Real-Time Scheduling

Market Structure Working Group

February 26-27, 2002

Meeting Approach

- Proceed through agenda (1 – 1½ days)
- Questions and answers throughout
- Short discussion issues addressed
- Issues better addressed in Energy or Ancillary Services discussions logged
- Longer discussion issues logged and held to end of two day meeting (½ – 1 days)
- Inter-relation of topics may require re-assessment

Agenda

- Meeting Approach
- Architecture
  - RTC
  - RTD
  - RTD-CAM
- Local Reliability Rules
- Market Power Mitigations
- PAR Scheduling
- Transaction Scheduling
- Generation Scheduling

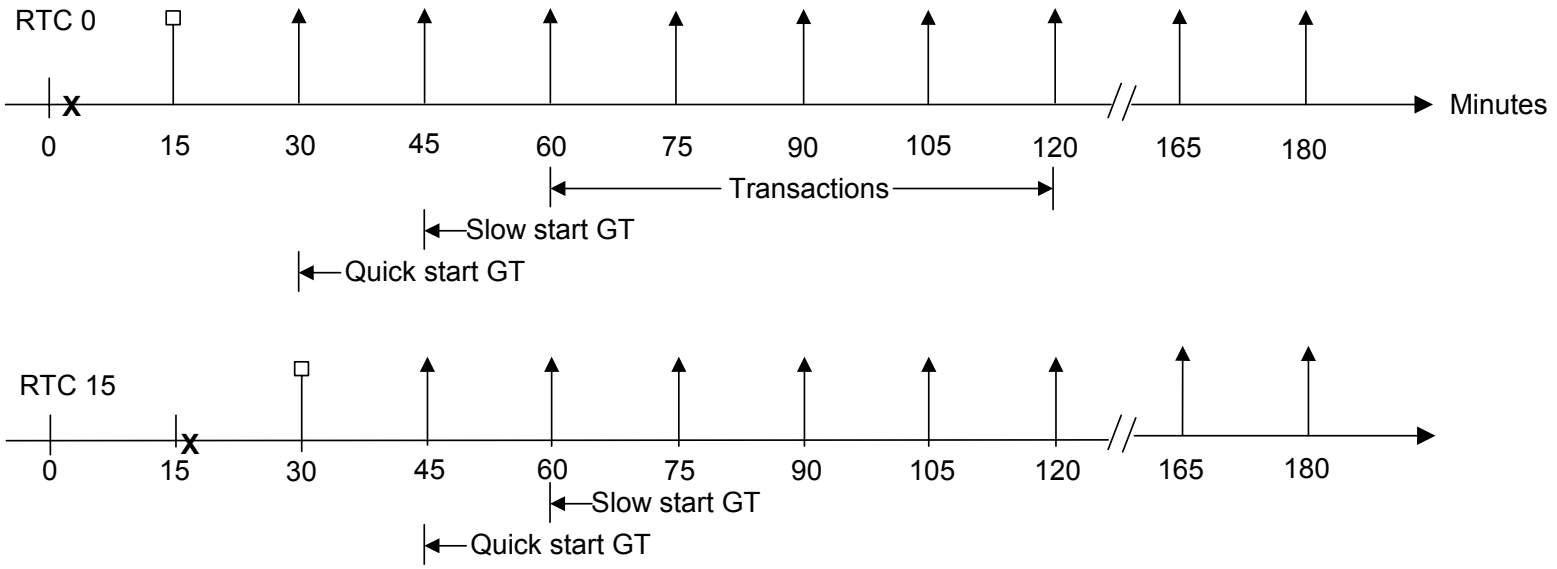
Future Meetings

- Energy Markets
  - Scheduling
  - Pricing
    - Hybrid Dispatch
    - Ex-ante / Ex-post
    - Nodal / Zonal
  - Load Profile
  - Trading Hubs
  - Transaction Handling
  - GT Modeling
- Ancillary Services
  - Scheduling and Pricing
  - Two Settlement
  - Reserve Pickup
    Restore
  - Demand curves

Real-Time Commitment (RTC)

