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September 21, 2015

WebEx Broadcast

Coordinated Transactions Scheduling (CTS) Training

Using CTS as an ISO New England (ISO-NE) Market Participant

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ISO new england

Note this presentation was updated on 11/2/2015. Impacted slides are 15, 16, and 17.

Topics

- Background
- Summary and examples of CTS process
- Submitting external transactions
- Spread bid example
- Day-ahead market (DAM) impacts
- Forward Capacity Market (FCM) impacts
- Prices, Constraints, and Publishing
- Settlements

Background

Background

Coordinated Transaction Scheduling (CTS):

- Result of joint New York and New England stakeholder process to improve the market efficiency of external transactions between the NY and NE regions
- Inefficient scheduling root causes were identified:
  - **Latency delay:** Time delay between when tie is scheduled and when power flows, during which time system conditions and LMPs may change
  - **Non-economic clearing:** ISOs evaluate tie schedule requests without economic coordination, producing inefficient schedules
  - **Transaction costs:** Fees and charges levied by each ISO on external transactions serve as a disincentive to engage in trade, impeding price convergence, and raising total system costs

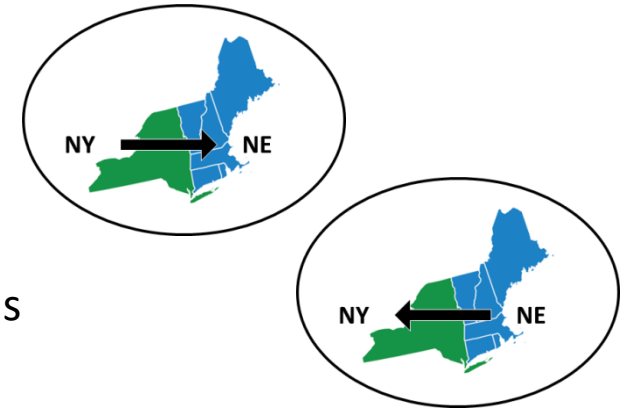
Background, *continued*

Coordinated Transaction Scheduling (CTS):

- CTS features:
  - Scheduling every 15 minutes
  - New external transaction format, interface bid
  - Coordinated economic clearing
  - Eliminates fees and charges for interface bids
- To be implemented at NY Northern AC external interface (.I.ROSETON 345)

Background, *continued*

- Interface bid
  - "A unified real-time bid to simultaneously purchase and sell energy on each side of an external interface for which the enhanced scheduling procedures…" are implemented
    - Eliminates requirement for separate transactions to be submitted to each ISO in real time
  - Contains direction, bid quantity, and bid price
  - Bid price indicates the price between the two regions that the participant is willing to accept



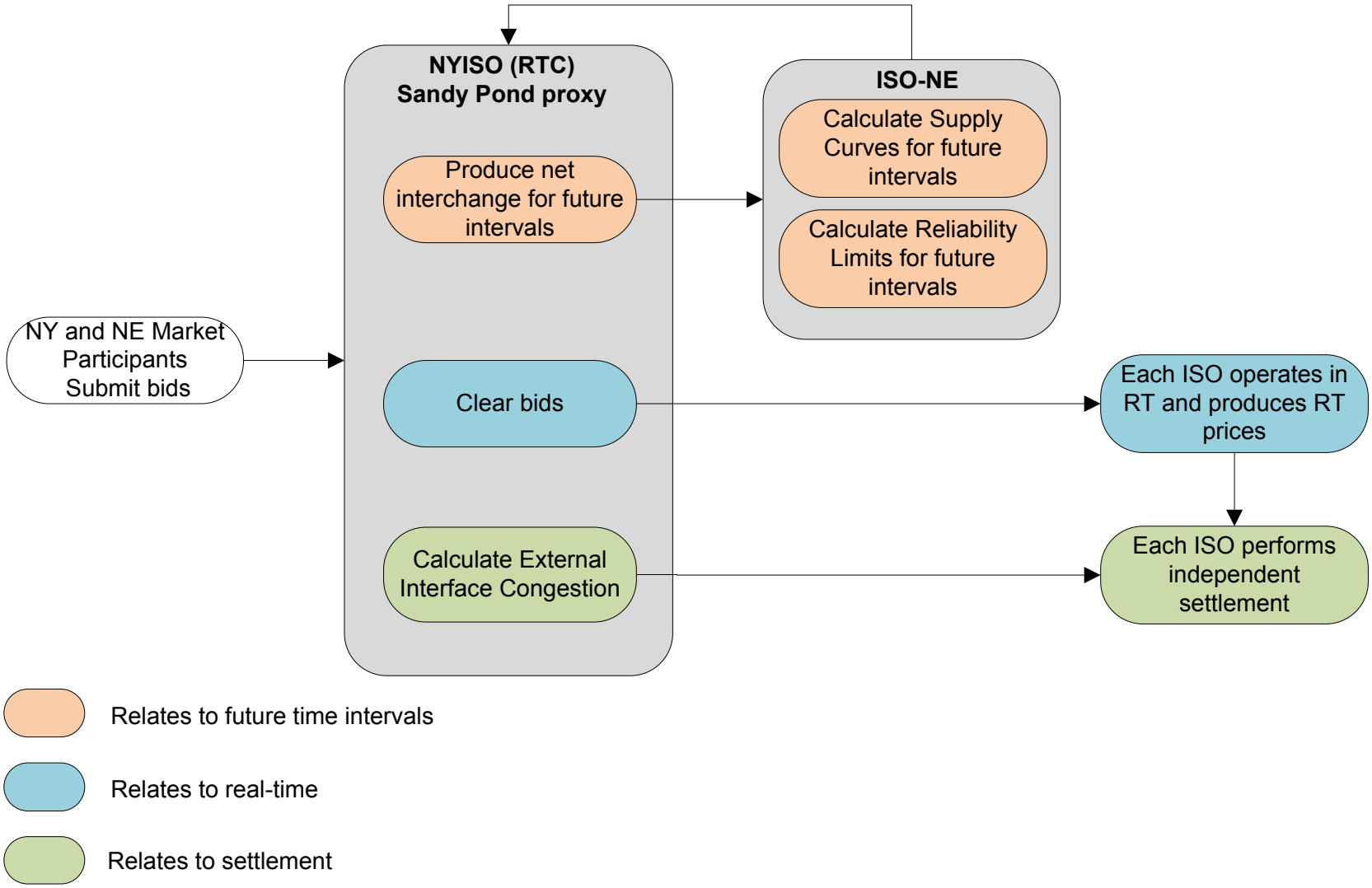
- Coordinated economic clearing between the two regions
  - Facilitates flow of power from the region with the lower LMP to the region with the higher LMP
  - NYISO performs clearing of interface bids, which includes forecasted price of ISO-NE supply

