



1150

Building the Energy Markets of Tomorrow . . . Today

SMD 2.0 Market Rule Changes



Topics Covered

- ✓ Overview
- ✓ Market Efficiency and Uplift Improvements
- ✓ Generator Bidding
- ✓ Reserve Market
- ✓ Regulation Market
- ✓ Transaction Bidding
- ✓ Mitigation
- ✓ Items of Special Interest

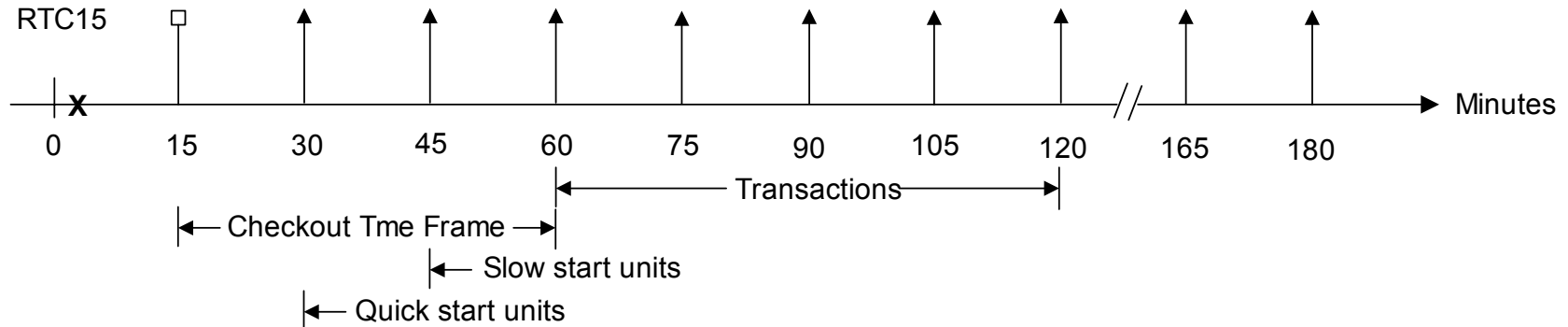


Overview - RTS Architecture

- ✓ Real-Time Scheduling (RTS)
 - Real-Time Commitment (RTC)
 - ✧ Replaces BME
 - ✧ Scheduling/commitment/de-commitment evaluation every 15 minutes.
 - Real-Time Dispatch (RTD)
 - ✧ Replaces SCD
 - ✧ Co-optimization of energy, reserve & regulation every 5 minutes in real-time
 - Corrective Action Mode (RTD-CAM)
 - ✧ Replaces SCD Special Modes