- Scheduled execution every 15 minutes
- 15 minute intervals
- Look ahead for 10 intervals

Real-Time Commitment (RTC) Time Line Sequence



X = RTC/RTD Start of execution AGC BP = Base Points for Automatic Generation Control

□ = RTC/RTD Solutions available for posting/notification (real-time)

↑ = RTC/RTD Forecasted Solutions

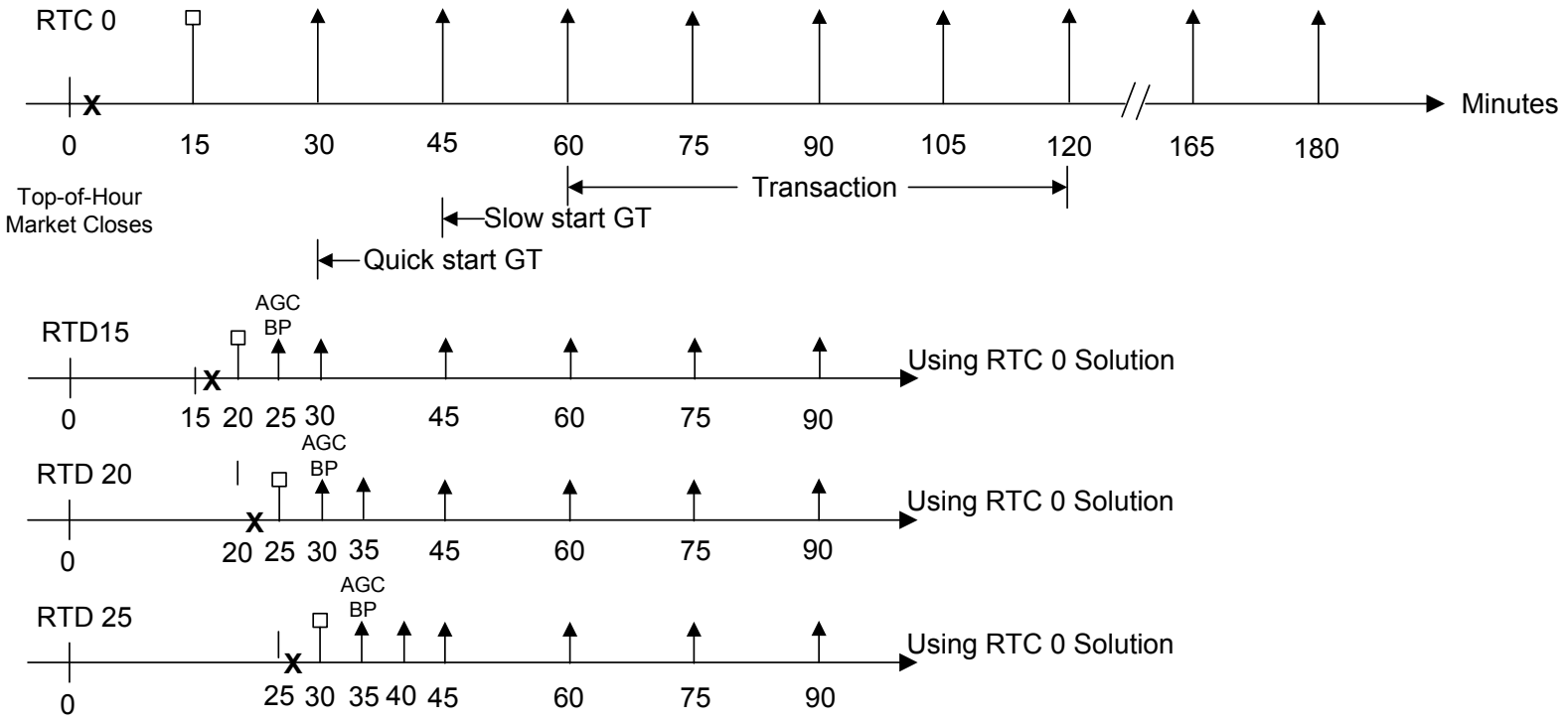
Real-Time Commitment (RTC)

