Coordinating without the ConEd/ PSEG Wheel

Reposted – Revisions in Red Font

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KCC

DRAFT – FOR DISCUSSION PURPOSES ONLY

Agenda

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Background

Background

PJM/NYISO Wheel Replacement Protocol Project Overview	
Why was the project started?	ConEdison notified involved parties of intention to terminate non-conforming wheeling service on April 28, 2016. PJM and NYISO are working jointly to develop a replacement protocol to address the operational, planning, and market impacts.
What is the wheeling service that is currently in place?	The non-conforming wheeling service has historically been implemented by NYISO and PJM by modeling a fixed 1000 MW flowing from NYISO to PJM over the JK (Ramapo-Waldwick) interface and from PJM to NYISO over the ABC (Hudson-Farragut and Linden-Goethals) interface
When does the replacement protocol have to be in place?	• Current non-conforming wheeling service will end on April 30, 2017. • New protocol must be in place for use on May 1, 2017
What is the impact to Market Participants?	• Primary impact to PSE&G and ConEdison as facility owners • Beyond the revised protocol/ market impacts, no changes to OASIS/ Energy Transaction bidding processes

Background

- **Current protocol**
  - ***Real-time Operations***
    - **61% of NY-PJM AC interchange, and 80% of Rockland Electric Company (RECo) load is applied to the 5018 desired (i.e., target) flow calculation in Real-time Operations**
  - ***Markets:***
    - **NYISO Markets model 61% of the NY-PJM AC Interchange injected at 5018, and 39% at the Western Ties for scheduling and pricing**
    - **PJM Markets model 80% of the NY-PJM AC Interchange injected at the Roseton bus, and 20% injected at the Dunkirk bus for scheduling and pricing**
  - ***Planning:***
    - **Both NYISO and PJM Planning consider NY-PJM interchange and RECo load deliveries consistent with their market models**

Critical Factors for a Near-Term Solution

- **Supports reliable operation of the transmission system**
- **Effectively manages congestion across the region**
- **Provides for open access and utilization of the facilities to serve the public interest and provide benefit to consumers**
- **Does not hinder use of the facilities to respond to emergencies in real-time**
- **Preserves competitive market behaviors**
- **Can be facilitated with the Phase Angle Regulator (PAR) technology at the ABC, JK, and 5018 interfaces (current equipment for May 1, 2017 implementation)**
- **Can be implemented in both PJM and NYISO market models**

Proposal Summary

Proposal Summary

- **Include ABC and JK as part of the NY-PJM AC interface for interchange scheduling**
  - ***A percentage of the NY-PJM AC interchange* will be modeled in the NYISO and PJM Day-Ahead (DA) and Real-Time (RT) markets***
    - **In RT, the percentages are applied to the expected incremental impacts of changes to interchange schedules over the forward scheduling horizon**
  - ***A flow offset, the Operational Base Flow (OBF), will be modeled in the DA Market and applied to the Market-to-Market (M2M) target in RT***
- **Add the PARs on ABC and JK to the Market-to-Market PAR coordination process between NYISO and PJM, which takes place in RT**
  - ***The OBF will be applied to the JK and ABC Interfaces as part of each Interface's M2M target flow, in addition to each Interface's Interchange Percentage***
- **The NYISO and PJM proposal is based on current grid equipment**
  - ***If the technology in use changes, then the NYISO and PJM would have to revisit this design***
  - ***In the future, if the PARs at the ABC, JK, and 5018 interfaces are upgraded in a manner that allowed them to effectively implement interface-specific interchange schedules, then such modeling is possible within the NYISO's market structure***

***See Appendix II for the proposed Interchange Percentage values**

Operational Base Flow (OBF)

- **Reliability issues in Northern NJ were observed in PJM operational studies***
  - ***Because of these reliability issues, further studies were performed to focus on natural system flows with zero interchange and PARs held at neutral tap***
    - **This analysis yielded the OBF as a solution to the reliability issues in Northern NJ**
    - **The OBF is expected to be reduced to zero MW within the next five (5) years, once system conditions permit such a reduction**
- **Absent an OBF, the NYISO and PJM would have to decrease the TTC limit on the NY-PJM AC Interface and modify the proposed interchange percentages at Appendix II**

***For further information on the OBF, please see Appendix III**

Tariff Revisions

Tariff Revisions - Overview

- **MST 17.1 revisions**
- **The NYISO discussed Joint Operating Agreement revisions with PJM**
  - ***These include revisions to the following sections:***
    - **35.2, 35.6, 35.12, 35.20, 35.21, 35.22, 35.23**