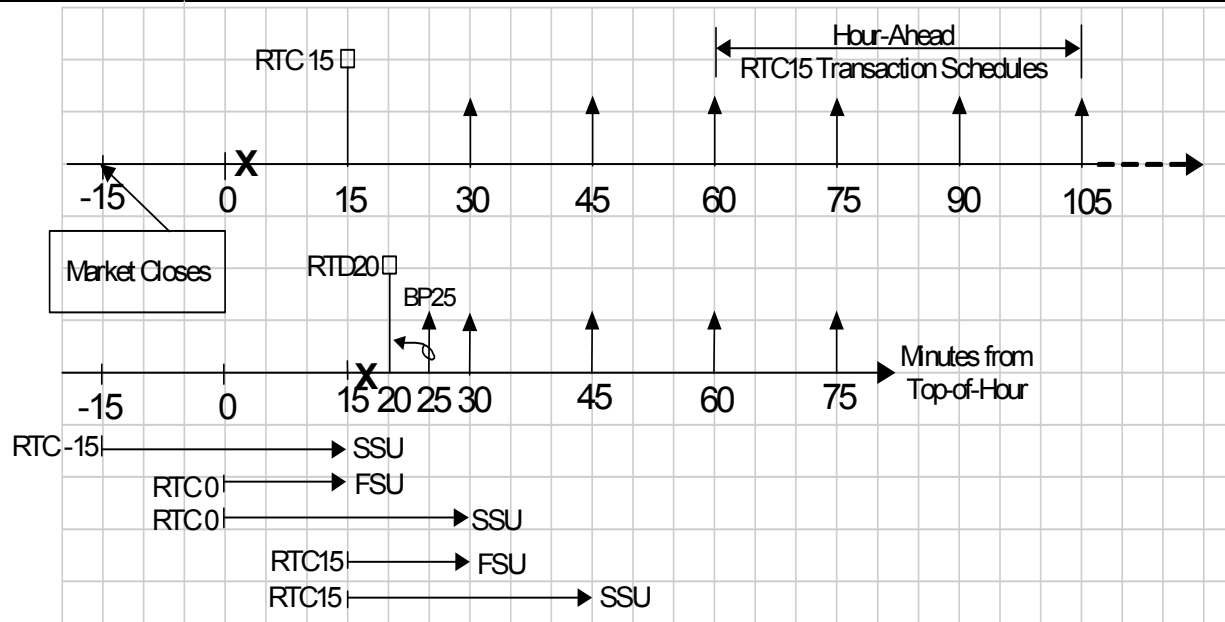
Overview - RTC Time Line



- ✓ Real-Time Commitment (RTC)
 - Executes every 15 minutes
 - Schedules in 15 minute increments
 - Optimizes over 10 $\frac{1}{4}$ hr periods – total 2 $\frac{1}{4}$ hours
 - Schedules Transactions
 - Initially hourly, supportive of $\frac{1}{4}$ schedules
 - Commits 10 and 30 min start resources
 - Recognizes unit startup times and costs



Overview - RTC and RTD Time Line



- ✓ Real-Time Dispatch (RTD)
 - Executes every 5 minutes
 - Optimizes over a 50, 55 or 60 minute period
 - Incorporate transaction schedules and self-schedules
 - Dispatches resources committed by RTC
 - Determines reserve and regulation schedules



Overview – RTD-CAM

- ✓ Corrective Action Mode
 - Run on-demand by the system operators

- ✓ RTD-CAM execution options include
 - Reserve pickup
 - Max Gen pickup
 - Base points ASAP, no commitments
 - Base points ASAP, commit as needed
 - Re-sequencing



Market Efficiency & Uplift Improvements

- ✓ All latent reserves are visible and available to the optimization programs for scheduling as energy or reserves
 - Eliminates artificial scarcity sometimes seen in hourly scheduling by BME today.
 - Eliminates price inconsistencies between commitment and dispatch programs as both are operating with consistent energy, reserve and regulation constraints.
 - Real-time availability bids must be \$0. Recognizes that units available to supply energy have a \$0 cost to supply reserves.

- ✓ Demand curves for Reserve and Regulation
 - Incorporates shortage cost into both the reserve and energy prices (both day-ahead and real-time).
 - Except for an EDRP/SCR call, scarcity pricing is fully integrated into the pricing algorithms rather than administratively determined.
 - Recognition of all latent reserves to ensure shortage conditions are valid versus the current system which can be short because available reserve capacity simply didn't bid into the market.



Market Efficiency & Uplift Improvements

- ✓ Clearing price for ancillary services more accurately reflects the true cost of acquiring these services
 - Eliminates separate Lost Opportunity Cost payments uplifted via RS-1.
 - Marginal LOCs incorporated into a published, and therefore more readily hedgeable clearing price.
- ✓ Two settlement system for Ancillary Services
 - Loads purchase full ancillary service requirement in the day-ahead market.
 - Real-time balancing obligation lies with suppliers with a day-ahead schedule.
 - Eliminates additional costs in today's market due to re-optimization or procurement of replacement services in real-time.



Market Efficiency & Uplift Improvements

- ✓ Load forecast at $\frac{1}{4}$ hour increments
 - New more robust real-time load forecasting tool
 - 15 minute versus hourly granularity allows greater refinement of forward load profile to better match scheduling and commitment of resources.
- ✓ $\frac{1}{4}$ hour commitment/de-commitment and scheduling of supply
 - 10 & 30 minute start resources are brought online closer to when they are actually needed.
 - Minimizes delay in shutting down uneconomic resources that have run out their min-run times.
- ✓ Real Time Market Power Mitigation
 - AMP style conduct and impact testing



Market Efficiency & Uplift Improvements

- ✓ Units dispatched and responding consistent with pricing.
 - RTD ability to re-optimize dispatch of energy, reserves and regulation every 5 minutes.
- ✓ 3-part bidding in real-time
 - Start-Up, Min Gen Cost & Incremental Cost are part of RTC and RTD-CAM evaluation to commit fast-start resources.
- ✓ Real-Time Demand Response for Reserves
 - Potential to increase competition in reserve markets.
 - Provides a means for a load to be truly price responsive. Loads capable of responding and exposed to real-time prices would receive the reserve clearing price for the option to call on them and avoid high energy prices when actually dispatched.