Background, *continued*

- Whitepaper: Inter-Regional Interchange Scheduling: Analysis and Options
- Joint Stakeholder Meeting Materials
  - 2/14/2011
    - Examples of general concepts
    - Examples of DAM to RTM settlement
  - 3/7/2011
    - Examples of congestion between DAM to RTM
  - 4/28/2011
    - Examples of latency risk

Summary and Examples of CTS Process

General Iterative Process



RTC = Real-time commitment

CTS Process, ISO-NE Data Provided to NYISO

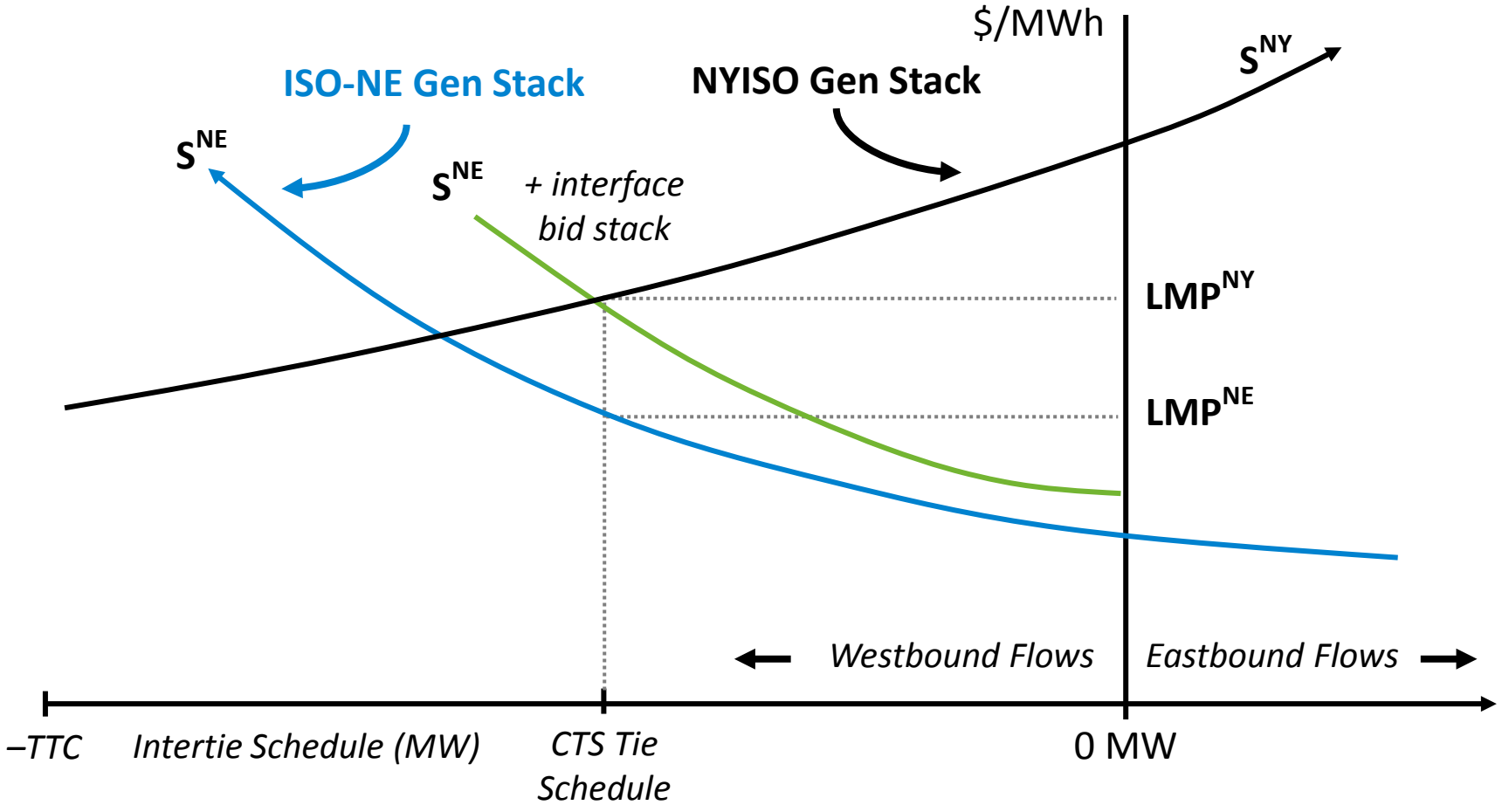
ISO-NE calculates and provides data every 15 minutes to NYISO including:

