

# Bid/Offer Evaluation Process

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**LBMP In-Depth**

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Remote Learning

# Session Topics

- **Overview: Bid/Offer Evaluation Process**
- **Day-Ahead Market Bid/Offer Evaluation Process**
  - SCUC – Outputs and Inputs
  - SCUC- Scheduling Process
    - 4 Pass Methodology
    - Components of each Pass
- **Real-Time Market Bid/Offer Evaluation Process**
  - RTC: Real Time Commitment Process
  - RTD: Real Time Dispatch Process
  - RTD-CAM: Real Time Dispatch-Corrective Action Mode
- **Supplemental Resource Evaluation (SRE Process)**

# Session Objectives

- **At the end of this module, learners will be able to:**
  - Describe the purpose of the Bid/Offer Evaluation process and the Day- Ahead and Real-Time Software components involved
  - List the main outputs from the Day Ahead Scheduling software – SCUC
  - Describe how the various inputs are processed by the SCUC to arrive at the Day-Ahead schedules and prices for generation, load and external transactions
  - Explain the SCUC scheduling process: The 4-pass methodology and the components of each pass
  - Reproduce a timeline of events that constitute the Day Ahead Scheduling Process
  - Identify the various components of the Real Time Bid/Offer Evaluation process

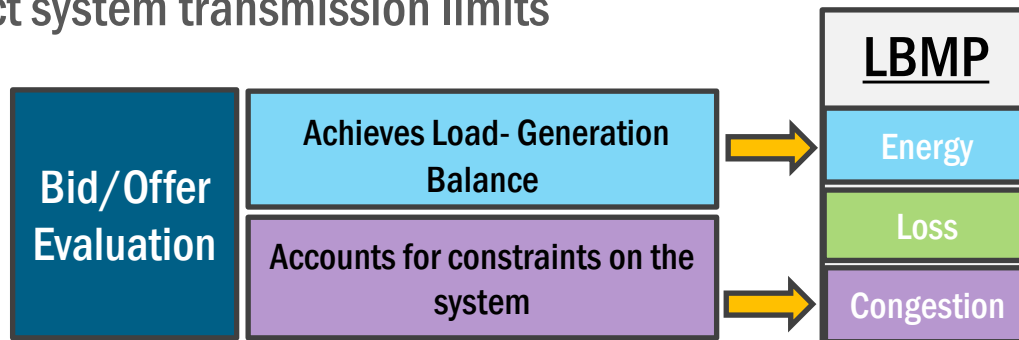
# Session Objectives (cont'd)

- List the main outputs from the RTC/ RTD
- Describe how the various inputs are processed by RTC/RTD to arrive at the Real-Time schedules and prices for generation, load and external transactions
- Explain the RTC process of commitment and dispatch of internal generators and External Transactions
- Explain the RTD process of dispatch and the interactions between RTC and RTD
- State when and why RTD-CAM is activated and detail the 5 modes of activation
- Reproduce a timeline of events that constitute the Real-Time scheduling process
- Describe the Supplemental Resource Evaluation (SRE) process and timeline

# Overview: Bid/Offer Evaluation Process

# Bid/Offer Evaluation Process

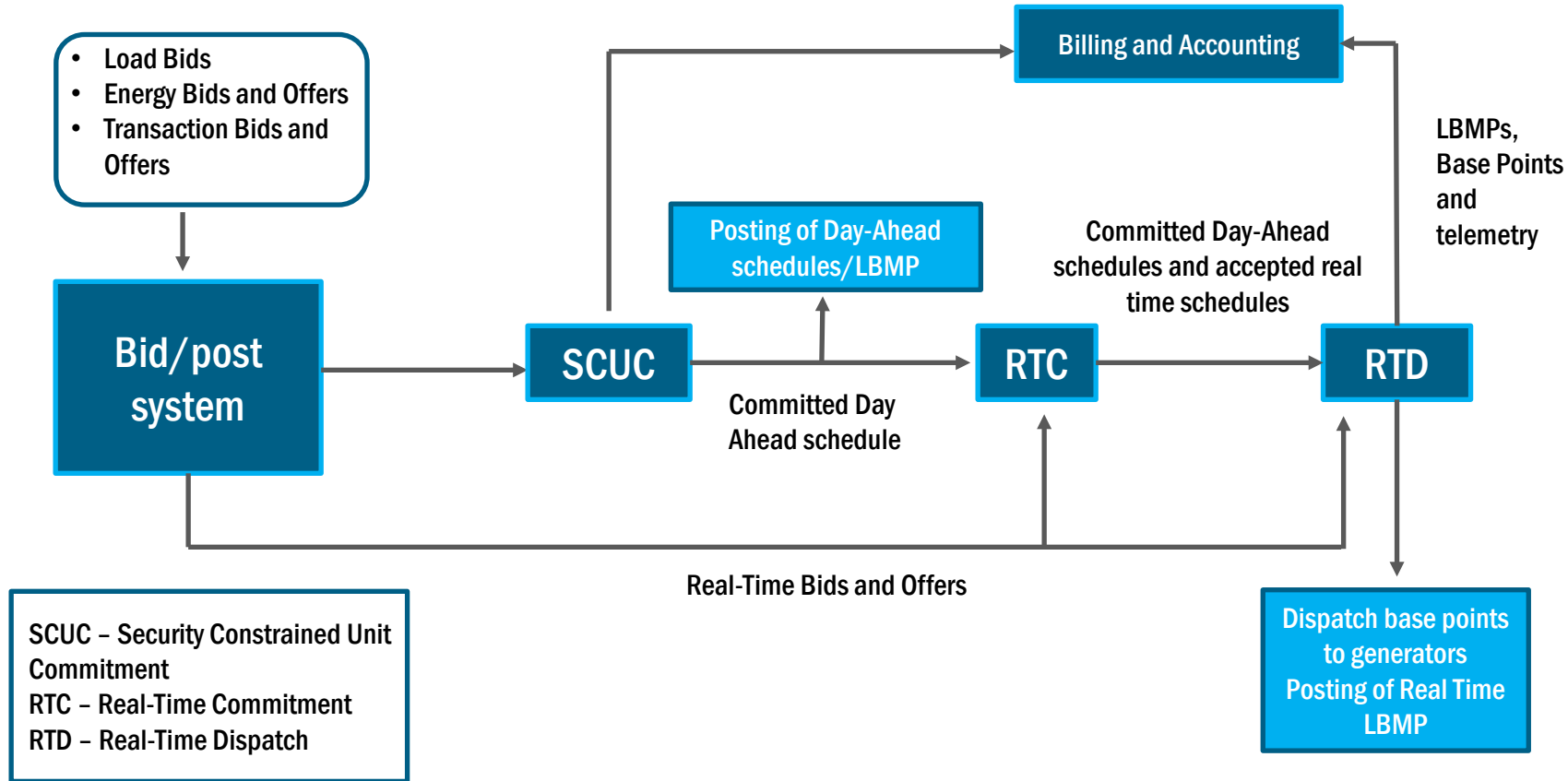
- Purpose:
  - Use Economic Dispatch to meet Load requirements, while honoring reliability standards
  - Co-optimize energy, operating reserves and regulation bids in order to minimize total as-bid cost of production
  - Respect system transmission limits



# Bid Offer Evaluation Process

- **Day-Ahead Market:**
  - Security Constrained Unit Commitment (SCUC) scheduling software optimizes to solve simultaneously for Energy, Operating Reserves and Regulation service requirements to minimize total bid production costs
- **Real-Time Market:**
  - Real Time Software (RTS) co-optimizes to solve simultaneously for energy, operating reserves and regulation service requirements, while accounting for system changes over its optimization timeframe
    - **Four software modules working together:**
      - Real-Time Commitment (RTC)
      - Real-Time Dispatch (RTD)
      - Real-Time Commitment – Automated Mitigation Procedure (RTC-AMP)
      - Real-Time Dispatch – Corrective Action Mode (RTD-CAM)

