*economic transactions to flow**

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Numerical Example 1

Price in NYISO: $23/MWh, **Price in PJM: $17/MWh**

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Numerical Example 1

Price in NYISO: $23/MWh, **Price in PJM: $17/MWh**

Legacy Scheduling

- **Marketer enters $19/MWh LBMP Bid**

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Numerical Example 1

Price in NYISO: $23/MWh, **Price in PJM: $17/MWh**

Legacy Scheduling

- **Marketer enters $19/MWh LBMP Bid**
- **Marketer secures energy at $17/MWh in PJM and arranges for transmission and ramp.**

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Numerical Example 1

Price in NYISO: $23/MWh, **Price in PJM: $17/MWh**

Legacy Scheduling

- **Marketer enters $19/MWh LBMP Bid**
- **Marketer secures energy at $17/MWh in PJM and arranges for transmission and ramp.**
- **Transaction is scheduled in NY (because $19/MW<$23/MWh)**

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Numerical Example 1

Price in NYISO: $23/MWh, **Price in PJM: $17/MWh**

Legacy Scheduling

- **Marketer enters $19/MWh LBMP Bid**
- **Marketer secures energy at $17/MWh in PJM and arranges for transmission and ramp.**
- **Transaction is scheduled in NY (because $19/MW<$23/MWh)**
- **The Marketer makes $6/MWh (=$23/MWh-$17/MWh) which covers costs of $5/MWH.**

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Numerical Example 1

Price in NYISO: $23/MWh,

Legacy Scheduling

- Marketer enters $19/MWh LBMP Bid
- Marketer secures energy at $17/MWh in PJM and arranges for transmission and ramp.
- Transaction is scheduled in NY (because $19/MW<$23/MWh)
- The Marketer makes $6/MWh (=$23/MWh-$17/MWh) which covers costs of $5/MWH.

Price in PJM: $17/MWh

Proposed CTS

- Marketer enters $5/MWh CTS Interface Bid

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Numerical Example 1

Price in NYISO: $23/MWh,

Legacy Scheduling

- Marketer enters $19/MWh LBMP Bid
- Marketer secures energy at $17/MWh in PJM and arranges for transmission and ramp.
- Transaction is scheduled in NY (because $19/MW<$23/MWh)
- The Marketer makes $6/MWh (=$23/MWh-$17/MWh) which covers costs of $5/MWH.

Price in PJM: $17/MWh

Proposed CTS

- Marketer enters $5/MWh CTS Interface Bid
- The CTS scheduling adds the CTS Interface Bid to the expected price and compares it to the NY price
  $17/MWh+$5/MWh=
  $22/MWH< $23/MWh
  The Transaction is scheduled

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Numerical Example 1

Price in NYISO: $23/MWh,

Legacy Scheduling

- Marketer enters $19/MWh LBMP Bid
- Marketer secures energy at $17/MWh in PJM and arranges for transmission and ramp.
- Transaction is scheduled in NY (because $19/MW<$23/MWh)
- The Marketer makes $6/MWh (=$23/MWh-$17/MWh) which covers costs of $5/MWH.

Price in PJM: $17/MWh

Proposed CTS

- Marketer enters $5/MWh CTS Interface Bid
- The CTS scheduling adds the CTS Interface Bid to the expected price and compares it to the NY price
  $17/MWh+$5/MWh=
  $22/MWH< $23/MWh
  The Transaction is scheduled
- The Marketer makes $6/MWh (=$23/MWh-$17/MWh) which covers costs of $5/MWH.