- Forecasted prices at Roseton representing the sensitivity to change in flow on the CTS interface
- Forecasted reliability limits representing constraints that cannot be modeled directly by NYISO
  - Indicates limit on ability to export, or a required import, considering reserve requirements
  - Indicates limit on ability to import considering back down room on internal generation

CTS Process, NYISO RTC Clearing

- NYISO RTC runs every 15 minutes for 2-1/2 hour duration (ten 15 minutes intervals)
- Optimizes economics combining CTS interface bids with ISO-NE forecasted supply prices
- Limitations on economic solution
  - Transfer limits considered are most restrictive of normal transfer limits and reliability limits sent by ISO-NE
  - Ramp limits
    - CTS interface limit = 200 MW every 15 minutes
    - NYISO system wide limit = 700 MW every hour

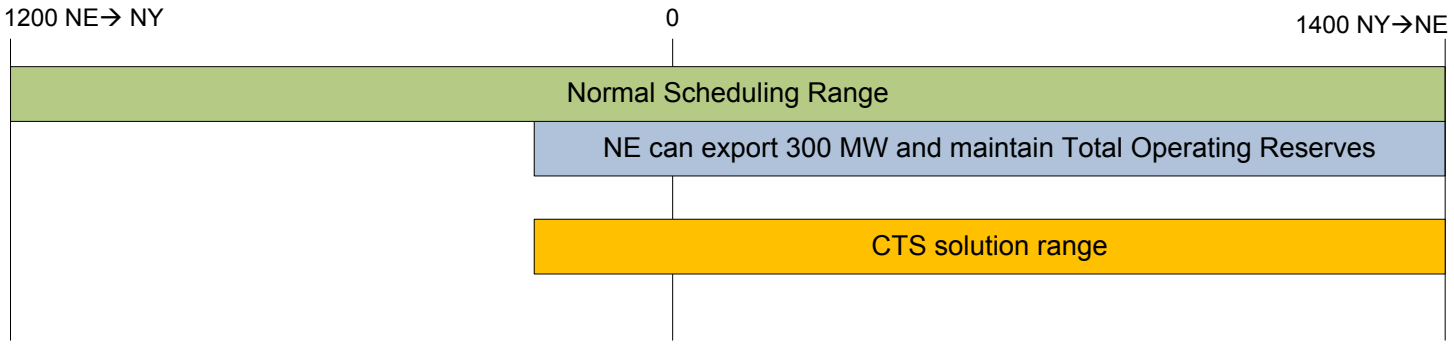
CTS Process General Example



ISO Data Provided to NYISO, Reliability Limits

Example considering one interval in time

- Input:
  - NYISO forecasted net interchange = -500 MW (into NE)
  - AT that net interchange, ISO-NE Total Operating Reserve surplus = 800 MW
    - where, Surplus = Total Operating reserve available - Total Operating reserve required
- Reliability Limit = -500 + 800 = 300 MW
  - ISO-NE can support up to 300 MW of export to NYISO and still maintain Total Operating Reserve requirements
- RTC solution range = 300 MW export to 1400 MW import



External Interface Congestion

- If a constraint binds on the CTS interface in the NYISO RTC solution, the resulting congestion is split between the two ISOs depending on the constraint that is binding

Constraint	Split
Normal transfer limits	50/50
CTS interface ramp limit	50/50
NYCA ramp limit	100% NY
Reliability limits	100% NE

- ISO-NE incorporates this congestion into the final Roseton LMP

External Interface Congestion, Flow at TTC Example

Scenario: Price cannot be equalized at full TTC

RTC results:

- Scheduled flow = -1400 MW to NE
- Marginal interface bid = $4/MWh
- NYISO Sandy Pond LBMP = $61/MWh
- ISO-NE scheduling price = $65/MWh
- Assume external congestion due to flow limit = -$12/MWh
- With RTC result, NYISO internal scheduling price = $61 + (-$12) = $49

Settlement occurs at RT prices (assume consistent with RTC):