Generator Bidding Changes

- ✓ General Bidding Features
 - 3-part bidding (startup cost, minimum generation cost and incremental energy cost) permitted for all units in real-time.
- ✓ Startup Cost Bid
 - Startup cost as a function of the number of hours since shutdown (increasing or decreasing) or a unique startup cost for each hour of the day.
 - Where a startup cost is specified for a given hour, it will take precedence over the cost curve value.
 - Hourly startup costs allow units to better manage commitment at the end of the day.



Generator Bidding Changes

- ✓ Incremental Energy Bid
 - SCUC and RTS will use only stepped bids.
 - Up to eleven monotonically increasing constant cost incremental energy steps are permitted.
 - Energy bid must cover the full range of the unit being offered, from the physical minimum generation MW to the DMNC.
- ✓ Upper Operating Limit (UOL)
 - All units specify both a Normal and Emergency UOL.
 - Emergency UOL must be $>$ or $=$ the Normal UOL
 - ISO procedures will permit activation of Emergency UOLs in SCUC or real-time



Generator Bidding Changes

- ✓ Minimum Run Time
 - The minimum amount of time for which an energy resource can be committed. The values allowed in RTC can be as little as 15 minutes to a maximum of 1 hour.

- ✓ Startup Time
 - The time needed start and synchronize the resource and load the resource to its minimum generation level. RTC can commit resources with a startup time of 30 minutes or less.
 - ✧ This provides an improvement over current capabilities by allowing for scheduling closer to real time conditions.



Generator Bidding Changes

- ✓ **Minimum Down Time**
 - The minimum down time is honored by RTC unless a unit has at least one hour of a Day-Ahead Market commitment included as part of the 10 period RTC window. In this situation, RTC will automatically reset the bid minimum down time parameter to one hour at the start of its evaluation.

- ✓ **Emergency Response Rate**
 - RTD-CAM will use the higher of the emergency response rate or the normal response rate during the corrective actions of reserve pickup and maximum generation pickup. The emergency rate may be no less than the capacity weighted average of the normal response rates.
 - ✧ Allows for more accurate reflection of a unit's actual capability



Generator Bidding Changes

✓ Unit Status

- ISO-Committed Flexible – ISO committed and dispatched for energy, reserves and optionally regulation. Unit follows a 5 minute, or if regulating a 6 second basepoint.
- Self-Committed Flexible – MP self-committed and self-scheduled lower limit that can be dispatched for energy, reserves and optionally regulation. Unit follows a 5-minute, or if regulating a 6 second basepoint above a bid lower limit.
- ISO-Committed Fixed – Unit will be ISO-committed and economically dispatched for energy only in the DAM and will be treated as a self-scheduled fixed unit in real-time.
- Self-Committed Fixed – MP committed and MP specified fixed MW schedule for energy only.



Generator Bidding Changes

- ✓ Self-Schedule MWs
 - A self-scheduled unit will provide a single self-scheduled MW value for a given hour in the day-ahead market.
 - In RTS, self-scheduled units may provide a different MW value for each $\frac{1}{4}$ hour period in a given hour.
 - The unit will be pre-ramped such that it arrives at its self-schedule level for the specified $\frac{1}{4}$ hour period.
 - Self-schedule levels will be financially binding.



Generator Bidding Changes

- ✓ The allowable unit status in a particular hour of the Real-Time market is restricted based on the status bid in the Day-Ahead market.

Day Ahead	Real Time		
	ISO-Committed Flexible	Self-Committed Flexible	Self-Committed Fixed
ISO-Committed Flexible	Yes	Yes	By exception only
Self-Committed Flexible	No	Yes	By exception only
ISO-Committed Fixed	No	No	Yes
Self-Committed Fixed	No	No	Yes
No Day-Ahead Schedule	Yes	Yes	Yes



Generator Bidding Changes

- ✓ Internal units are eligible to bid ancillary services as indicated in the table below.