# Day Ahead to Real Time Process





# Bid/Offer Evaluation Process

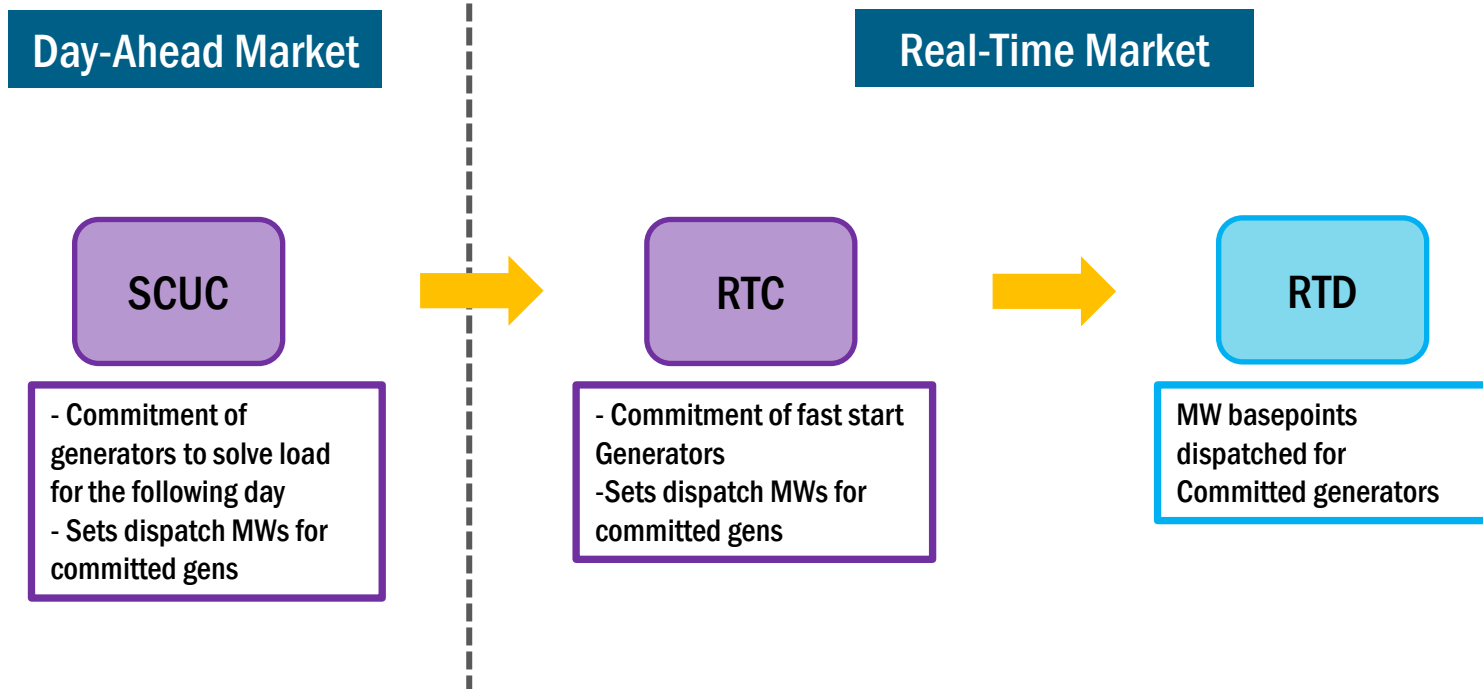
## ■ Unit Commitment:

- Process of selecting units from the available generators to meet the demand
- Determines start-up and shut-down schedule of all production units
- Refers to the NYISO scheduling a generator to start-up to run at, or above, its minimum generation level

## ■ Unit Dispatch:

- Follows Commitment
- For each Day-Ahead or Real-Time interval, determines the actual power output of each of the committed generating units needed to supply demand while complying with Transmission limits
- **RTD** dispatches the resources committed by the **SCUC** and **RTC** and provides base points for injecting or withdrawing MWs on the grid

# Bid/Offer Evaluation Process



# Day Ahead Market Bid/Offer Evaluation Process

# Day-Ahead Market Evaluation Process

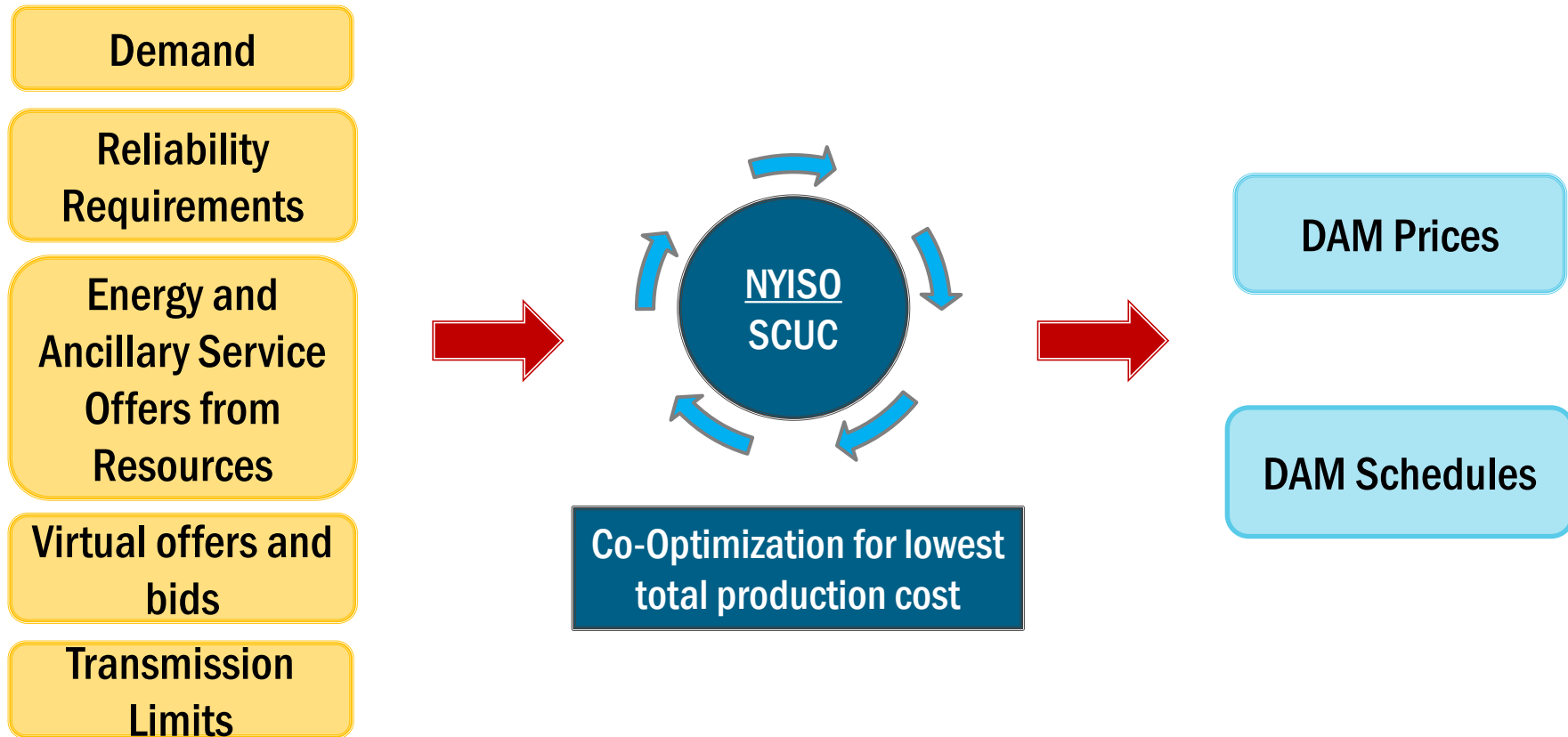
- SCUC- Objective and Overview
- Outputs and Inputs
- Day-Ahead Scheduling Process
  - 4 Pass Methodology- SCUC
  - Components of Each Pass - SCUC
- Timeline (Summary)

# SCUC - Overview

# SCUC – Overview

- **Purpose:**
  - Establishes Day-Ahead schedules for generation, load, and transactions
  - Uses economic dispatch to meet demand while minimizing total as-bid production costs
  - Respects Transmission limits and system ramp constraints
  - Accounts for forecast load, bid load, and ancillary service requirements; also includes virtual supply/load bids and demand response bids

# SCUC - Overview



# SCUC – Outputs and Inputs



# SCUC – Primary Outputs

## Hourly Prices – Next Day of Operation

- Energy Market Clearing Price (LBMP)
  - Generator: Bus level
  - Load: Zonal
  - Transactions: Proxy Bus level
- Operating Reserve Prices
  - By Location and Product type
- Regulation Market Clearing Prices
  - Statewide Regulation Capacity Price