- NYISO RT Sandy Pond LBMP = 49 – (-$12/2) = $55/MWh
- ISO-NE RT LMP = $65 + (-$12/2) = $59/MWh
- All bids settle at $59 - $55 = $4/MWh

Note: External congestion is due to a normal transfer limit, split 50/50

External Interface Congestion, Reliability Limit Example

Scenario: ISO-NE sends a reliability limit for minimum generation with a maximum import to NE of -400 MW

RTC results:

- Scheduled flow = -400 MW to NE, constrained by reliability limit
- Marginal interface bid = $2/MWh
- NYISO Sandy Pond LBMP = $21/MWh
- ISO-NE scheduling price = $23/MWh
- External congestion due to flow limit = -$8/MWh
- With RTC result, NYISO internal scheduling price = $21 + (-$8) = $13

Settlement occurs at RT prices (assume consistent with RTC):

- NYISO RT Sandy Pond LBMP = $13 + 0 = $13/MWh
- ISO-NE RT LMP = $23 + (-$8) = $15/MWh

Note: External congestion is due to a reliability limit, 100% to ISO-NE

External Interface Congestion, Reliability Limit Example

Scenario: ISO-NE sends a reliability limit for 30 Min reserves requiring a minimum import to NE of -400 MW

RTC results:

- Scheduled flow = -400 MW to NE, constrained by reliability limit
- Marginal interface bid = $4/MWh
- NYISO Sandy Pond LBMP = $56/MWh
- ISO-NE scheduling price = $60/MWh
- External congestion due to flow limit = $22/MWh
- With RTC result, NYISO internal scheduling price = $56 + ($22) = $78

Settlement occurs at RT prices (assume consistent with RTC):

- NYISO RT Sandy Pond LBMP = $78 + 0 = $78/MWh
- ISO-NE RT LMP = $60 + ($22) = $82/MWh

Note: External congestion is due to a reliability limit, 100% to ISO-NE

Slide added on 11/2/2015

Questions

Submitting External Transactions

Day-Ahead Market Transactions

- Transactions are submitted to NY and NE separately
- All DAM transactions must continue to be submitted to Enhanced Energy Scheduling (EES)
- No change for transactions on non-CTS interfaces
- For CTS interface, DAM transactions now require:
  - eTag ID
  - Import resource, if applicable

Real-Time Market Transactions

- On CTS interface, all transactions must be submitted into NYISO Joint Energy Scheduling System (JESS)
- For imports and exports on CTS interface, transactions cannot be submitted into EES
  - One exception is for import capacity resources backed by generation wheeling through NYISO
- No change for transactions on non-CTS interfaces
- No change for transactions wheeling through ISO-NE

Transaction Submittal Software

	EES		JESS
	DAM	*RTM*	*RTM*
CTS Interface	ALL, Add: eTag ID, Import Capacity Resource ID	**ONLY:** a) Wheeling through ISO-NE b) Import Capacity Resource that is wheeling through NYISO	ALL
Non-CTS Interface	ALL	ALL	not applicable

Access to JESS

- NYISO hosting the JESS bidding platform
- ISO-NE digital certificate provides comparable access to JESS
  - No separate NYISO JESS application access is required in CAMS
- NYISO JESS access is determined from EES role in CAMS
  - 10 digit phone number (no extension) required to setup NYISO JESS password
- User must establish a password upon initial entry into NYISO JESS

High Level JESS Features

- Either ISO-NE or NYISO participant can create/modify bid
- All submittals requires confirmation by other company
  - If confirmation not received the Bid is not evaluated
- Trust Relationships can be setup between ISO-NE or NYISO companies to ‘auto confirm’

Actions Required Today vs. Tomorrow

Task	Today	Tomorrow	
eTag	NE or NY FRP create eTag	no change	
DA NY	NY FRP submit in JESS	no change	
DA NE	NE FRP submit in EES	no change	
RT NY	NY FRP submit in JESS	NY FRP, no change	NY FRP confirms*
RT NE	NE FRP submit in EES	NE FRP confirm in JESS*	NE FRP submits in JESS

OR

*Confirmation can occur through one-time setup of Trust Relationship

RTM Bids in JESS

- JESS bid types

Bid Type	Flow
15 Min CTS	NY → NE, NE→NY
Hourly CTS	NE Wheel
Hourly LBMP	NY Wheel

- 15 minute CTS bids must be one hour long
  - MW and price may vary at 15 minute level
  - Normally evaluated every 15 minutes
- Hourly CTS, hourly LBMP must be one hour long
  - MW and price must be constant over the hour
  - Evaluated once an hour

RTM Bids in JESS, *continued*

- Price for all bids in JESS must be between -$1000 and $1000
- Generation Information System (GIS) ID field in JESS allows entry of GIS ID
  - Comparable to special exception option “Generation Information System” in EES
- Submittal deadline for all bids in JESS is 75 minutes prior to the start of the hour

RTM Bids in JESS, *continued*

- Bids submitted into NYISO JESS will not be visible in ISO-NE EES software
- Bids and resulting schedules can be downloaded directly from JESS
  - Information available in JESS for 10 days