MST 17.1

- **Section 17.1.1.1.2**
  - ***Delete reference to ConEdison's DA market hourly election under OATT 35.22 Attachment CC, Schedule C***
  - ***Update reference from Branchburg-Ramapo to Hopatcong-Ramapo throughout***
  - ***Include that the expected flow over the ABC and JK interfaces will be adjusted by the Operational Base Flow (OBF) as described in the JOA***
  - ***Include that the NYISO will post the interchange percentages and OBF***
  - ***Formatting revisions***

Joint Operating Agreement (JOA)

- **OATT 35.2**
  - ***Delete reference to Schedule C of the JOA***
  - ***Provide new definitions for:***
    - **3500 PAR, 4500 PAR, A PAR, ABC Interface, ABC PARs, Available PAR, B PAR, C PAR, E PAR, F PAR, JK Interface, NY-NJ PARs, O PAR, Operational Base Flow, Ramapo Interface, Ramapo PARs and Waldwick PARs**
    - **The definition of Operational Base Flow specifies that the OBF will not result in charges from one Party to the other Party, except for the settlements described in Sections 7 and 8 of Schedule D of the JOA**
    - **Internal references to other JOA sections were revised for consistency**
    - **The definition of the OBF reads "…in order to facilitate the reliable operation of the NYISO and/or PJM transmission system"**

Joint Operating Agreement (JOA)

- **OATT 35.6**
  - ***Describe expectations for PAR operation during emergencies***
  - ***Include language to ensure the agreement does not limit the ISO/RTO's ability to respond to emergencies***

Joint Operating Agreement (JOA)

- **OATT 35.12**
  - ***Update references from Ramapo PARs to NY-NJ PARs throughout***
- **OATT 35.20**
  - ***Revisions to the addresses in the Notices section 35.20.22***
  - ***Revisions to the signatories named at the end of the section***

Joint Operating Agreement (JOA)

- **OATT 35.21**
  - ***Add two additional interconnection facilities***

PJM	NYISO	Designated	(kV)	Common Meter Point(s)
Homer City	Mainesburg	47	345	Homer & Mainesburg
Homer City	Pierce Brook	48	345	Homer & Pierce Brook

  - ***Update the names of four existing interconnection facilities***

PJM	NYISO	Designated	(kV)	Common Meter Point(s)
Hopatcong	Ramapo	5018	500	Ramapo
Mainesburg	Watercure	30	345	Mainesburg
Pierce Brook	Five Mile Rd.	37	345	Pierce Brook
Marion	Farragut	C3403	345	Farragut

- **OATT 35.22**
  - ***Delete this section, as it describes the operating protocol for the implementation of the ConEd/ PSEG Wheel***

Joint Operating Agreement (JOA)

- **OATT 35.23**
  - ***Update references from Ramapo PARs to NY-NJ PARs where appropriate throughout***
  - ***Delete reference to Schedule C of the Joint Operating Agreement***
  - ***Minor deletion at section 6.2***
  - ***At section 7 - Real-Time Energy Market Coordination***
    - **Specify that operation of the ABC PARs, Ramapo PARs, and Waldwick (JK) PARs shall be coordinated by the RTOs**
    - **Change reference from Ramapo to PAR_x throughout the equations in 35.23**
    - **Replace *PJMRamapoPayment* and *NYRamapoPayment* with the term *M2MPARSettlement throughout 35.23***

Joint Operating Agreement (JOA)

- **OATT 35.23 (Continued)**
  - ***At section 7.2 – Real-Time NY-NJ PAR Coordination***
    - **Delete reference to the interchange schedules under outage conditions (included in section 7.2.1)**
    - **Include language differentiating operational control from physical control of the PARs**
    - **Include an operational bandwidth of +/- 50 MW around each NY-NJ PAR's target flow to limit tap movements and to maintain actual flows at acceptable levels (this operational bandwidth will not impact the settlements rules discussed in section 8.3)**
    - **Specify that if the maximum number of PAR tap changes are exceeded, then the operational bandwidth shall be increased in 50 MW increments until these maximums are no longer exceeded**
    - **In order to implement the NY-NJ PAR coordination process, including the establishment and continuation of the initial and any future OBF, the facilities comprising the ABC and JK Interfaces shall remain functional and operational at all times, consistent with Good Utility Practice, except when taken out-of-service to perform maintenance or when subject to a forced outage**

Joint Operating Agreement (JOA)