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Numerical Example 2

Price in NYISO: $18/MWh, **Price in PJM: $10/MWh**

Legacy Scheduling **Proposed CTS**

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Numerical Example 2

Price in NYISO: $18/MWh,

Legacy Scheduling

- **Marketer enters $19/MWh LBMP Bid**

Price in PJM: $10/MWh

Proposed CTS

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Numerical Example 2

Price in NYISO: $18/MWh,

Legacy Scheduling

- **Marketer enters $19/MWh LBMP Bid**
- **Marketer secures energy at $10/MWh in PJM and arranges for transmission and ramp.**

Price in PJM: $10/MWh

Proposed CTS

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Numerical Example 2

Price in NYISO: $18/MWh,

Legacy Scheduling

- **Marketer enters $19/MWh LBMP Bid**
- **Marketer secures energy at $10/MWh in PJM and arranges for transmission and ramp.**
- **Transaction is not scheduled in NY ($19/MW>$18/MWh)**

Price in PJM: $10/MWh

Proposed CTS

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Numerical Example 2

Price in NYISO: $18/MWh,

Legacy Scheduling

- Marketer enters $19/MWh LBMP Bid
- Marketer secures energy at $10/MWh in PJM and arranges for transmission and ramp.
- Transaction is not scheduled in NY ($19/MW>$18/MWh)
- The Marketer makes $0/MWh and has to unwind the PJM position.

Price in PJM: $10/MWh

Proposed CTS

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Numerical Example 2

Price in NYISO: $18/MWh,

Legacy Scheduling

- Marketer enters $19/MWh LBMP Bid
- Marketer secures energy at $10/MWh in PJM and arranges for transmission and ramp.
- Transaction is not scheduled in NY ($19/MW>$18/MWh)
- The Marketer makes $0/MWh and has to unwind the PJM position.

Price in PJM: $10/MWh

Proposed CTS

- Marketer enters $5/MWh CTS Interface Bid

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Numerical Example 2

Price in NYISO: $18/MWh,

Legacy Scheduling

- Marketer enters $19/MWh LBMP Bid
- Marketer secures energy at $10/MWh in PJM and arranges for transmission and ramp.
- Transaction is not scheduled in NY ($19/MW>$18/MWh)
- The Marketer makes $0/MWh and has to unwind the PJM position.

Price in PJM: $10/MWh

Proposed CTS

- Marketer enters $5/MWh CTS Interface Bid
- The CTS scheduling adds the CTS Interface Bid to the expected price and compares it to the NY price
  $10/MWh+$5/MWh=
  $15/MWH< $18/MWh
  The Transaction is scheduled

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Numerical Example 2

Price in NYISO: $18/MWh,

Legacy Scheduling

- Marketer enters $19/MWh LBMP Bid
- Marketer secures energy at $10/MWh in PJM and arranges for transmission and ramp.
- Transaction is not scheduled in NY ($19/MW>$18/MWh)
- The Marketer makes $0/MWh and has to unwind the PJM position.

Price in PJM: $10/MWh

Proposed CTS

- Marketer enters $5/MWh CTS Interface Bid
- The CTS scheduling adds the CTS Interface Bid to the expected price and compares it to the NY price
  $10/MWh+$5/MWh=
  $15/MWH< $18/MWh
  The Transaction is scheduled
- The Marketer makes $8/MWh (=$18/MWh-$10/MWh) which covers costs of $5/MWH.

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Numerical Example 3

Price in NYISO: $28/MWh, **Price in PJM: $30/MWh**

Legacy Scheduling **Proposed CTS**

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Numerical Example 3

Price in NYISO: $28/MWh,

Legacy Scheduling

- **Marketer enters $19/MWh LBMP Bid**
- **Transaction is scheduled in NY ($19/MW<$28/MWh)**

Price in PJM: $30/MWh

Proposed CTS

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Numerical Example 3

Price in NYISO: $28/MWh,

Legacy Scheduling

- **Marketer enters $19/MWh LBMP Bid**
- **Transaction is scheduled in NY ($19/MW<$28/MWh)**
- **The Marketer loses $9/MWh including costs of $5/MWH.**