EES File Upload/Download

- There are no changes to the EES file upload/download format
- Existing file upload format supports the inclusion of the eTag ID and import resource special exception on DAM transactions
  - ISO-NE validations of the file upload document are modified accordingly

Questions

Interface Bid Example

Interface Bid Example

Scenario: Transaction from NYISO to ISO-NE only in RTM

Pre-CTS	Post-CTS
Participants submit: • ISO-NE participant submits fixed export to ISO-NE RTM • NYISO participant submits priced import to NYISO RTM, say $28	**Participants submit:** • CTS Interface Bid NE→ NY at price = $3
RTC results: • Forecasted NYISO price = $30, transaction clears, scheduled in RT	**RTC results:** • Forecasted ISO-NE price = $26 • Forecasted NYISO price = $20
Possible financial outcome: • ISO-NE RTM price = $34 • NYISO RTM price = $30 • Net = -$4 [NYISO clearing does not take into account ISO-NE prices]	**Outcome:** $20-$26 = -$6 < $3 Transaction would not be cleared by NYISO RTC

Interface Bid Scenario

Scenario: CTS bids from NYISO to ISO-NE only in RTM

Participants submit:

- CTS Interface Bid NY→ NE at price = $3/MWh

RTC results for one interval:

- Forecasted NYISO price = $20/MWh, forecasted ISO-NE price = $25/MWh
  - Forecasted price difference = $25 – $20 = $5/MWh
- Transaction is cleared by NYISO RTC

Settlement outcome examples:

- Settlement based on final RTM prices in both ISO-NE and NYISO

	RTM Prices as Forecasted *15 Minute LMP ($/MWh)*	**RTM Prices Not as Forecasted** *15 Minute LMP ($/MWh)*
NYISO RTM prices	$20	$24
ISO-NE RTM prices	$25	$25
Net	**25 – 20 = $5**	**25 – 24 = $1**

Questions

Day-Ahead Market (DAM) Impacts

Submitting External Transactions

- Transactions on CTS interface continue to be submitted to NYISO and ISO-NE separately
- ISO-NE DAM transactions on CTS interface now require:
  - eTag ID
  - Import Resource ID, if applicable

DAM Clearing

- NYISO and ISO-NE continue to clear DAM independently
- Clearing at the CTS interface, Roseton PNode is modified to allow congestion due to external interface constraints
  - Congestion due to bids and offers at external node will be reflected in DAM clearing when the external interface constraint is binding

DAM Clearing Import Example

- Import transfer limit 800 MW
- System LMP (no internal constraints) = $40 /MWh

	Pre-CTS					Post CTS Implementation				
Submitted to DAM (MW)	**Cleared MW**	**Roseton LMP $/MWh**	**Energy Settlement**	**NCPC Settlement**	**Total Energy + NCPC**	**Cleared MW**	**Roseton LMP $/MWh**	**Energy Settlement**	**NCPC Settlement**	**Total Energy + NCPC**
Total Fixed Imports 1000	1000	40	$40,000	$(28,000)	$12,000	1000	-100	$(100,000)	$ -	$(100,000)
Counterflow Export -200 @ -$100/MWh	-200	40	$(8,000)	28,000	$20,000	-200	-100	$20,000	$ -	$20,000

- Fixed imports are treated as -$150/MWh in DAM clearing

Settlement MIS Report Sign Convention			
Import = + MWh	Export = - MWh	Payments = + $	Charges = - $

DAM Clearing Export Example

- Export transfer limit 700 MW
- System LMP (no internal constraints) = $50 /MWh

	Pre-CTS					Post CTS Implementation				
Submitted to DAM (MW)	Cleared MW	Roseton LMP $/MWh	Energy Settlement	NCPC Settlement	Total Energy + NCPC	Cleared MW	Roseton LMP $/MWh	Energy Settlement	NCPC Settlement	Total Energy + NCPC
Total Fixed Exports -1000	-1000	50	$(50,000)	$(135,000)	$(185,000)	-1000	500	$(500,000)	$ -	$(500,000)
Counterflow Import 300 @ $500/MWh	300	50	$15,000	$135,000	$150,000	300	500	$150,000	$ -	$150,000

- Fixed exports are treated as $1000/MWh in DAM clearing

Settlement MIS Report Sign Convention			
Import = + MWh	Export = - MWh	Payments = + $	Charges = - $

Questions

Forward Capacity Market (FCM) Impacts

Import Capacity Resource with Capacity Located in NYISO

Obligations

- Obligation to submit ISO-NE DAM transaction in EES continues and must now include reference to:
  - eTag
  - Import Capacity Resource ID
- Obligation to submit ISO-NE RTM transaction in EES is eliminated
  - No RTM External Transaction required or accepted in EES
- Generator supporting the import capacity resource maintain obligation in NYISO as if it is a capacity resource in NYISO

Import Capacity Resource with Capacity Located in NYISO

Evaluation of Obligations

- Failure to Offer evaluation in DAM unchanged
- Failure to Offer evaluation in RTM no longer applicable
- Failure to Deliver evaluation triggered if RT net interchange less than capacity requested by ISO
  - ISO-NE does not request capacity from NYISO unless system needs to be importing to maintain Total Operating Reserves
- Shortage event trigger is unchanged