## Hourly Schedules – Next Day of Operation

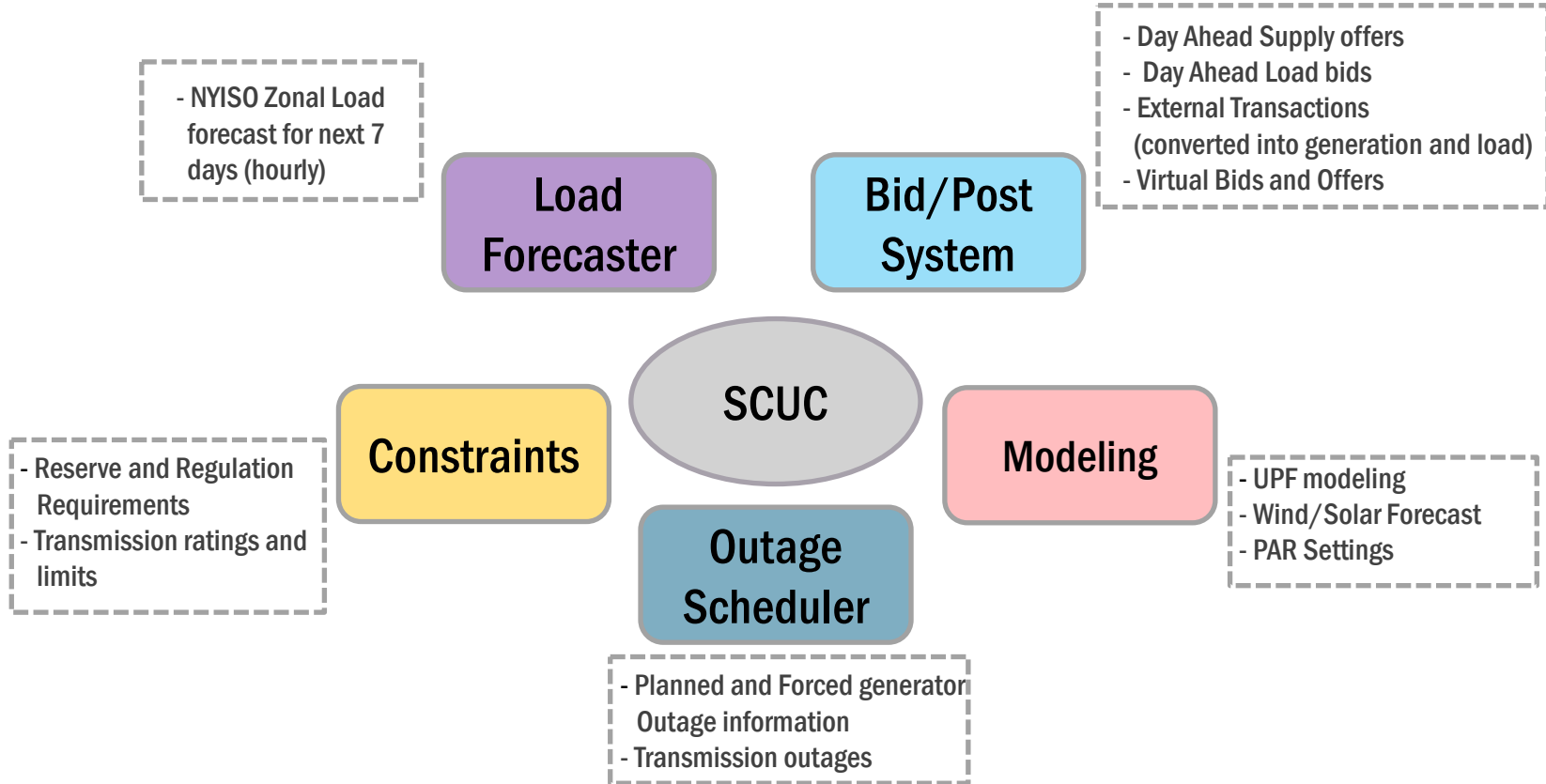
- Generator Schedules
- Operating Reserve Schedules
- Regulation Schedules
- External Transaction Schedules

**Also posted: The 7 Day Advisory NYISO Forecast, Updated Total Transfer Capabilities (TTCs) and Available Transfer Capabilities (ATCs), Limiting constraints and PAR flows**

# SCUC – Primary Inputs

- Load Forecast
- Bids/Offers
- Transmission and Generator Outage information
- Transmission Limits
- Modeling inputs

# SCUC – Where Inputs come from



# Demand – Load Bids and NYISO Forecast

## Load Bids

- Bids entered by LSEs to purchase energy in the Day-Ahead Market
- Load Bids could be
  - Fixed Price Load Bids, AND/OR
  - Zonal Price Capped Load Bids
  - Virtual Supply/Load (Virtual Supply is treated as negative load)
  - Export Transactions
- SCUC solves for Load Bids in the First Pass – Bid Load Pass

## NYISO Forecast

- Developed using zonal forecast models and historical load patterns for the next 7 days
- SCUC solves for additional generators required to meet the NYISO forecast load in the Second Pass – Forecast Load Pass

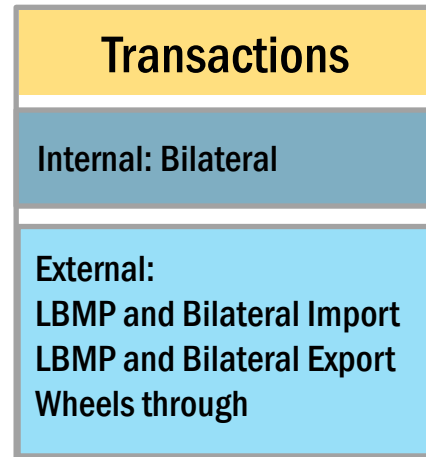
# Generator Parameters

## Generator Parameters

Registration Parameters	Supply Offer			
<ul style="list-style-type: none"> <li>Physical Upper and Lower Operating Limits</li> <li>Normal and Emergency Response Rates</li> </ul>	Commitment Parameters	Energy Bid	Unit Operating Modes	Ancillary Services
	<ul style="list-style-type: none"> <li>Minimum Run Time</li> <li>Minimum Down Time</li> <li>Max Stops/Day</li> <li>Expiration Date</li> </ul>	<ul style="list-style-type: none"> <li>Normal and Emergency Upper Operating Limit (UOLN and UOLE)</li> <li>Lower Operating Limit (LOL)</li> <li>Bid Curve ( 11 points)</li> <li>Minimum Generation Cost / MW</li> <li>Startup Bid</li> </ul>	<ul style="list-style-type: none"> <li>ISO Committed Fixed</li> <li>ISO Committed Flexible</li> <li>Self Committed Fixed</li> <li>Self Committed Flexible</li> </ul>	<ul style="list-style-type: none"> <li>Operating Reserve Bid Price</li> <li>Regulation Service Bid               <ul style="list-style-type: none"> <li>- Capacity Bid MW &amp; Price</li> <li>- Movement Bid Price</li> </ul> </li> </ul>

# Transactions

- Internal Bilateral Transactions are tabulated and automatically approved
- Transactions into or out of the NYCA will be scheduled based on economics and Available Transmission Capacity (ATC)
- Transactions are converted to equivalent generation and load in order to allow SCUC to consider them
- Transactions must be bid for minimum 1 hour
  - MHBTs: Transactions bid for multiple hours



# Virtual Trading Bids and Offers

- In the SCUC, Virtual Supply Offers and Virtual Load Bids are considered in the first Pass and the fifth pass (will be explained later)
- Virtual Offers and Bids impact DAM LBMP Calculation
  - No effect on Real-Time physical energy consumption

$$\text{Bid Load} = \frac{\text{Physical Load}}{\text{Load}} + \text{Virtual Load} - \text{Virtual Supply}$$

# Effect of Virtual Bids on Day Ahead Market Price

DAM Solution with no Virtual Bids/Offers	
Day-Ahead Market Load	MWh
Physical Load Bid	200
Supply stack that supplies Load:	
Resource A 50 MW @ \$20	50
Resource B 50 MW @ \$25	50
Resource C 110 MW @ \$30	100
Resource D 150 MW @ \$40	
	200
Marginal Energy Cost is <u>\$30</u> in the DAM	

DAM Solution with the addition of Virtual Bids/Offers	
Day-Ahead Market Load	MWh
Physical Load Bid	200
Supply stack that supplies Load:	
Resource A 50 MW @ \$20	50
Virtual Load - 45 MW @ \$22	-45
Resource B 50 MW @ \$25	50
Virtual Supply 30 MW @ \$28	30
Resource C 110 MW @ \$30	110
Resource D 150 MW @ \$40	5
	200
Marginal Energy Cost is <u>\$40</u> in the DAM	



# PAR Modeling

- PAR (Phase Angle Regulator) modeling:
  - PARs used to control the phase angle across transformers
    - Allows transformers to regulate the power flow through it
    - PARs can be used to prevent line overloads
  - Typical PAR schedule for SCUC is the previous like day's PAR schedule + any modifications due to anticipated or maintenance facility outages

# Unscheduled Power Flow Modeling

- The measured difference between actual and scheduled flow at the NY (NYISO)
- Normally determined on a historical rolling 30-day average, an on peak and off-peak value are calculated
- Scheduled MW in the Day Ahead Market that changes weekly, typically the same for market days Wednesday to Tuesday
- **Lake Erie Circulation**
  - The measured difference between actual and scheduled flow at the NY (NYISO) and Ontario (IESO) border
  - More actual flow into NY than scheduled is referred to as Clockwise circulation
  - Less actual flow into NY than scheduled is referred to as Counter-Clockwise circulation