- **OATT 35.23 (Continued)**
  - ***At section 7.2.1 – NY-NJ PAR Target Values***
    - **Express the calculation of the NY-NJ PAR Target Values as made up of the Interchange Factor, Operational Base Flow and RECo Load**
    - **At the Interchange Factor term definition, include that if a NY-NJ PAR is unavailable, the percentage of interchange normally assigned to that NY-NJ PAR will be modeled as flowing over the western ties**

Joint Operating Agreement (JOA)

- **OATT 35.23 (Continued)**
  - ***At section 7.2.1 – NY-NJ PAR Target Values (continued)***
    - **Include that the definition of $OperationalBaseFlow_{PARx}$ is the MW value of OBF distributed across each of the in-service ABC PARs and Waldwick PARs**
    - **Further describe that either Party may establish a temporary OBF to address a reliability issue until a long-term solution to the identified reliability issue can be implemented**
      - ***Any temporary OBF that is established shall be at a level that both Parties can reliably support***
      - ***The Party that establishes the OBF shall:***
        - **(1) explain the reliability need to the other Party;**
        - **(2) describe how the OBF addresses the identified reliability need; and**
        - **(3) identify the expected long-term solution to address the reliability need**
    - **The initial 400 MW OBF, effective on May 1, 2017, is expected to be reduced to zero MW by June 1, 2021**
    - **The Parties may mutually agree to modify an established OBF value that normally applies when all of the ABC PARs and Waldwick PARs are in service**
    - **Modification of the normally applied OBF value will be implemented no sooner than two years after mutual agreement on such modification has been reached, unless NYISO and PJM mutually agree to an earlier implementation date**
    - **The NYISO and PJM shall post the OBF values, in MW, normally applied to each ABC PAR and Waldwick PAR when all of the ABC PARs and Waldwick PARs are in service, on their respective websites**
      - ***The NYISO and PJM shall also post the methodology used to reduce the OBF under certain outage conditions on their respective websites***
    - **The NYISO and PJM shall review the OBF MW value at least annually**

Joint Operating Agreement (JOA)

- **OATT 35.23 (Continued)**
  - ***At section 7.2.1 – NY-NJ PAR Target Values (continued)***
    - **At the definition of the RECo load term, include that in the event one of the Ramapo PARs is out of service the full RECo Load Percentage (80%) will be applied to the in service Ramapo PAR**
    - **Include a table listing the interchange percentages and RECo load percentages applied to each PAR**
      - ***Note that the percentages in the table are those ordinarily applied to RECo***

Joint Operating Agreement (JOA)

- **OATT 35.23 (Continued)**
  - ***At section 8.3 – NY-NJ PAR Settlements****
    - **Update the equations to calculate *NYImpact and PJMImpact* for each PAR**
    - **Calculate the minimum of either, the summation of the congestion impact for the respective RTO or zero**
      - ***Take the delta of these values for each RTO to arrive at the M2MPARSettlement***
  - ***At section 8.3.1 – NY-NJ PAR Settlements During Storm Watch Events***
    - **Replace reference to desired flows for the JK interface and ABC interface from Schedule C with reference to the Target flows for those interfaces**
    - **Clarify that during the first 15-minutes when a Storm Watch is in effect, section 8.3.1 excuses Parties from paying an *M2MPARSettlement* to each other**

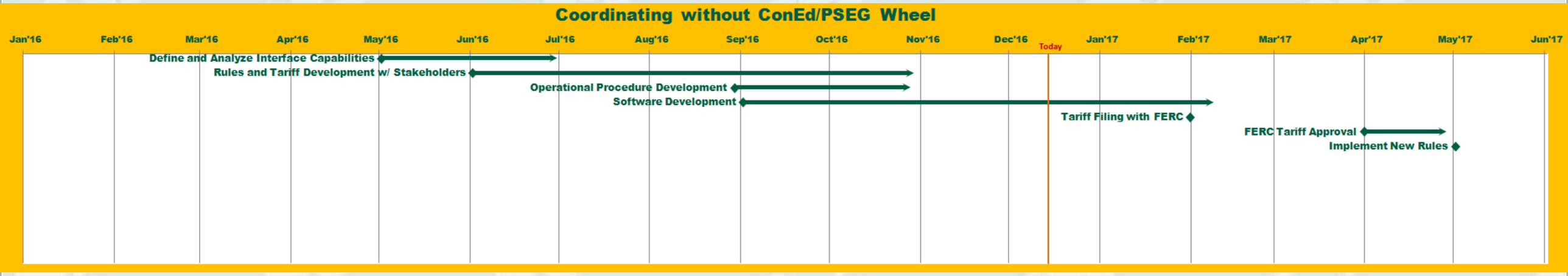
***See Appendix IV – M2M PAR Settlements Example**