Price in PJM: $30/MWh

Proposed CTS

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Numerical Example 3

Price in NYISO: $28/MWh,

Legacy Scheduling

- **Transaction is scheduled in NY ($19/MW<$28/MWh)**
- **The Marketer loses $9/MWh including costs of $5/MWH.**

Price in PJM: $30/MWh

Proposed CTS

- **Marketer enters $5/MWh CTS Interface Bid**

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Numerical Example 3

Price in NYISO: $28/MWh,

Legacy Scheduling

- **Transaction is scheduled in NY ($19/MW<$28/MWh)**
- **The Marketer loses $9/MWh including costs of $5/MWH.**

Price in PJM: $30/MWh

Proposed CTS

- **Marketer enters $5/MWh CTS Interface Bid**
- **The CTS scheduling adds the CTS Interface Bid to the expected price and compares it to the NY price**
  $30/MWh+$5/MWh=
  $35/MWH> $28/MWh
  The Transaction is not scheduled

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Numerical Example 3

Price in NYISO: $28/MWh,

Legacy Scheduling

- Transaction is scheduled in NY ($19/MW<$28/MWh)
- The Marketer loses $9/MWh including costs of $5/MWH.

Price in PJM: $30/MWh

Proposed CTS

- Marketer enters $5/MWh CTS Interface Bid
- The CTS scheduling adds the CTS Interface Bid to the expected price and compares it to the NY price
  $30/MWh+$5/MWh=
  $35/MWH> $28/MWh
  The Transaction is not scheduled
- The Marketer makes $0/MWh

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BACKGROUND

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Data analysis

- **The previously presented analysis has been updated to include all of 2012 (previously only Q1-Q3 were available) and expanded to provide information on the controllable interfaces (Neptune and Linden)**
- **At the previous joint stakeholder meeting, some market participants asked why there was no differentiation between "firm" (or "physical") flows (that are not price dependent) and other (price-dependent) flows.**
  - ***If a market participant has "firm" MWs that they wish to flow, no matter the price difference between NY and PJM, another market participant would be willing to take the counter position if it was valuable to do so. Therefore, when looking at the utilization of the interface the differentiation between price sensitive and non-price sensitive flows is not material. It is the (net) MW of flow at the interface that indicates under-utilization.***