# IPR Forecasting

- Wind and Solar IPR Forecasts:
  - Day Ahead Forecasts produced twice a day – 4 a.m and 4 p.m
  - Forecasts based on hourly averages
  - Wind and solar power forecasts will be an input to Pass 2 (Forecast pass), regardless of whether the IPR generator provided a bid

# Day-Ahead Scheduling Process

# Day-Ahead Scheduling Process

## Assembly of Day-Ahead Outages:

- The transmission system outages scheduled for the next day are extracted from the TOA Outage Scheduling system
- Used to update transmission limits during SCUC initialization and to provide SCUC with a network topology that reflects expected transmission capability

## Assembly of Day-Ahead Reliability Units:

- Resources committed in the DAM solely for reliability reasons, irrespective of economic merit
- Requests made by Transmission owners (TOs) for local reliability needs or NYISO for state-wide reliability

## Production of preliminary NYISO Zonal Load forecasts:

- Prepared by the Load Forecast program
- Independent of LSEs' forecasts



```
graph TD; A[Assembly of Day-Ahead Outages] --- B[Assembly of Day-Ahead Reliability Units]; B --- C[Production of preliminary NYISO Zonal Load forecasts]; C --- D[SCUC Initialization]; D --> E[Execution of SCUC];
```

**SCUC Initialization**

**Execution of SCUC**

# SCUC Four Pass Methodology

## Pass 1 of SCUC

Solves for Bid Load, Virtual Load and Virtual Supply



## Pass 2 of SCUC

Commits additional units used to supply Forecast Load; Load bids (physical & virtual) and Virtual Supply bids are NOT considered in this pass



## Pass 3 of SCUC

Reserved for future use



## Pass 4 of SCUC

Forecast Load Re-dispatch; Dispatches units committed in Pass 2



## Pass 5 of SCUC

Final dispatch determined to supply Load Bid, Virtual Load and Virtual Supply; Final Day Ahead LBMPs are established

# SCUC – Pass 1, Bid-Load Pass

- **SCUC commits and schedules generating units and interchange, including DARUs, to supply Bid Load (Physical and Virtual) less Virtual supply**
  - Secured against normal NYISO bulk power system contingency and LRRs
  - Interchange Transactions, Virtual Load, Virtual Supply and Internal Generators are evaluated
  - Also includes resources committed to meet state-wide reliability needs and local reliability requirements
  - Automatic mitigation evaluation is performed once the commitment run has converged

# Bid Load Pass – LRR Evaluation

- **Local Reliability Rules (LRR) are incorporated with the Bid Load Pass**
  - Solves for additional capacity constraints for New York City network security
- **A Day-Ahead Reliability Unit (DARU) may be designated by a TO or the NYISO for commitment for reliability reasons in advance of the DAM**
- **Advantages of including LRR within the Bid pass:**
  - Allows economic de-commitment of units that are not required after securing local reliability rules and reduces the potential for out of market commitments once DAM is complete
- **Optimization to minimize total as-bid production cost given reliability requirements**



# Automated Mitigation Procedures

## (AMP)

- AMP is a selective bid mitigation mechanism that is automatically activated when conditions are not workably competitive
- Integrated into the Day-Ahead and Real-Time market solutions for generators located in New York City

### Conduct Tests

- Compares offer ( $\$ \text{ Energy} + \$ \text{ Start up cost} + \$ \text{ Min gen cost}$ ) to the resource's references
- Conduct failed, if offer costs higher than references by a tariff defined amount

### Impact Tests

- Examines the change in prices that would prevail if conduct failing offer prices were mitigated
- Impact failed if change in LBMP exceeds tariff specified amounts for constrained areas

### Mitigation

- Mitigation applied to offers that fail Impact tests
- Offers mitigated to corresponding references

# Pass 2: Bulk Power System (BPS) - Forecast Load Pass

- Determines the additional generators required to meet the NYISO forecast load
  - FRED – Forecast Required Energy for Dispatch
    - Additional expected energy needed to meet the NYISO forecasted load that is in excess of the sum of Day-Ahead load bids
- Price sensitive Load and Virtual resources are not included in this evaluation
- Generator limits and commitment statuses are modified to ensure that units selected in pass 1 will not be de-committed or dispatched below their Pass 1 value
- Optimization for least additional uplift
- Solves for bulk power system (BPS) facilities and contingencies
- Wind and solar forecast incorporated to schedule wind and solar intermittent resources
- Results in Gen Set 2
  - Includes all units in pass 1 plus additional units to meet forecast load

# Pass 4: Forecast Load Re-dispatch

- In Pass #4, the set of generators from committed in Pass #2 is dispatched using the original energy bids
- The dispatch supplies the forecast load and is limited by the bulk power system constraint set produced in the Pass #2 commitment
- The unit capacities (Energy + 30-minute Reserve + Regulation capacity) from this dispatch are used to calculate the forecast reserve for economic dispatch

# Pass 5: Bid Load, Virtual Load and Virtual Supply Re-dispatch

- Final dispatch is determined to supply the Bid load, Virtual Load and Virtual Supply (negative load)
- Pass 1 GTs are forced on, all other GTs are forced off (dispatched at 0)
  - Generators dispatched in Pass 4 that are not needed in Pass 5 will be backed down to their min gen
  - Will not be able to set LBMP, but will be eligible for Bid production Cost Guarantee (BPCG)
- Day-Ahead Hourly LBMP is set

# Wind and Solar IPR Units- SCUC

## Process

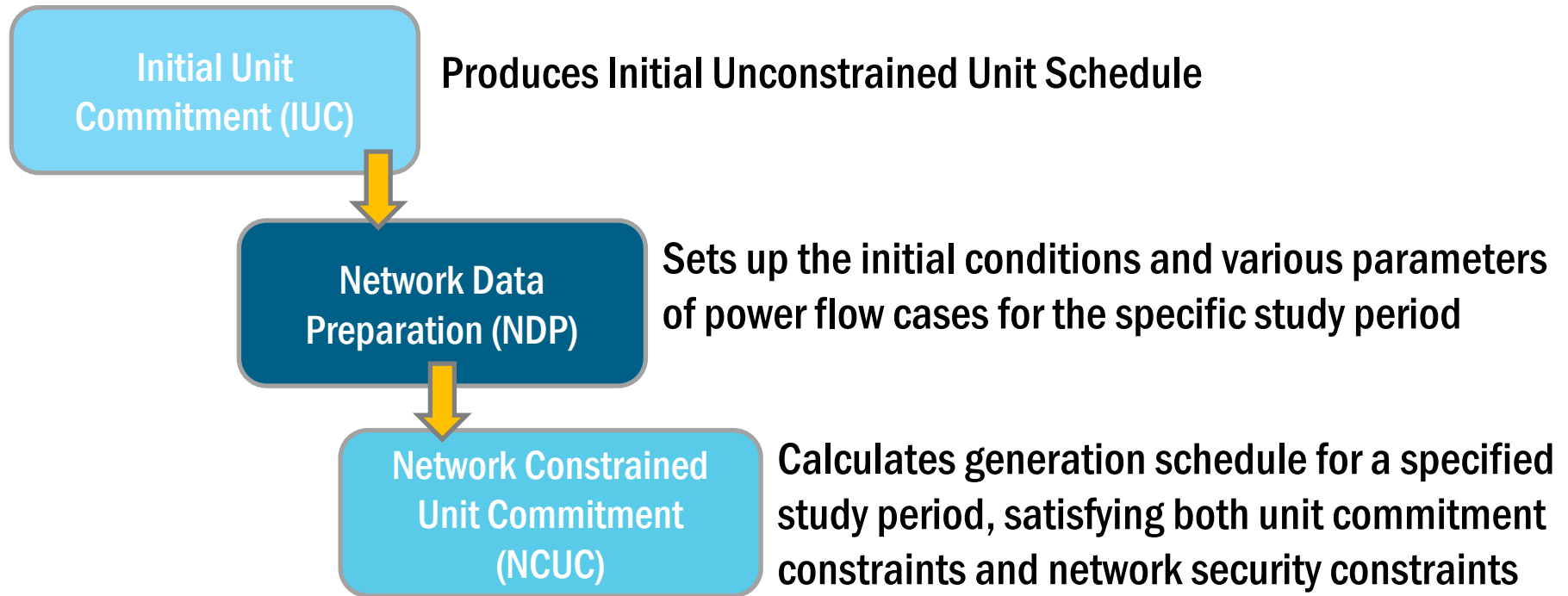
- **Pass 1 (Bid-Load Pass):** Only wind and solar generators that provide bids will be considered in this solution
- **Pass 2 (BPS Forecast Load Pass):** Wind and solar generator bids will be dropped, and wind and solar generation forecasts will be used in this solution
- **Pass 4 (BPS Forecast Re-dispatch passes):** This pass will use the same wind and solar generator forecasts as Pass 2
- **Pass 5 (Bid- Load Re-dispatch pass):** Will ignore any wind and solar generator forecasts scheduled in passes 2-4, but will instead use any wind and solar generator bids
  - Will use commitments made from pass 1
  - Only economically committed wind and solar generators can be scheduled in this pass