Joint Operating Agreement (JOA)

- **OATT 35.23 (Continued)**
  - ***At section 10.1.8 – Suspension of M2M Settlement when a Request for Taps on NY-NJ PARs to Prevent Overuse is Refused***
    - **Delete the statement that "the refusing Party shall not be relieved of any of its M2M settlement obligations"**
  - ***At section 10.1.9 – Suspension of NY-NJ PAR Settlement due to Transmission Facility Outage(s)***
    - **State that the Parties shall suspend PAR Settlements for a NY-NJ PAR when that NY-NJ PAR is out of service, is bypassed, or the RTOs mutually agree that a NY-NJ PAR is incapable of facilitating interchange**

Timeline/ Next Steps

Timeline



Date	Task
5/1/2016	Define and Analyze Interface Capabilities
6/1/2016	Rules and Tariff Development w/ Stakeholders
8/29/2016	Operational Procedure Development
9/1/2016	Software Development
1/31/2017	Tariff Filing with FERC
3/31/2017	FERC Tariff Approval
5/1/2017	Implement New Rules

Next Steps

- **December MC**
  - ***Vote on draft tariff language***
- **PJM's December Committee Meetings**
  - ***Review PJM/NYISO JOA language updates***
- **January 2017**
  - ***TCC Market Operations begins stakeholder discussions***
    - **Impacts from this proposal will be incorporated beginning with the Spring 2017 Centralized TCC auction**
  - ***Seek Board Approval***
  - ***File with FERC (Joint Filing)***
- **May 1, 2017 Implementation**