Status	Start-Up	10-Spin	10-NS	30-Spin	30-NS	Regulation
ISO-Committed Flexible		✓		✓		✓
ISO-Committed Fixed						
Self-Committed Flexible		✓		✓		✓
Self-Committed Fixed						
Off-line	10-minute		✓			
	30-minute				✓	



Generator Bidding Changes

- ✓ Notable characteristics that remain unchanged for Generator Bids
 - Real-Time bids for energy and ancillary services will be locked 75 Minutes before the beginning of the hour.
 - Prices under the Day-ahead scheduled portion of incremental energy bid cannot be increased.
 - The Minimum Generation Bid is defined by a total minimum generation cost in \$ per hour to operate at the minimum generation MW and may change hourly.
 - The Maximum Stops Per Day parameter is enforced only by SCUC.
 - SCUC honors the minimum down time within the 24-hour evaluation period only; requirements across midnight are not recognized.



Reserve Market Changes

- ✓ Bidding & Scheduling
 - All resources bidding as ISO-committed flexible or Self-committed flexible (i.e. a dispatchable resource) will participate in the reserves markets.
 - Reserve capabilities are inferred from the unit's stated response rate and will be limited at the top of their dispatch range by the applicable Emergency or Normal UOL.
 - Availability bids are not used in real-time for all categories of reserve and thus are not submitted.
 - Availability bids are permitted for reserves day-ahead, however if no offer is entered then a \$0 offer is assumed.



Reserve Market Changes

✓ Pricing

- Reserve market clearing prices will be set based on the shadow prices (SCUC & RTD)
- Shadow price incorporates marginal Lost Opportunity Costs (LOC) and availability bids, if any (SCUC & RTD).
- Real-time reserve services will be scheduled and settled, nominally on a 5-minute basis (RTD).
- Reserve prices impact LBMP only when the NYCA is capacity constrained locationally or statewide, and serving the next Mw of load creates or increases the shortage.



Reserve Market Changes

- ✓ Settlement
 - Full two-settlement for reserves (SCUC & RTD).
 - Day ahead obligations balanced against real time schedules.
 - Suppliers with net real time reserve schedules will be settled at real time prices.
 - Reserve MWs converted to energy would be paid the RT LBMP price based on actual output.
 - Modified the Day Ahead Margin Assurance Payment due to the addition of the 2nd settlement for reserve services to ensure suppliers are “held harmless” from their day-ahead schedules when rescheduled by the ISO in real-time.



Reserve Market Changes

- ✓ Reserves during a RTD-CAM Reserve Pickup
 - Continue to solve for reserve requirements.
 - Continue to calculate and set energy and reserve prices.
 - Reserve demand curves remain active.
 - Regulation requirement is suspended.
 - Two modes of Reserve Pickup
 - ✧ Large Event - Does not allow units to be backed down
 - ✧ Small Event - May back down units as part of the reserve pickup
- ✓ Changes to Penalties
 - Remove explicit reduction in availability payment based on daily performance index for reserve pickups.
 - Remove requirement to purchase replacement energy at LBMP for failure to perform during a reserve pickup.
 - Remove 30-minute reserve penalties.
 - ✧ Incentives to perform are inherent in a two-settlement system, reducing the need for penalties.



Reserve Market Changes

- ✓ Demand Curves
 - Applied for all categories and locations of reserve and will remain in place throughout all modes of operation.
 - Consistent demand curves will be applied in SCUC, RTC and RTD.
 - Reserve demand curves will be applied for each of the reserve constraints including:

	NYCA	East	LI
Spin	\$500	\$25	\$25
10-Total	\$150	\$500	\$25
30-Total	200 MW @ \$50, 200 MW @ \$100 and remainder @ \$200	\$25	\$300



Reserve Market Changes

- ✓ Notable characteristics that remain unchanged for Reserves
 - Locationally Priced – East & West.
 - Long Island pricing rules continued.
 - All units paid for overgeneration at LBMP during a reserve pickup.
 - Units responding to a reserve pickup will not incur performance penalties for overgeneration for 3 RTD intervals following the termination of the reserve pickup.
 - Like all other dispatches, persistent undergeneration penalties during a reserve pickup will be assessed at the regulation clearing price.



Regulation Market Changes

- ✓ Bidding and Scheduling
 - Suppliers must bid as ISO-committed flexible or self-scheduled flexible in order to be eligible to provide regulation.
 - Regulation suppliers must specify both the maximum amount of regulation offered (MW) and an availability offer (\$/MW).



Regulation Market Changes

✓ Pricing

- Regulation market clearing prices will be set based on the shadow prices (SCUC & RTD)
- Shadow price incorporates marginal Lost Opportunity Costs (LOC) and availability bids (SCUC & RTD).
- Real-time regulation service will be scheduled and settled, nominally on a 5-minute basis (RTD).
- Regulation prices impact LBMP only when the NYCA is capacity constrained and serving the next Mw of load creates or increases the shortage.