# Transmission Loss Calculation – SCUC Process

- **Power losses occur in the transmission system as energy flows from generation sources to the loads**
  - These losses appear as additional electrical load, requiring the generators to produce additional power to supply the losses
- **Transmission losses are calculated in the Forecast Load pass of the SCUC**
  - As part of the power flow solution for each time interval simulated by these programs for each of the eleven load zones in the NYCA

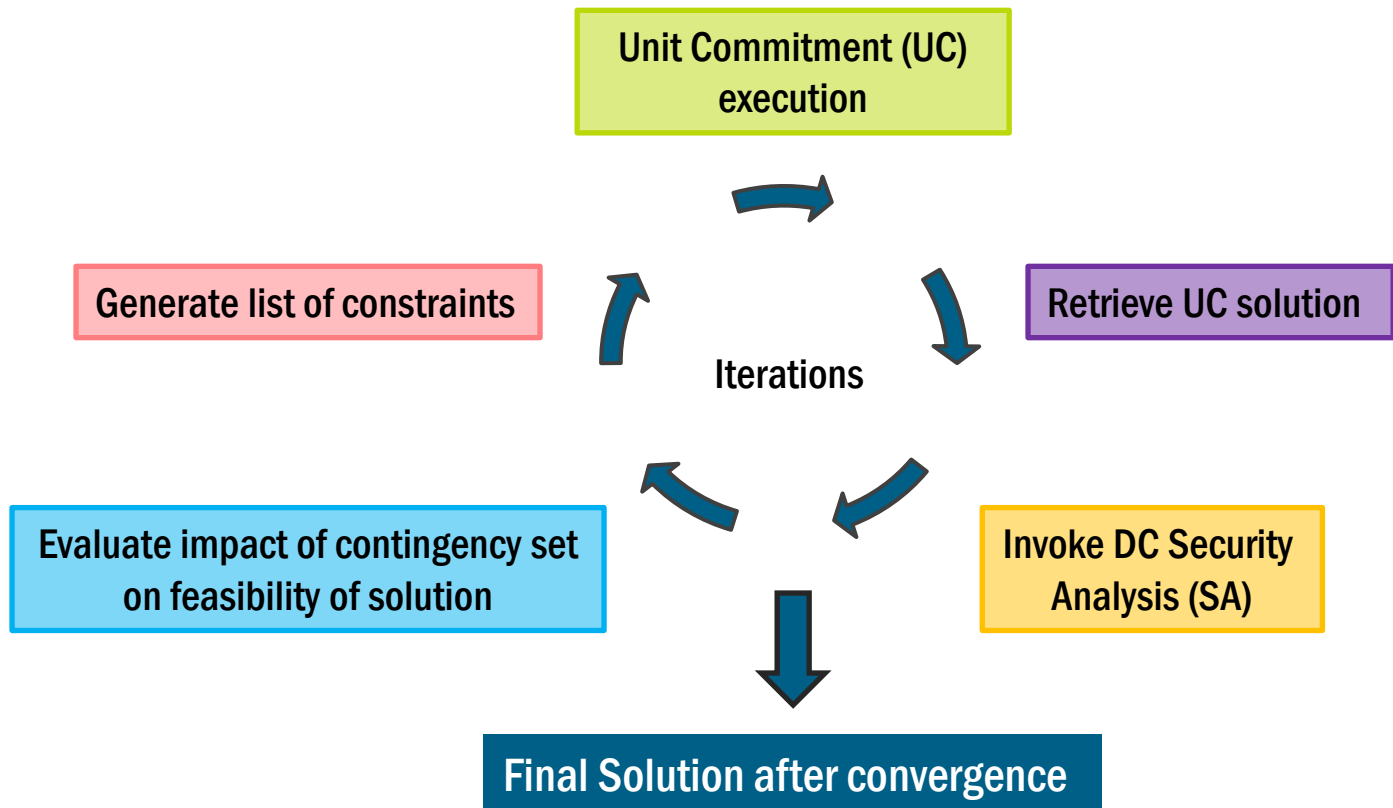
# SCUC – Components of each Pass

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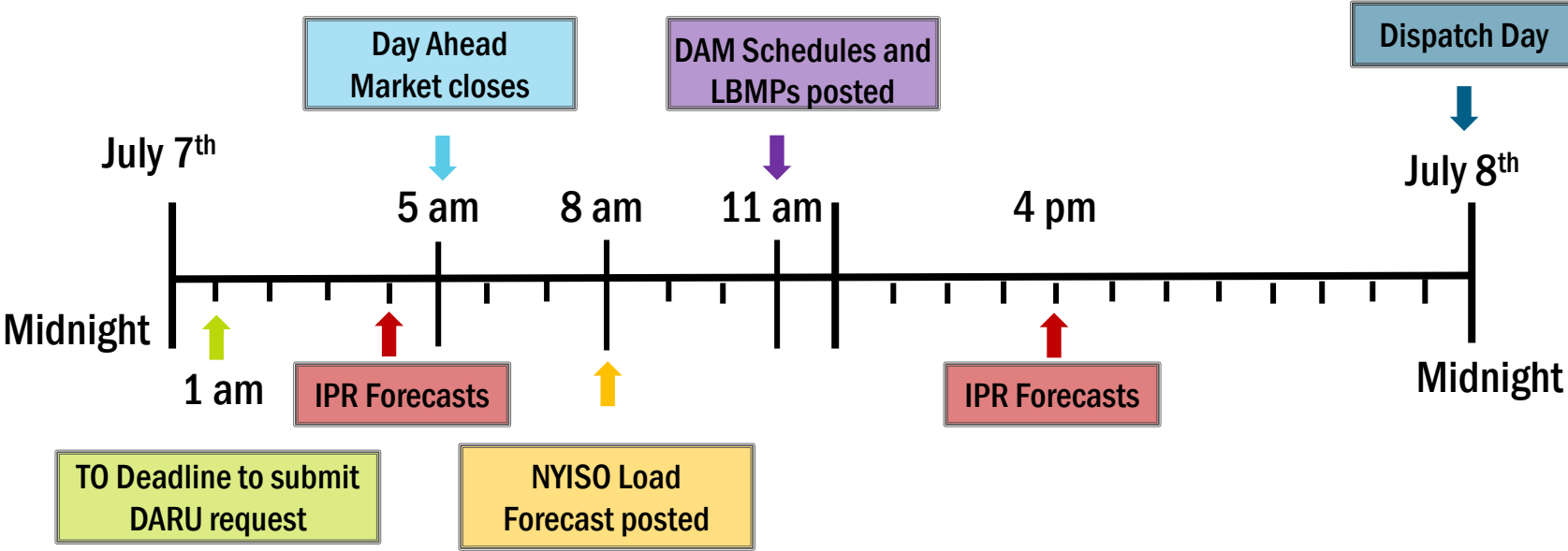




# Network Constrained Unit Commitment (NCUC)



# Day-Ahead Market Timeline



# Real-Time Market Bid/Offer Evaluation Process

# Real-Time Market Bid/Offer Evaluation Process

- Real-Time Software (RTS)- Overview
- Outputs and Inputs
- Real-Time Commitment (RTC) Process
- Real-Time Dispatch (RTD) Process
- Real-Time Dispatch – Corrective Action Mode (RTD-CAM)
- Timeline (Summary)

# Real-Time Software – Overview

# Real-Time Software - Overview

- Real Time Software (RTS) co-optimizes to solve simultaneously for energy, operating reserves and regulation service requirements, while accounting for system changes over its optimization timeframe
- RTS evaluations include look ahead time horizon to pre-position dispatch for known system changes
- RTS will consider:
  - SCUC's resource commitment for the day;
  - Load and loss forecasts that will be produced 5-minutes;
  - Transmission limits; and
  - All Real-Time bids and bid parameters (RTC/RTD)

# Real-Time Software

- **RTC – Real-Time Commitment**
- **RTC- AMP – Real-Time Commitment Automated Mitigation Process**
- **RTD – Real-Time Dispatch**
- **RTD- CAM – Real-Time Dispatch Corrective Action Mode**