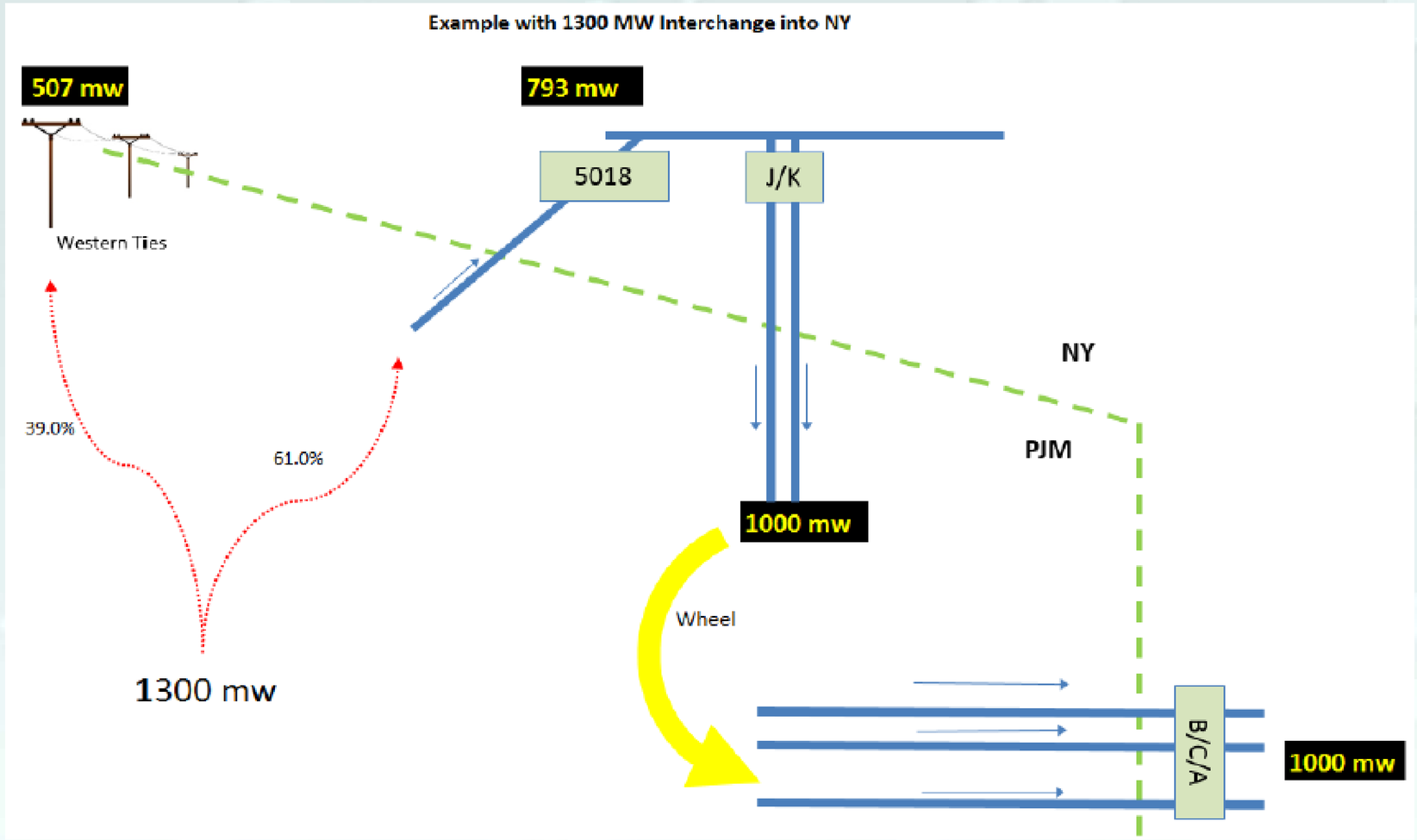
Appendix I: Current Process

Current Process

- **Currently, interchange between NY and PJM is expected to flow according to the pre-set distribution of 61% over 5018, and 39% over the Western ties**
  - ***This distribution is explicitly modeled in the NYISO's Day-Ahead and Real Time markets***
  - ***Interchange is also automatically distributed from 5018 to the ABC and JK lines when the PARs on the transmission lines between New York and New Jersey are unable to maintain the desired flow (i.e., when flows across the 5018 are at limits)***
- **When a market participant submits an economic offer to schedule energy between PJM and NY, NYISO and PJM economically evaluate the offer against:**
  - ***Offers from internal NY and PJM generators***
  - ***Import/export offers at other proxy buses, and***
  - ***Price sensitive bids and offers***
- **The congestion impacts of proposed imports and exports on the NY and PJM transmission system are considered in the NYISO's and PJM's market evaluations and are reflected in the NYISO LBMPs at the Keystone proxy bus or PJM LMPs at the NYIS proxy bus, respectively**