Regulation Market Changes

- ✓ Settlement
 - Full two-settlement for regulation (SCUC & RTD).
 - Day ahead obligations balanced against real time schedules.
 - Suppliers with net real time regulation schedules will be settled at real time prices.
 - Added a Regulation Revenue Adjustment Payment (“RRAP”) and Regulation Revenue Adjustment Charge (“RRAC”) to ensure that regulation providers are properly compensated for regulating relative to the LBMP and their economic RTD basepoint.
 - Modified the Day Ahead Margin Assurance Payment due to the addition of the 2nd settlement for regulation services to ensure suppliers are “held harmless” from their day-ahead schedules when rescheduled by the ISO in real-time.



Regulation Market Changes

- ✓ Demand Curve
 - The software will employ a regulation demand curve throughout all modes of operation in which regulation is scheduled (i.e., the NYCA regulation requirement).

	NYCA
Regulation	25 MW @ \$250 and remainder @ \$300



Regulation Market Changes

- ✓ Notable characteristics that remain unchanged for Regulation
 - Single, Statewide Price.
 - A performance index (PI) will be calculated for those units being paid for regulation. The PI is calculated for units providing regulation service in real time and is used to prorate payments based on their real time performance.



Transaction Bidding Changes

- ✓ ICAP Pre-scheduled Transactions
 - In-day pre-scheduled transactions for deliverability of external ICAP is being implemented on an hourly basis.
 - When called on for deliverability, ICAP pre-schedules will be assigned the highest economic scheduling priority in real-time.
- ✓ Settlement for failed transactions
 - Creation of an explicit “Financial Impact Charge” in order to provide billing clarity for charges currently assessed on failed external transactions.



Transaction Bidding Changes

- ✓ Notable characteristics that remain unchanged for Transactions
 - Day-ahead transaction pre-scheduling capability is maintained.
 - SCUC permits bidding hourly or as multi-hour block transactions.
 - RTS permits hourly bidding only.
 - One MW quantity and price for a transaction per hour.
 - Transactions in RTS must be submitted no later than 75 minutes before the start of the hour.



Mitigation Changes

- ✓ Day-Ahead AMP
 - Inclusion of startup and minimum generation mitigation statewide.
 - Process allows for time-of-day varying reference levels for startup bids to reflect costs associated minimum run times that cross midnight.
 - Modeling and mitigation will recognize intra-zonal congestion in the load pockets.
 - Load Pocket Thresholds will be determined by the frequency of constrained hours in the DAM.
 - Temporal selectivity incorporated; energy mitigated only for hours of failed conduct and impact tests.
 - The trigger will be based on congestion into NYC.
 - Con Ed mitigation measures requiring spin-capable units to bid a \$0 availability bid day-ahead are maintained.
- ✓ Real-Time AMP
 - Extension of Real-Time AMP capabilities beyond New York City.
 - Modeling and mitigation of NYC load pockets moved into RTS and incorporates full conduct and impact tests.



Items of Special Interest

- ✓ Reserve and Regulation Demand Curve Modification
 - Operations remains able to buy reserves to respond to operational or reliability problems that arise in real-time.
 - Notice of such a purchase will be posted as soon as reasonably possible and reported on at the next meeting of the Business Issues Committee.
 - The NYISO is seeking authority to temporarily modify the curve points for a period of 90 days, pending FERC approval, and when possible, will consult with market participants in advance.
 - The NYISO shall periodically review the curves to determine whether they should be adjusted.



Items of Special Interest

- ✓ Real-Time Demand Response
 - Tariff language included to permit demand side resources to supply non-synchronous reserves in the real-time market.
 - The RTS architecture has been designed and developed to support the modeling and inclusion of demand side supply.
 - There is not yet agreement on the specifics of an implementation that would meet the needs of interested participants.
 - This capability is intended to be developed and will be pursued when a stakeholder proposal is finalized.



Items of Special Interest

- ✓ SMD2/RTS development and coordination efforts
 - Monitored for consistency with the FERC SMD market standardization initiative.
 - With consultation and participation of staff and stakeholders from neighboring ISOs.
 - Incorporates other strategic infrastructure developments that improve on SEAMs issues such as:
 - ✧ Facilitated Checkout
 - ✧ E-Tag Integration and Automation
 - ✧ Ability to Model Multiple Proxy Buses



✓ Questions?