# Real Time Commitment (RTC)- Overview

- Multi-period security constrained unit commitment model that simultaneously solves for load, reserves and regulation over a 2.5 hours horizon
- Similar software model and structure as SCUC
  - Executes every 15 minutes, optimizing 10 fifteen-minute periods – producing a 2 ½ hour look-ahead with advisory prices and schedules
- RTC makes binding schedule decisions for external interchange transactions, including CTS Transactions and LBMP Transactions
- RTC produces advisory dispatch for all other resources
  - Commitment decisions for other resources will come from the DAM's SCUC solution
  - RTC will only re-evaluate Fast Start resources (provide additional commitment)
  - RTC will not commit “dispatch only” resources such as ESRs and Wind/Solar resources
    - These are considered available over the optimization period



# Real-Time Dispatch - RTD

- Multi-period security constrained dispatch model that simultaneously solves for load, reserves and regulation over a 60-minute horizon
  - Executes every 5-minutes
  - RTD optimizes over an hour
    - One 5-minute timestep, which produces the binding real-time schedules/prices, and advisory timesteps occurring on the next 4 fifteen-minute boundaries
- RTD Makes no unit commitment decisions (except RTD-CAM)
- RTD simply dispatches the resources already expected to be online based on SCUC and RTC commitment decisions
  - Each RTD run will use unit commitments from most recent RTC run for the same period of time

# RTC and RTD – Outputs and Inputs

# RTC - Output

- On 15-minute intervals RTC will:
  - Schedule generation to meet load, reserve/regulation, and transmission limits
  - Commit 10 and 30-minute resources
  - Issue advisory commitment and schedules beyond the 30-minute horizon
  - Schedules Hourly and Intra-hourly Transactions
  - Posts Available Transmission Capability (ATC)'s/ Total Transmission Capability (TTC)'s, advisory generator/zonal and external proxy prices, limiting constraints, and shadow prices

# RTD – Final Outputs

## 5 Minute Prices- Dispatch Day

- **Energy Market Clearing Price (LBMP)**
  - Generator: Bus level
  - Load: Zonal
  - Transactions: Proxy Bus level\*
- **Operating Reserve Prices**
  - 10-min Spinning Reserve by Load Zone
  - 10-min Non-Spinning Reserve by Load Zone
  - 30-min Spin/Non-Spin Reserve by Load Zone
- **Regulation Market Clearing Prices (NYCA only)**
  - Capacity Price
  - Movement Price

## 5 Minute Schedule – Dispatch Day

- **5-minute base points for internal generators and demand side resources**
  - Energy (sent to AGC)
  - Operating Reserves
- **Advisory base points for the rest of the hour (15-minute level)**

# RTC and RTD – Inputs

- Resource Commitment Results from SCUC
- New Generator Bids/Offers
  - Energy, Reserve, Regulation
- New Transaction Bids/Offers
- Telemetry information
- Load Forecasts
- Wind/Solar Forecasts
- PAR Modeling
- Loop Flow Modeling
- Reserve and Regulation Requirements
- Transmission Limits

# Real Time Commitment – Process

# RTC Process

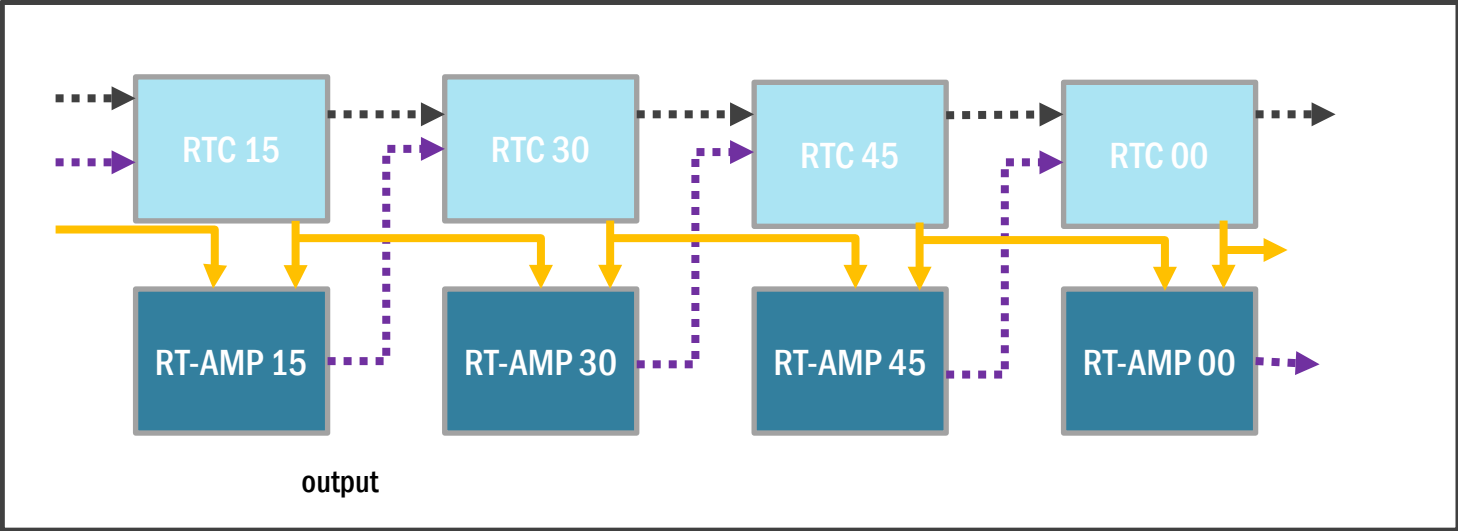
- **RTC runs initialize every 15 minutes and posts 15 minutes after initialization**
  - RTC runs are labeled by when they post; *e.g.*, RTC15 initializes at XX:00, and posts at XX:15
- **For each RTC run, the first timestep begins 15 minutes after RTC posts; *e.g.*, for RTC15, that is XX:30**
  - Commitment, schedules, and basepoints in RTC and RTD are labeled by the timestep
- **Newly committed Fast Start Resources will receive their start-up notification through RTD**
  - For 10-min Fast Start Resources, that can include a start-up notification to be at min gen by the first timestep
  - For 30-min Fast Start Resources, that start-up notification would be for the second timestep
- **For all other Resources, RTC will make available to subsequent RTCs/RTDs the unit commitment status over the optimization period**

# RTC-Automated Mitigation Procedure (RTC-AMP)

- Runs automatically every 15 minutes evaluating a 2.5-hour time horizon
- Runs parallel to RTC with synchronized data except for mitigated bids
- Evaluates if resources are unfairly setting prices (market power) due to reliability
- Mitigated bids determined to cause impact are applied to remainder of current hour and/or all of the next hour
- Conduct, Impact and Mitigation evaluation similar to the SCUC AMP process