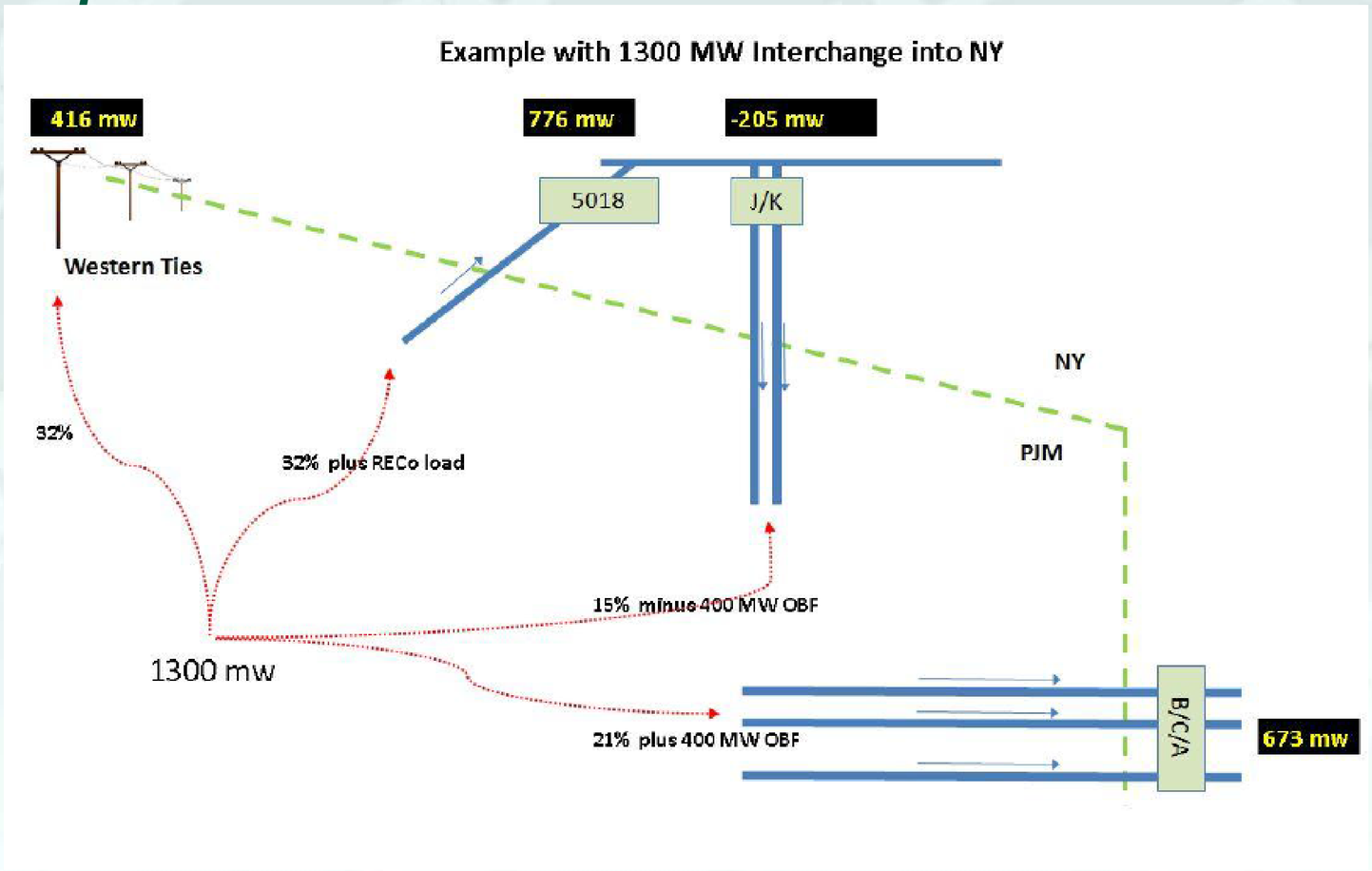
Interchange to NY – Today's View

- **This figure illustrates an example of how interchange at the Keystone Proxy Bus is handled today, along with the ConEd/PSEG Wheel, in the NYISO Day Ahead and Real-Time markets**