Import Capacity Resource with Capacity Wheeling through NY

- Obligation to submit DAM and RTM transactions to EES is unchanged
  - Must submit NY Wheel transaction into JESS, same as today
- Failure of Offer evaluation in DAM and RTM is unchanged
- Failure to Deliver evaluation is unchanged
- Shortage event evaluation is unchanged

Questions

Prices, Constraints, and Publishing

Roseton Real-Time Price Calculation and Finalization

Roseton price will be available for three types of intervals:

- 5-minute
- 15-minute
- Hourly

Roseton RT Price Calculation and Finalization, *continued*

- **5-minute price** comes from the ISO-NE LMP calculator and does not include the CTS congestion
- **Hourly** and four, 15-minute prices are calculated after the hour is passed and will include CTS congestion
- **15-minute price** is calculated in two steps:
  - Use time-weighted formula to calculate a base LMP, by using the three, 5-minute LMPs calculated by ISO-NE LMP Calculator for this interval
    - Similar to current method of calculating hourly real-time LMPs
  - Apply the external congestion adder that is applicable to this 15-minute interval to calculate the final LMP

Hourly and 15-minute prices are reviewed and finalized in accordance with Market Rules

Web Publishing of *Preliminary* External Constraints and

Roseton Prices

- Preliminary external constraints, including constraint name and shadow prices, are published as soon as they are received from NYISO, usually before the interval begins
  - If shadow price exceeds the ISO-NE established thresholds, no constraint information is published for that interval
- Preliminary Roseton 5-minute, 15-minute, and hourly prices are published shortly after they are calculated
  - Preliminary data may not be published if the calculated values exceed ISO-NE established thresholds
- Preliminary external constraint, Roseton 5-minute, 15-minute, and hourly prices are available from both ISO Express and web services

Web Publishing of *Final* External Constraints and and Roseton Prices

- Final external constraints, Roseton 15-minute and hourly prices are published as soon as they are approved
- Final external constraints, Roseton15-minute and hourly prices are available from both ISO Express and web services

Settlements

Jin Thian

Supervisor, Monthly Markets

Coordinated Transaction Scheduling (CTS)

December 2015 Implementation

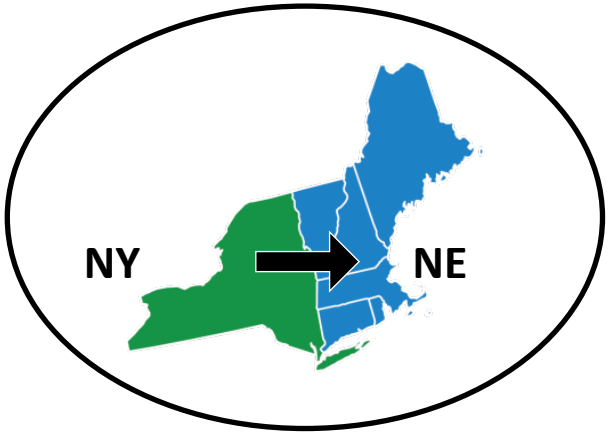
Two broad categories of real-time transactions at CTS location:

1. **Coordinated External Transaction (CET)**
2. **Non-CET**

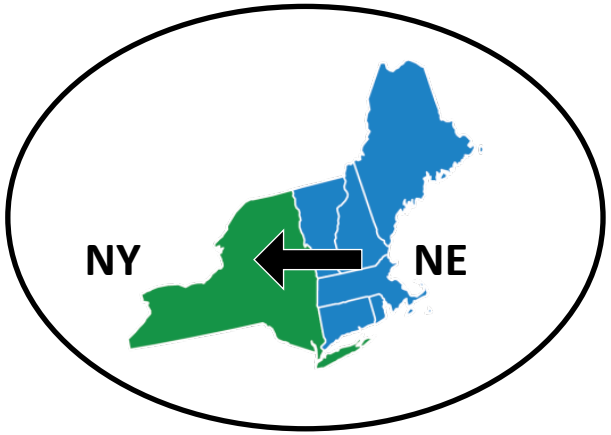
Please note that all information contained within this presentation relates to Roseton.

Coordinated External Transaction (CET)

CET in RTM is an interface bid between NYISO and ISO-NE energy markets



New York Export & New England Import

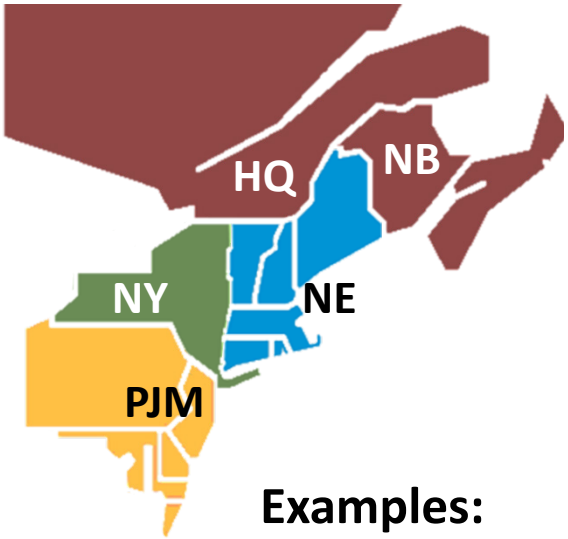


New England Export & New York Import

Non-CET

Non-CET: A wheeling transaction through one or more control areas

- New England may be source, sink, or “in the middle”