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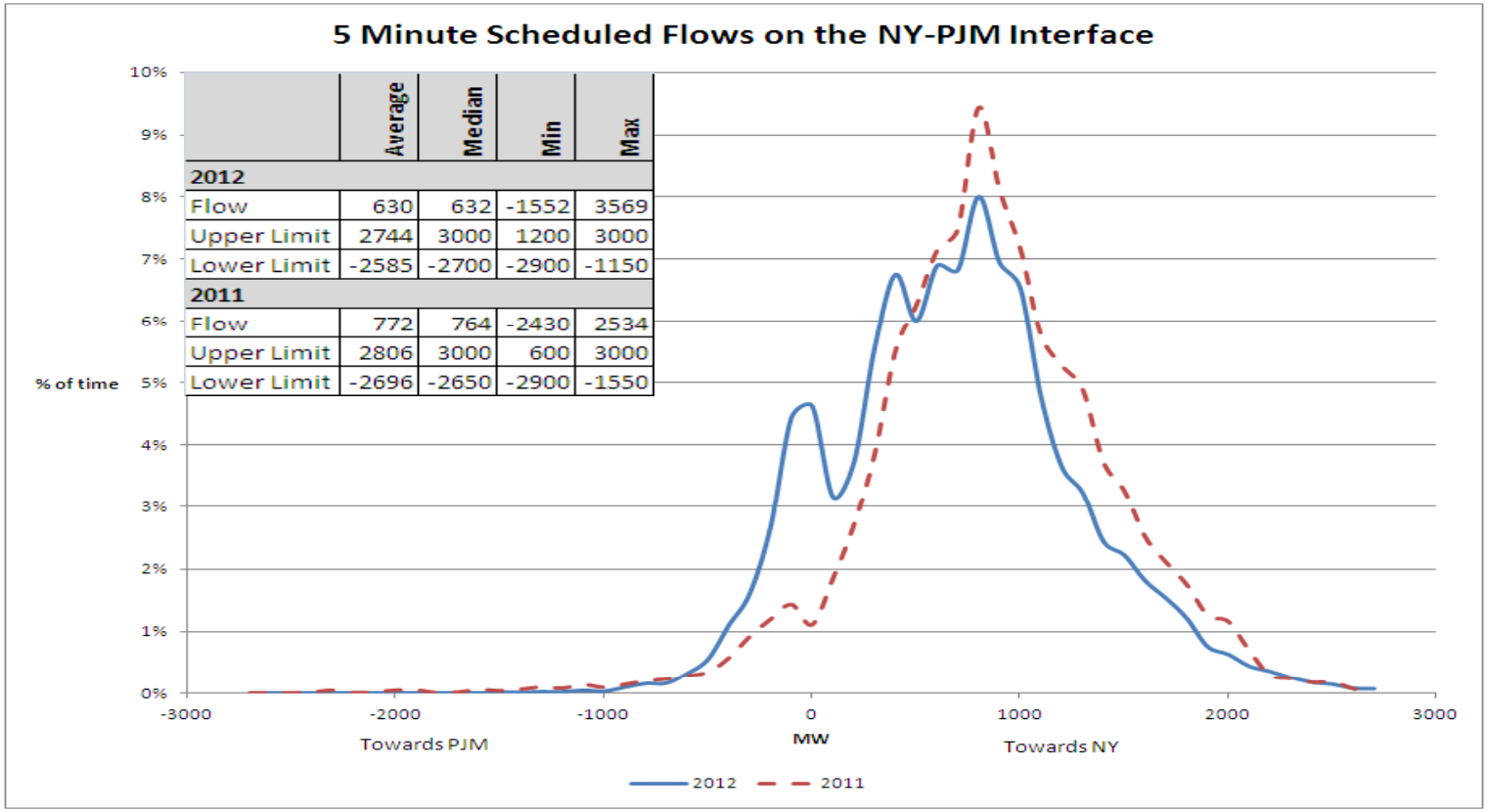
Flows between NY and PJM



	Average	Median	Min	Max
2012				
Flow	630	632	-1552	3569
Upper Limit	2744	3000	1200	3000
Lower Limit	-2585	-2700	-2900	-1150
2011				
Flow	772	764	-2430	2534
Upper Limit	2806	3000	600	3000
Lower Limit	-2696	-2650	-2900	-1550