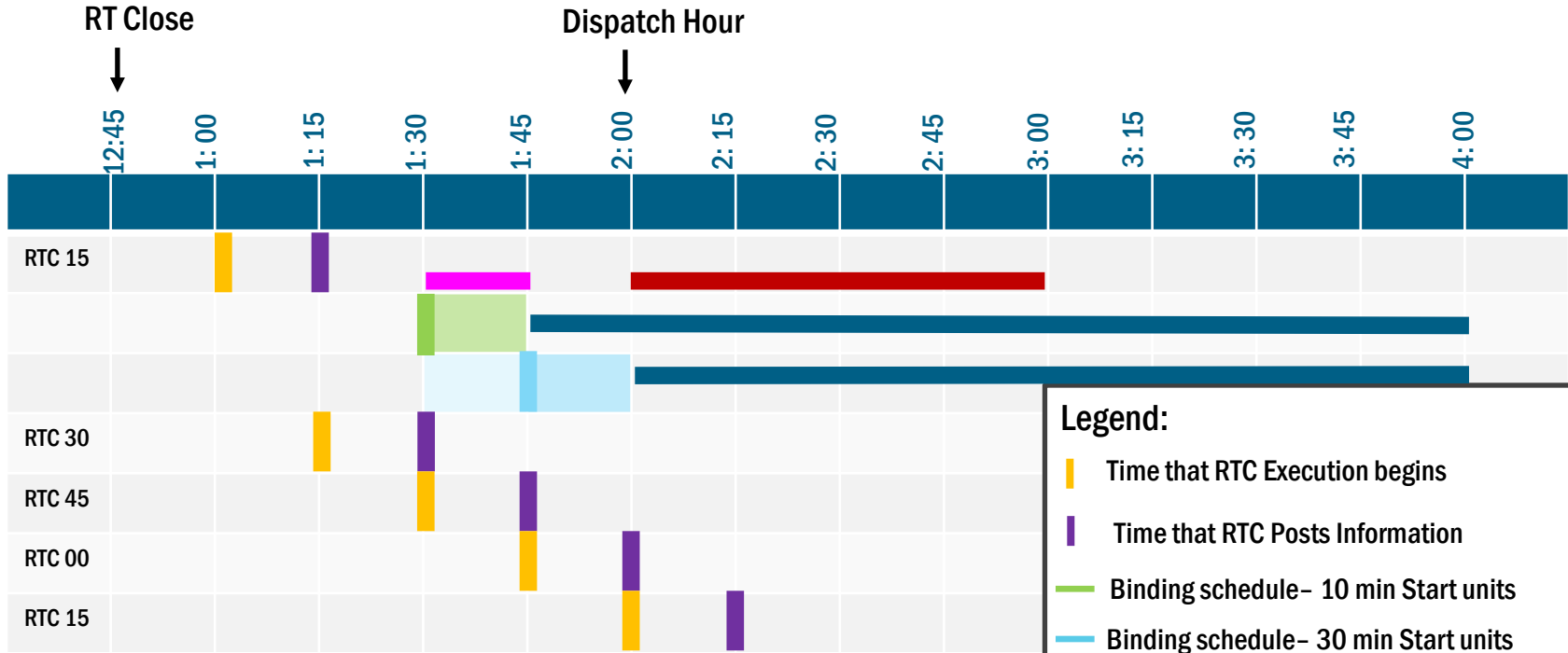
# RT-AMP Timeline



# External Transactions – RTC

- Interchange Transactions receive commitment and dispatch schedules from RTC
  - Generators involved in Internal Transactions receive dispatch signals from RTD
- 15-minute interchange transactions are evaluated during each RTC run, with binding schedules developed for the first 15 minutes timestep
  - All other timesteps are advisory
- Hourly Transactions are evaluated during the RTC15 run, with binding schedules developed for the next hour
  - All other timesteps are advisory
- Interchange Transactions scheduled through RTC then go through the Operator Checkout process before being scheduled to flow

# RTC Timeline



**Legend:**

- Time that RTC Execution begins
- Time that RTC Posts Information
- Binding schedule- 10 min Start units
- Binding schedule- 30 min Start units
- 2.5 hr Advisory Schedule
- 15 min Transactions - Binding Schedule
- Hourly Transactions - Binding Schedule

\*The very light blue (1:30) for 30 - minute resources, comes from a prior RTC run

# Fast Start Resources – RT Scheduling

- **Fast-Start Resources:**
  - Can respond to instructions to start, synchronize to the grid, inject energy within 30 minutes, and
  - Have a minimum run time of one hour or less
  - Are treated as dispatchable between zero and their UOL
    - ESRs withdrawing energy: treated as dispatchable between LOL and zero
- **RTC makes binding commitment and de-commitment decisions only for these 10 and 30 min start resources and produces advisory dispatch for all other resources**
- **Fast-start resources' commitment costs (*i.e.*, start-up costs and minimum generation costs) will be added to incremental cost curves for calculation of LBMP**

Refer Attachment C, T and D manual for example of Fast Start Pricing logic

# Real-Time Dispatch – Process

# RTC to RTD Interactions

- **When each RTD initializes, it will pull unit commitments from the most recent RTC**
  - This includes SCUC commitments fulfilled by RTC as well as additional RTC commitments
  - Commitment decisions from RTC include the timestep that the unit will be at Min Gen
- **For Example: RTC commits units to be online at 14:30**
  - The 3 RTD runs that develop binding schedules for the RTD timesteps covering 14:30-14:45 timeframe will dispatch those units based on the RTC commitment decision for its 14:30 timestep
- **RTD will also incorporate RTC interchange schedules into its solution**
  - These schedules are fixed and not reevaluated by RTD

# RTD - Process

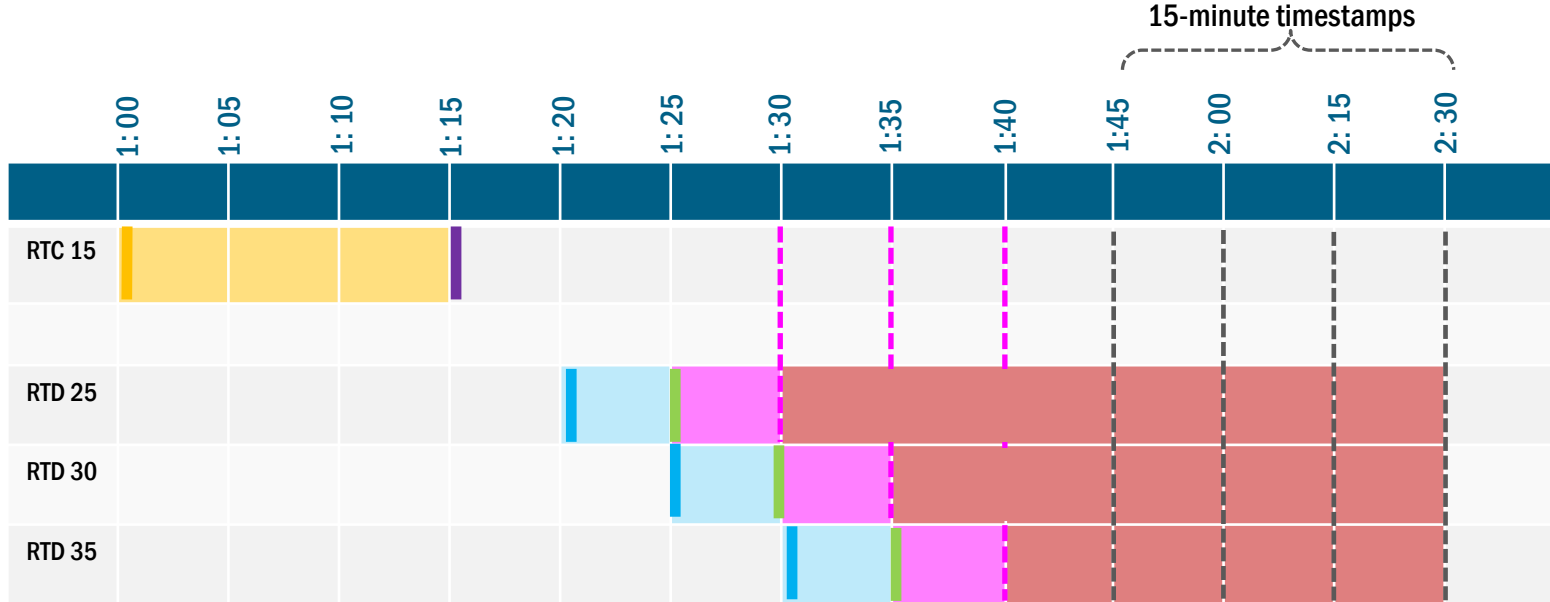
- **RTD calculates a short-term generation schedule for each of the generating units designated as flexible or “on-dispatch”**
  - RTD retrieves the information it needs to perform the calculation from data maintained in MIS/OIS&R.
- **RTD runs every 5 minutes and the ~60-minute time horizon is divided into one five-minute timestep referred to as a “basepoint” and four 15-minute advisory timesteps**
- **Binding RTD basepoints are typically generated every five minutes to inform Resources of their target MW output**
  - Basepoints are used by AGC to ramp units up or down from one binding RTD basepoint to the next
  - Resources that are Regulation providers may be sent basepoints from AGC that deviate from their binding RTD basepoint to manage immediate generation-load imbalances

# RTD Process

- RTD initializes every 5 minutes and post 5 minutes after initialization
- RTD runs are labeled by when they post; *e.g.*, RTD15 initializes at XX:10, and posts at XX:15
- For each RTD run, the first timestep (basepoint) occurs 5 minutes after RTD posts
  - AGC will ramp units on a 6-second basis from the time that RTD posts until the basepoint
    - *E.g.*, at 14:15, RTD15 posts the basepoint for 14:20; AGC will ramp the unit from 14:15 to 14:20 to meet basepoint



# RTD Timeline



## Legend:

- █ Time RTC execution begins
- █ Time RTC posts information
- █ Time RTD execution begins
- █ Time RTD posts information
- █ Binding dispatch period
- █ Advisory Dispatch period

# RTC to RTD Divergence Factors - Examples

<b>Transmission Network Modeling</b>	<ul style="list-style-type: none"><li>- Forecast errors on PAR controlled lines</li><li>- Variation in Transfer Capability</li></ul>
<b>Forecast Errors</b>	<ul style="list-style-type: none"><li>- Load Forecast Errors</li><li>- Wind/Solar Forecast Errors</li></ul>
<b>RTC/RTD Timing</b>	<ul style="list-style-type: none"><li>- Inconsistencies in timing of RTC and RTD evaluations</li></ul>
<b>Loop Flow Modeling</b>	<ul style="list-style-type: none"><li>- Changes in Loop flow circulation between RTC and RTD</li></ul>
<b>Generator Performance</b>	<ul style="list-style-type: none"><li>- Not following Dispatch</li><li>- Forced Outages and Derates</li></ul>
<b>Transactions</b>	<ul style="list-style-type: none"><li>- Transaction Curtailments</li></ul>