Examples:

1. NE→NY→PJM
2. HQ→NY→NE
3. NB→NE→NY

Real-Time Energy Settlement Changes for CTS

CTS location settlement interval will be 15 minutes

- 15 minute settlement interval at the CTS interface will be reported in a dedicated section of the *Real-Time Energy Market Locational Summary* report
- All real-time transactions at the CTS interface will be presented in this 15-minute reporting section: both CETs and non-CETs
- 15 minute data will be “rolled up,” and presented at the standard hour interval in the *Real-Time Energy Market Locational Summary* report

Real-Time Example – *Without* Day-Ahead Activity

100 MW − 0 MW = 100 MW
RT CET *DA* *Deviations*

100 MW x $50/MWh = $5000
Deviations *LMP* *$/hour*

$5000 / 4 = $1250
$/MWh *$ for Interval*

15 Minute Reporting

Interval	DA *MW*	RT CET *MW*	Deviations *MW* RT − DA	15 min. LMP *$/MWh*	$ for Interval **Deviations x 15 min. LMP / 4**
7:15	0	100	100	$50	$1250
7:30	0	100	100	$60	$1500
7:45	0	0	0	$70	$0
8:00	0	0	0	$80	$0

Sum / 4 **Sum**

Hourly Reporting

Hour Ending	DA	RT CET	Deviation	LMP	$ for Hour
08	0	50	50	$65	$2750

Note: This is a conceptual representation of the settlement report.

Real-Time Example – *With* Day-Ahead Activity

0 MW − 100 MW = -100 MW
RT CET *DA* *Deviations*

-100 MW x $70/MWh = -$7000
Deviations *LMP* *$/hour*

-$7000 / 4 = -$1750
$/MWh *$ for Interval*

15 Minute Reporting

Interval	DA *MW*	RT CET *MW*	Deviations *MW* RT − DA	15 min. LMP *$/MWh*	$ for Interval **Deviations x 15 min. LMP / 4**
7:15	100	100	0	$50	$0
7:30	100	100	0	$60	$0
7:45	100	0	-100	$70	-$1750
8:00	100	0	-100	$80	-$2000

Sum / 4 **Sum**

Hourly Reporting

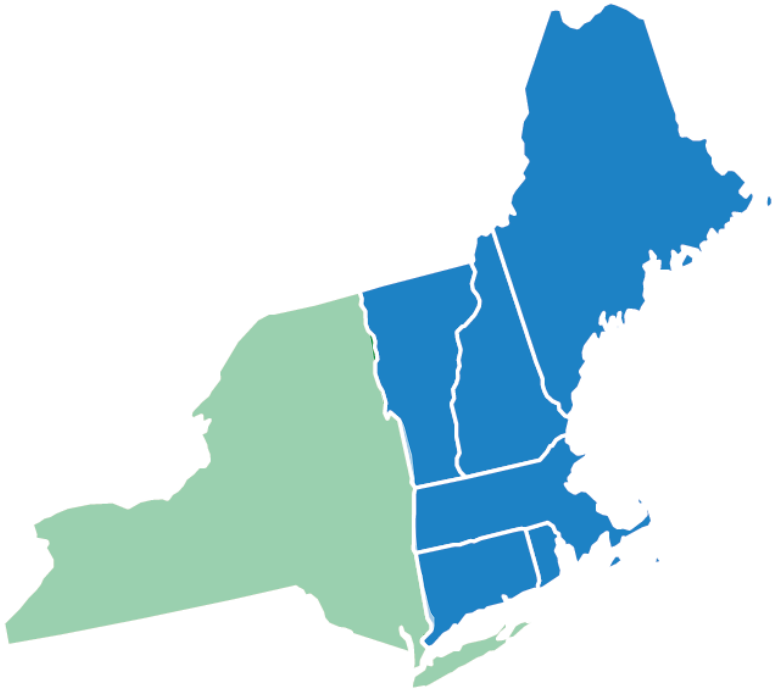
Hour Ending	DA	RT CET	Deviation	LMP	$ for Hour
08	100	50	-50	$65	-$3750

Note: This is a conceptual representation of the settlement report.