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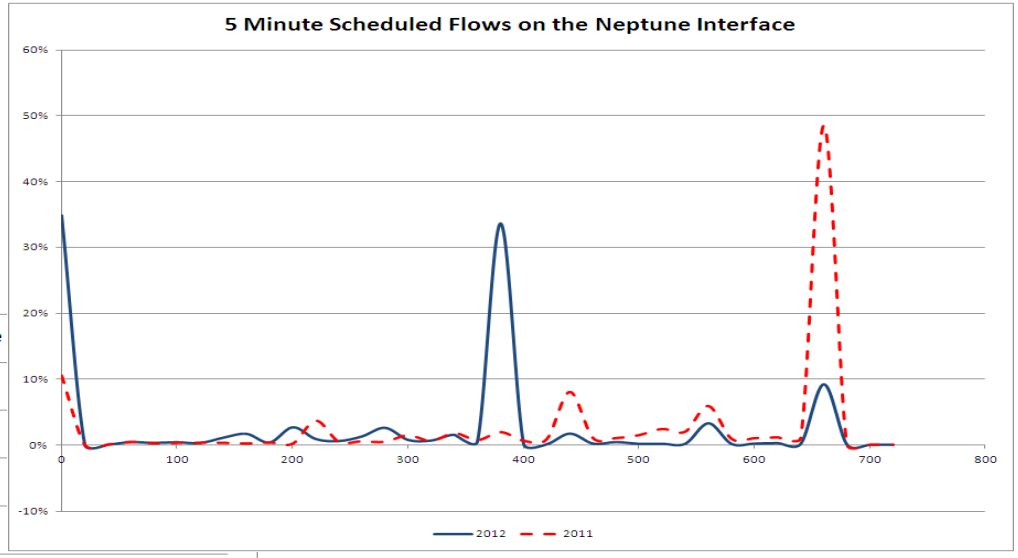
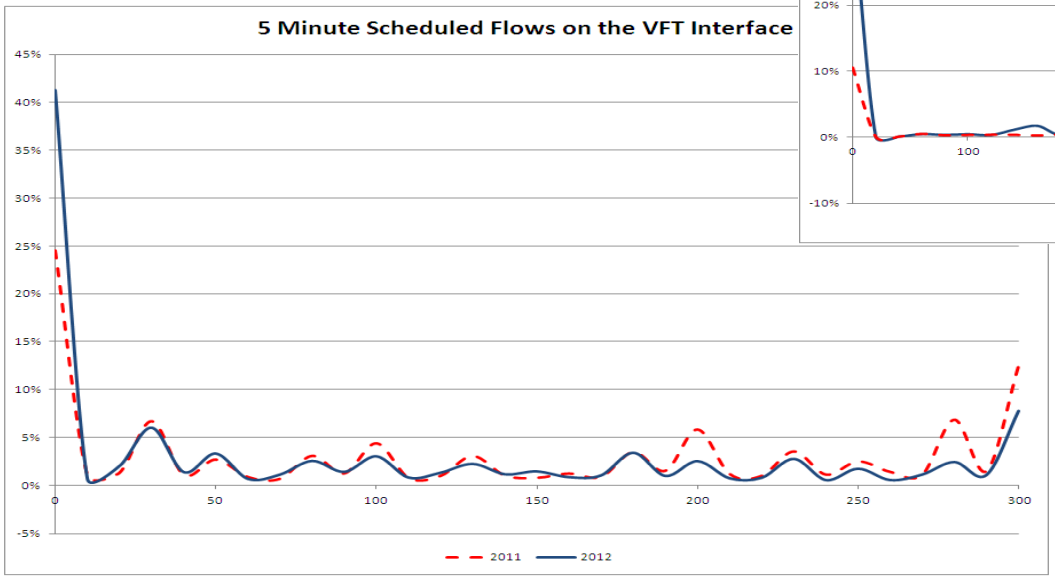
Flows at the Controllable Interfaces





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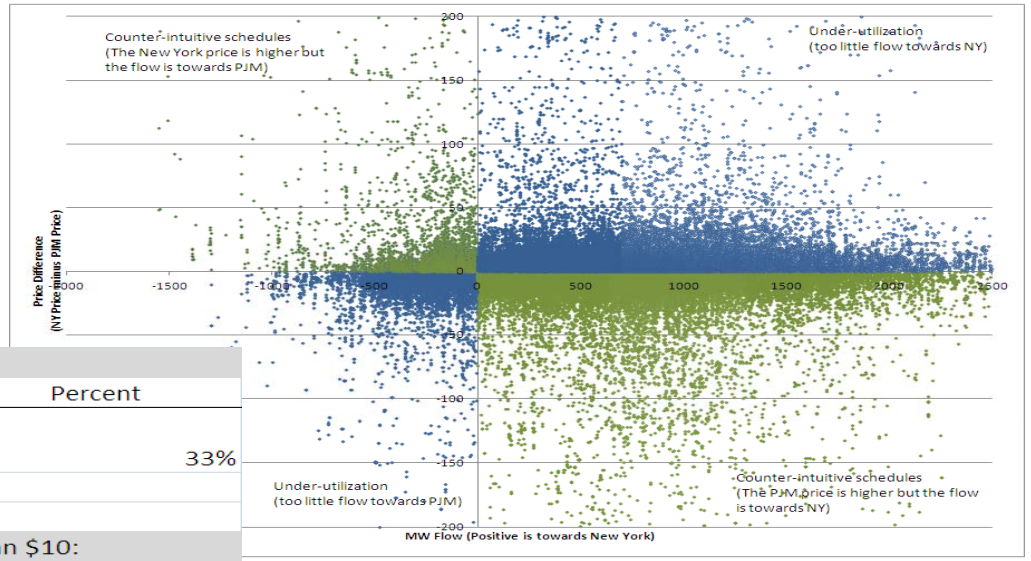
Opportunity-PJM-NY Interface 2012