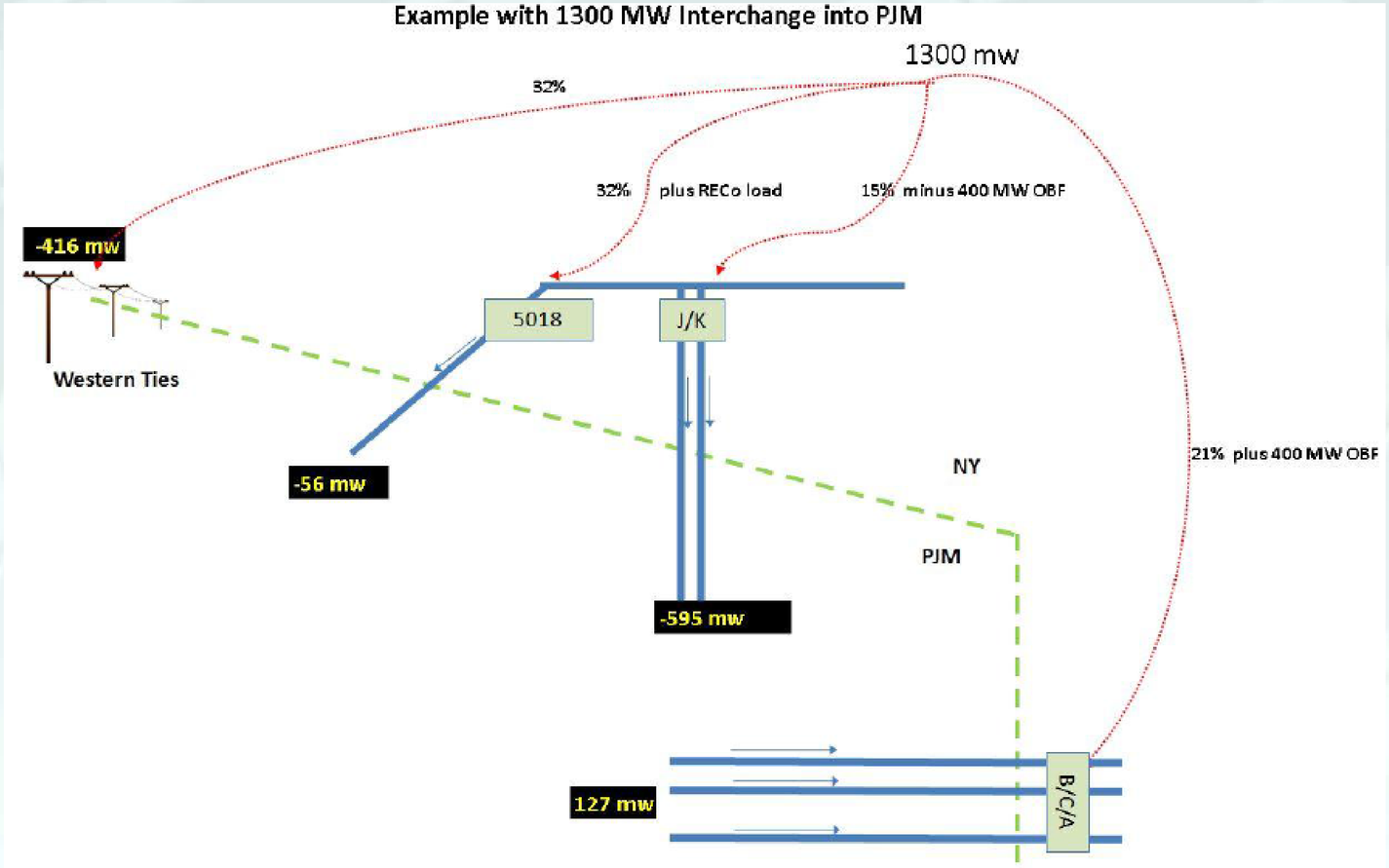
Interchange to NY - Proposed

- **This figure illustrates an example of the NYISO-PJM proposal for handling interchange once the ConEd/PSEG Wheel is no longer in place**
  - ***This example assumes RECo load is 450 MW***



Interchange to PJM - Proposed

- **This figure illustrates an example of the NYISO-PJM proposal for handling interchange once the ConEd/PSEG Wheel is no longer in place**
  - ***This example assumes RECo load is 450 MW***



M2M Coordination

- **Key steps in M2M PAR Coordination are outlined below**
  - ***A complete description of these rules is included in the current Joint Operating Agreement***

RT Target Flow Calculated for each PAR

- Derived in part based on the static interchange percentage distributions modeled in the market software

Cost of Congestion

- RT cost of congestion at each PAR Controlled line is the sum of the products of the PAR's shift factor on the shadow price of each active constraint

TAP signals

- The software will indicate to Ops the direction in which tap moves would be beneficial to minimize regional congestion by redistributing flows across the various AC interfaces between NY and PJM

RTO-to-RTO settlements

- Settlements between NYISO and PJM may occur when any over/under deliveries on the PAR controlled lines are increasing congestion in one region (compared to target flows)

Appendix II – Proposed Interchange Percentages

Interchange Percentages

- **Proposing a combination of two concepts:**
  - ***Account for an Operational Base Flow (OBF) as a starting point***
  - ***Apply an interchange percentage distributed to each PAR:***

Line	Line Percent Distribution	PAR	PAR Percent Distribution
5018	32%	3500	16%
		4500	16%
A	21%	A	7%
B		B	7%
C		C	7%
JK	15%	E	5%
		F	5%
		O	5%
Western Ties	32%	N/A	N/A

- **The percentages above would change absent an OBF based on current system topology**

Appendix III – Operational Base Flow (OBF)

Need for an Operational Base Flow

- **Power flow results have identified reliability issues in Northern New Jersey as well as delivery limitations when exporting from PJM to the NYISO on the JK interface**
  - ***Potential for voltage collapse in Northern New Jersey under high load Summer OATF case***
  - ***Forcing flow from 230 kV system to the 345 kV system***
  - ***PAR tap adjustments exhausted prior to achieving desired flow***
  - ***High voltage during light load periods and low interface flows will also be a concern/ consideration***
- **NYISO power flow results have also identified delivery limitations when exporting to PJM on the ABC interface after securing for N-1-1 on the NYISO system, and then attempting further deliveries**

Benefits of the OBF

- **Resolves reliability issues in Northern NJ observed in PJM operational studies**
- **Allows for higher levels of economic interchange to be scheduled over JK and ABC**
  - ***The OBF allows the NYISO and PJM to reliably meet interchange schedules without crowding out economic interchange transactions***
- **The OBF preserves PAR angle capability to achieve target**
- **Facilitate power flows in a manner that most effectively manages regional congestion**
- **Supports all of the critical factors of a solution outlined at the beginning of this presentation**
- **The OBF also provides operational flexibility by maintaining PAR angle capability to respond to emergencies in real-time**

Studies: PJM System Operations Power Flow Analysis Results

Scenario	Load (MW)	Generation	Outages	Interchange to NYISO (MW)	Interchange to PJM (MW)	Linden VFT	Neptune	HTP	PJM Contingency Criteria	Result
Summer 2016 OATF	157,178	All in Service	All Facilities in Service	2,500	1,500	315 MW to NYISO	660 MW to NYISO	320 MW to NYISO	N-1	Case did not solve
June 1, 2016	122,725	DA/ RT Combustion Turbine Commitment	RT Topology	2,500	1,500	315 MW to NYISO	660 MW to NYISO	320 MW to NYISO	N-1	Cases solve with heavy congestion in Northern NJ
July 25, 2016	151,753	DA/ RT Combustion Turbine Commitment	RT Topology	2,500	1,500	315 MW to NYISO	660 MW to NYISO	320 MW to NYISO	N-1	Cases solve with heavy congestion in Northern NJ