ISO-NE Settlement is for New England Activity Only

NYISO Settlement
New York export
New York import

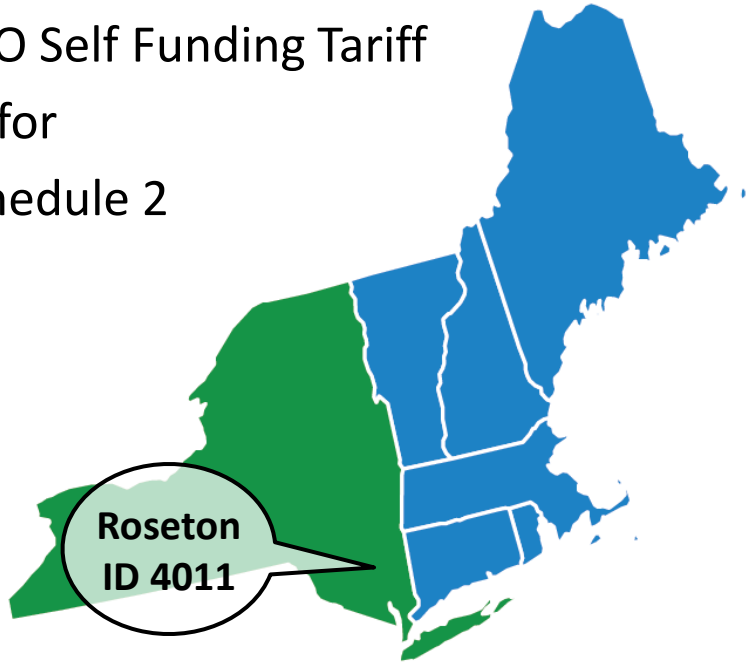
ISO-NE Settlement
New England import
New England export



Other Settlement Changes for CTS

- CETs not eligible for Net Commitment Period Compensation (NCPC) payments
- CETs exempt from cost allocation in the energy and ancillary services market
  - Day-ahead and real-time NCPC uplift
  - Regulation market charges
  - Inadvertent energy, marginal loss revenue, and emergency energy transactions
- CETs exempt from the cost allocators for ISO Self Funding Tariff Schedules 1-3, and from the cost allocator for Open Access Transmission Tariff (OATT) Schedule 2

For more detailed information, please refer to the appendix.



CTS Impact on Day-Ahead External Transaction Scenario

Before CTS, at Roseton node:
If a fixed transaction at Roseton exceeds the total transfer capability (TTC) in day-ahead, all transactions at Roseton pay the NCPC for counterflow

Under CTS, at Roseton node
If a fixed transaction at Roseton exceeds the total transfer capability (TTC) in day-ahead, the counterflow bids/offers set the LMP

All imports could clear as low as -$150
(import ***charged*** in energy market)

All exports could clear as high as $1000

See slides 36-38 for numerical examples.

FCM Settlement Changes for CTS

Forward Capacity Market (FCM) import resource backed by generation in New York with obligation at Roseton location

- FCM external transaction offer requirements

Day-Ahead Market	Real-Time Market
No change; note that EES submittal must include certain new information	• Real-time transaction requirement eliminated • Generation in NY must be offered as a capacity resource in the NYISO market

- FCM external transaction delivery requirements
  - FCM settlement change, where failure to deliver penalty incurred only if total energy delivered by the NYISO to ISO-NE constrained
- Shortage event availability
  - FCM settlement change, availability will be determined based on operation of NY generation associated with the import

FCM Settlement at CTS Location – Additional Note

FCM import resources backed by generation wheeled from another control area through New York, with obligation at Roseton location, will be subject to requirements and settlement evaluation **which are unchanged** for CTS

Wrap-Up – Settlement Reporting Changes

- Real-Time Energy Market reporting will be updated for 15-minute settlement interval sections
- Other market service reports will be updated with additional columns to reflect the cost allocation determinants after exclusion of CETs
- Detail of all MIS report changes will be provided at least 30 days prior to implementation of CTS project

Questions

Appendix

CTS – Market Settlement Impacts

Cost Allocation Exclusion – Energy and Ancillary Services Markets

CET exclusion from market cost allocations

- Energy Market
  - Inadvertent Energy, Marginal Loss Revenue, Emergency & Security Energy
- Net Commitment Period Compensation (NCPC)
  - Day-Ahead and Real-Time
    - Economic, Local Second Contingency Protection Resource, Voltage Support (VAR)
  - Posturing/Cancelled Starts/Hourly Shortfall
- Regulation
- MIS reports will have new columns for cost allocation determinants

CTS – Market Settlement Impacts

Cost Allocation Exclusion – Tariff Charges

CET exclusion from Tariff charges

- ISO Self Funding Tariff
  - Schedule 1, CET MW excluded from Through or Out (TOUT)
  - Schedule 2, CET hourly blocks excluded from Transaction Units
  - Schedule 2, CET import/export energy excluded from Volumetric charges
  - Schedule 3, CET MW excluded from TOUT
- Open Access Transmission Tariff (OATT)
  - Schedule 2, CET excluded from TOUT for VAR charges
- MIS reports will display determinants calculated with CET exclusion

Customer Support Information

Ask ISO (preferred)

- Self-service interface for submitting inquiries
- Accessible through the SMD Applications Homepage
- Requires a valid digital certificate with the role of Ask ISO/External User (Contact your security administrator for assistance)

Other Methods of Contacting Customer Support		
Method	**Contact Information**	**Availability**
Email	custserv@iso-ne.com	Anytime
Phone*	(413) 540-4220	Monday through Friday 8:00 a.m. to 5:00 p.m. (EST)
Pager (emergency inquiries)	(877) 226-4814	Outside of regular business hours

* *Recorded/monitored conversations*

Evaluations