# RTD – CAM

## Corrective Action Modes

# Real-Time Dispatch – Corrective Action Mode (RTD – CAM)

- Response to system conditions unanticipated by RTC or regular RTD executions
  - i.e., Loss of major generation or transmission
- Unlike ‘normal’ RTD, can commit (or de-commit) certain units
- Occurs within the dispatch/operating hour
  - Only looks ahead 10 minutes
- Schedules 10-minute Operating Reserve to energy
- 5 dispatch modes

# RTD-CAM: Five Dispatch Modes

## Reserve Pickup

- 10 Minute base points
- Optimize Energy and Reserves

## Max Gen Pickup

- All Generators in targeted area to UOLE

## Base Points ASAP – No Commitment

- Update base points for dispatchable units

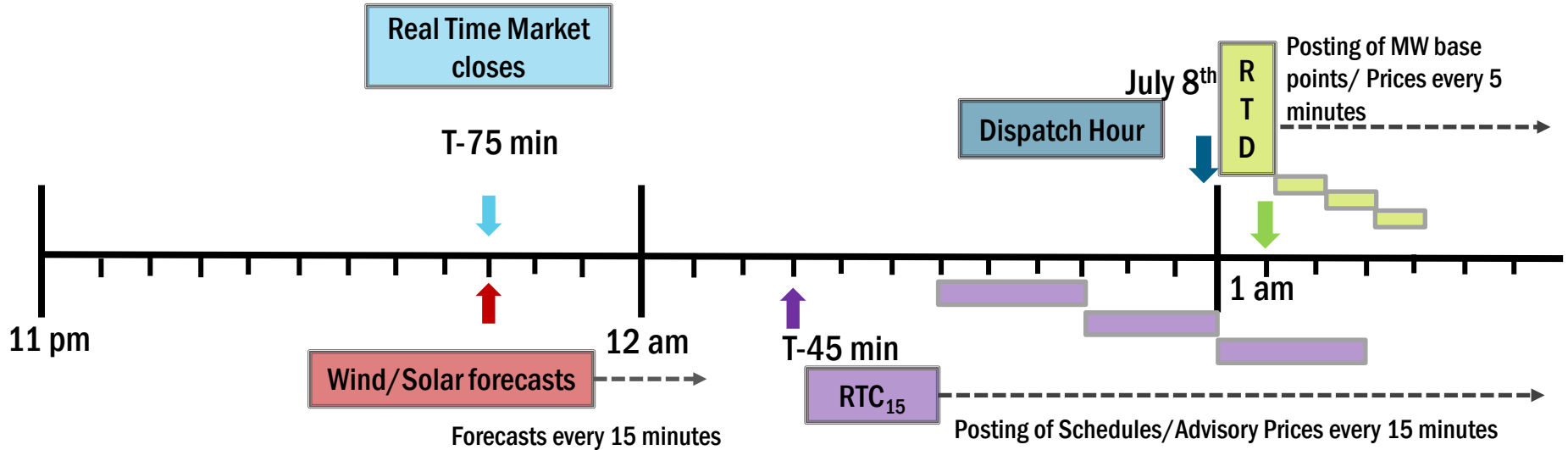
## Base Points ASAP – Commit as needed

- Same as previous RTD-CAM, but also can commit 10-minute units

## Re-Sequencing

- De-activate RTD- CAM

# Real-Time Timeline



# Supplemental Resource Evaluation (SRE)

# Supplemental Resource Evaluation (SRE)

- Process used to commit additional resources outside of the SCUC and RTC processes to meet NYISO reliability or local reliability requirements
- SRE is used to address resource deficiencies; not to reduce costs



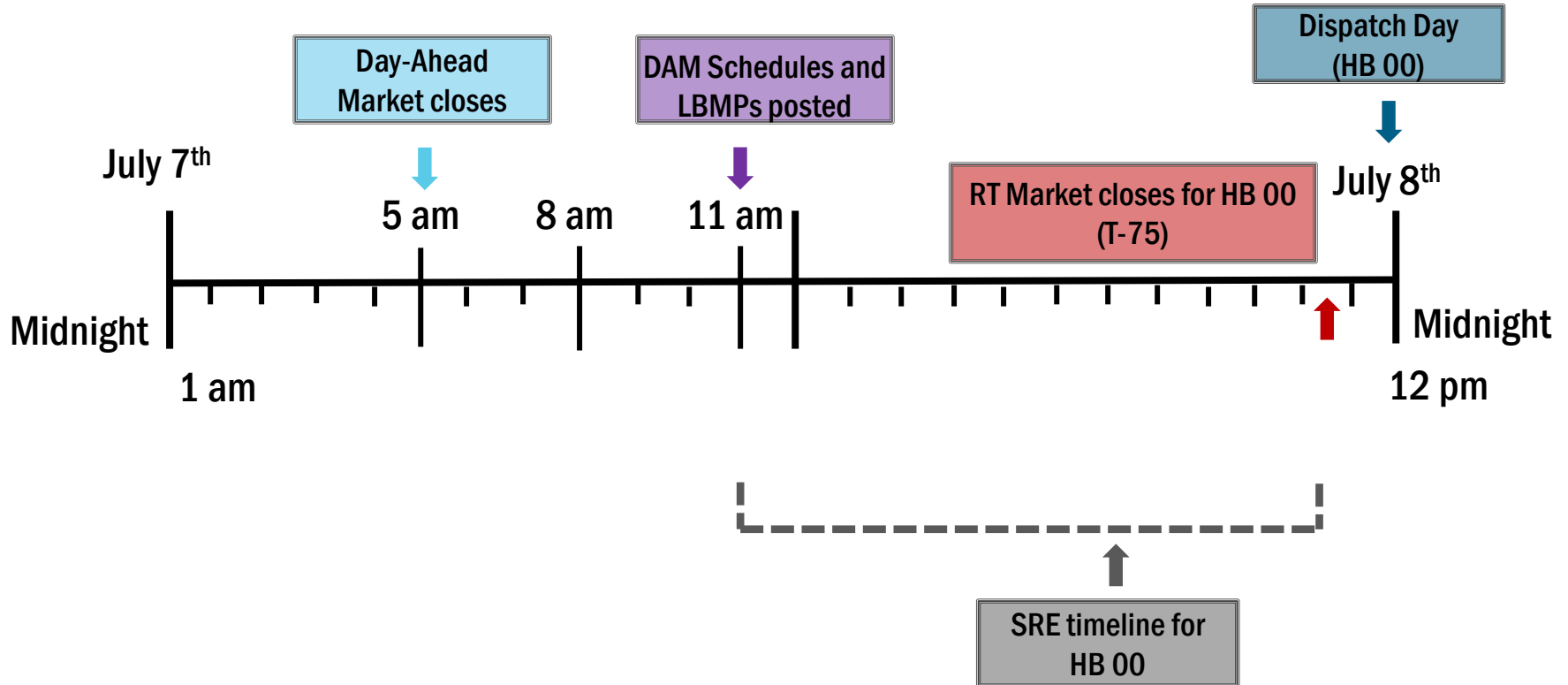
# Supplemental Resource Evaluation (SRE)

- SRE is used to address:
  - Loss of Generation
  - Loss of Transmission
  - Load "surprises"
- SRE can be used to obtain:
  - Energy
  - Operating Reserve
  - Regulation

# Supplemental Resource Evaluation (SRE)

- **The NYISO may perform SREs in response to the following two conditions:**
  - When Day-Ahead reliability criteria violations are forecast after SCUC has begun or completed its Day-Ahead evaluation (i.e.: too late for additional day-ahead commitments)
  - When In-Day reliability criteria violations are anticipated more than 75 minutes ahead (i.e.: too early for RTC commit additional resources)
- **TOs may request the NYISO to issue an SRE to commit additional resources for reliability purposes in a local area**
  - TO requests for SREs are subject to the same conditions and the same time frame as the NYISO's use of the SRE process – after SCUC has run

# Supplemental Resource Evaluation (SRE) Timeline



# Bid/Offer Evaluation Process - Summary

## ■ SESSION OBJECTIVES:

- Overview: Bid/Offer Evaluation Process
- Day-Ahead and Real-Time Software
  - SCUC – Security Constrained Unit Commitment
  - RTS
    - RTC: Real-Time Commitment
    - RTD: Real-Time Dispatch
    - RTD-CAM: Real-Time Dispatch-Corrective Action Mode
- Supplemental Resource Evaluation (SRE Process)

# Additional Resources

- **Open Access Transmission tariff (OATT) and Market Services Tariff (MST)**
- **Day Ahead Scheduling Manual**
- **Transmission and Dispatch Manual**
- **Market Participants User's Guide (MPUG)**