The percentage of inefficient schedules is generally around 33%



2012 Q1-Q3		
	Number of Intervals	Percent
When the price difference is greater than $10	33653	33%
All Intervals	103029	
Looking only at intervals when the price difference is great than $10:		
	Number of Intervals	Percent
Positive Price difference	18221	54%
Negative Price difference	15432	46%
Total	33653	
Flow towards NY (positive)	28117	85%
Flow towards PJM (negative)	4826	15%
Total	32943	
Counter Intutive	11968	50%
Under-Utilization	12027	50%
Total	23995	

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Proposed Timeline

- **Proposed Implementation Timeline**
  - ***EOY-2012:*** ***Introduce to Stakeholders***
  - ***Mid-2013:*** ***Market Design Approved***
  - ***2014:*** ***Implement***
- **Joint stakeholder meetings:**
  - ***April 2 at NYISO's Krey Corporate Center in Rensselaer***
  - ***June 25th at PJM's CTC in Valley Forge***
- **Each ISO/RTO will pursue tariff changes, as needed, with their stakeholders. Expected process and timeline:**

NYISO:

- **MIWG Review of tariff changes (June/July)**
- **Approval by the Business Issues Committee (BIC) (August)**
- **Approval by the Management Committee (MC) (August)**

PJM:

- **MIC Review of tariff changes (June/July)**
- **MRC Review of tariff changes (July/August)**
- **Approval by Members Committee (MC) (August)**

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Next Steps

- **Next joint stakeholder meetings:**
  - ***April 2 at NYISO's Krey Corporate Center in Rensselaer***
  - ***June 25th at PJM's CTC in Valley Forge***

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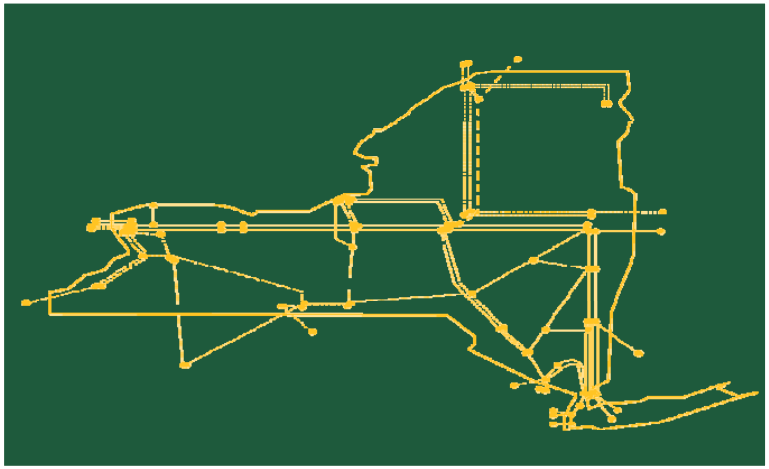
The New York Independent System Operator (NYISO) is a not-for-profit corporation responsible for operating the state's bulk electricity grid, administering New York's competitive wholesale electricity markets, conducting comprehensive long-term planning for the state's electric power system, and



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