NYISO Operations Studies

- **The current protocol has been widely studied and reliably implemented**
- **The NYISO utilized the 2016 summer operating case as well as the 2017 case from the 2016 Reliability Needs Assessment (RNA) to determine the reliable bounds on the NYISO system for importing to the NYISO on JK and exporting from the NYISO on ABC**
- **The objective was to develop a proposed protocol that would not limit the PJM/NYISO TTC based on 5018, JK, or ABC flow**

NYISO Operations Study Results

- **Results identified a lack of angle capability on the Waldwick PARs (JK) to hold flows to zero**
- **Identified an export limitation on the A, B, C lines to PJM for N-1-1**

Operational Base Flow Analysis

- **The OBF was determined through studies performed by the NYISO and PJM using the following assumptions:**
  - ***Zero net interchange between PJM and the NYISO***
  - ***PARs set to neutral tap setting***
- **The analysis of the NYISO and PJM studies have resulted in a proposed OBF of 400 MW**

Operational Base Flow

- **Given that the OBF is not needed to maintain reliability in NY:**
  - ***The NYISO and PJM have developed JOA language to clarify that the OBF is neither:***
    - **a firm service, nor**
    - **solving a reliability need in NY**
- **As such, the OBF shall not cause the NYISO, or its Market Participants, to be subjected to any PJM Regional Transmission Expansion Plan (RTEP) cost allocations**

Appendix IV – M2M PAR Settlement Example

Example: OATT 35.23 Section 7.2.2, Determination of Cost of Congestion at each NY-NJ PAR

	NYISO Active Constraints				PJM Active Constraints	
PAR	NYISO Constraint 1		NYISO Constraint 2		PJM Constraint 1	
	Shadow Price	$350.00	Shadow Price	$775.00	Shadow Price	$100.00
	Shift Factor	MCC*	Shift Factor	MCC	Shift Factor	MCC
PAR 1	-0.50	-175.00	0.30	232.50	-0.50	-50.00
PAR 2	0.10	35.00	0.05	38.75	0.15	15.00

- ***Congestion $$_{(PAR1,NY)}$$= -$175+$232.50 = $57.50/MWh***
- ***Congestion $$_{(PAR2,NY)}$$= $35+$38.75=$73.75/MWh***
- ***Congestion $$_{(PAR1,PJM)}$$ = -$50/MWh***
- ***Congestion $$_{(PAR2,PJM)}$$ = $15/MWh***

*MCC – Marginal Cost of Congestion

Example: OATT 35.23 Section 8.3, NY-NJ PARs Settlements

PAR	*Actual Flow (MW)*	*Target Flow (MW)*	*Congestion$NY*	*Congestion$PJM*
PAR 1	110	100	$57.50	-$50.00
PAR 2	170	175	$73.75	$15.00

- **$Actual_{PAR1} > Target_{PAR1}$**
  - ***$NYImpact_{PAR1}$=(MAX($57.50 *(100 – 110)), 0) * (3600/3600) = $0/hour***
  - ***$PJMImpact_{PAR1}$=(-$50.00 *(110 - 100)) * (3600/3600) = -$500/hour***
- **$Actual_{PAR2} < Target_{PAR2}$**
  - ***$NYImpact_{PAR2}$=($73.75 *(175-170)) * (3600/3600) = $368.75/hour***
  - ***$PJMImpact_{PAR2}$=(MAX($15.00 *(170-175)), 0) * (3600/3600) = $0/hour***

Example: OATT 35.23 Section 8.3, NY-NJ PARs Settlements

PAR	*NYImpact*	*PJMImpact*
PAR 1	$0.00	-$500.00
PAR 2	$368.75	$0.00

- **M2MPARSettlement =**

((Min($0.00+$368.75),0) – (Min(-$500.00+$0.00),0))*3600/3600

- **M2MPARSettlement = -$500/hour**

The Mission of the New York Independent System Operator, in collaboration with its stakeholders, is to serve the public interest and provide benefit to consumers by:

- ***Maintaining and enhancing regional reliability***
- ***Operating open, fair and competitive wholesale electricity markets***
- ***Planning the power system for the future***
- ***Providing factual information to policy makers, stakeholders and investors in the power system***

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