- Functionality
  - Scheduling transaction on up to ¼ hr interval
  - Determines all unit commitments
    - Honors DAM commitments
    - Commits all GT's
    - Commits all non-GT
    - Ancillary service scheduling

Real-Time Dispatch (RTD)

- Scheduled execution every 5 minutes
- Combination of 5, 10 and 15 minute intervals
  - Short range 5 minute base points
  - Longer range ramping
  - Coordinate with RTC schedule changes
- Look ahead for at least one hour

Real-Time Dispatch (RTD) - Time Line Sequence



X = RTC/RTD Start of execution	AGC BP = Base Points for Automatic Generation Control
□ = RTC/RTD Solutions available for posting/notification (real-time)	
↑ = RTC/RTD Forecasted Solutions	

Real-Time Dispatch (RTD)

- Functionality
  - Honors transaction schedules
  - Determines all unit dispatch schedules (base points)
  - Produces future hour schedule profile (MIS posting)
  - Demand resource scheduling
  - Ancillary service scheduling

Corrective Action Mode (RTD-CAM)

- Addresses short term emergency system conditions.
- Commits quick start (up to 15 minute) GT
  - Utilizes SCD like dispatch
- Short look ahead (15 minutes)
- Security constrained
- Re-sequencing issues with RTC/RTD

RTD-CAM

- Reserve Pickup
  - Utilize unit reserve capacity
  - Emergency response rates
  - GT commitment
  - Reserve pickup restore mode

RTD-CAM

- Maximum Generation Pickup
  - Location selection
  - GT commitment
  - Max ramp to maximum generation

RTD-CAM

- Emergency Scheduling
  - Respond to system event
  - Need for new base points prior to next RTD
  - GT commitment

Network Analysis

- Initial conditions based on combination of telemetry and State Estimator calculated values
- Utilize generation ramp rates
- Load distribution profile
- Incorporate NYISO bulk power contingencies and monitored elements, multiple event contingencies and Central-East voltage limitations, Voltage limited transfers
- Same security analysis model for DA/RTC/RTD and RTD-CAM
- Thunderstorm Alert

Market Impacts

- Market closes 60 minutes prior to hour
- Continue to utilize hourly bidding
- Electronic base points every 5 minutes
- MIS advisory schedules for 60 minutes
- Advisory prices
  - ex-ante / ex-post
- Finalized ex-post prices

Local Reliability Rules

- Not expected to be recognized in RTS
- Ongoing evaluation of requests
- No changes to SCUC implementation

Market Power Mitigation

- Implemented in RTC
- Potential limitations for use in RTD
  - Performance
  - Dispatch algorithm
- Similar implementation to Real-Time Mitigation
  - Conduct and Impact Tests
  - Utilize multi-pass evaluation modules
- To be fully defined after current RTM finalized

PAR Optimization

- Feasibility to optimize PAR flow setting to minimize costs in RTC and RTD
- Individual PAR selection
- Limitations on flow change per period
- Restricted use due to current operating practices

Transaction Scheduling

Generation Scheduling

- Selection (commitment) all units occurs in RTC
- Scheduling (dispatch) all units occurs in RTD
- Operator confirmation on GT start / stop
- All units on-dispatch or self-scheduled
- No off-dispatch or price-chasing units
- Design capable of recognizing dispatchable load
  - Future implementation
- Maximum minimum run time = 1 hour
- Run time measured from base point, not unit start

Generation Scheduling

- RTC0: runs from x00-x15, posts at x15
  - Determines longer startup GT selection for x45
- RTC15: runs from x15-x30, posts at x30
  - Determines short startup GT selection for x45
  - Determines non-GT selection for x45
- RTD35: runs from x35-x40, posts at x40
  - Sets BP for all units for x45
  - Expects units selected in RTC0 and RTC15 to be capable of minimum generation levels.

Generation Scheduling

- Gas Turbine Scheduling
  - Recognize GT bidding to include:
    - Startup costs / times
    - Minimum generation MW / costs
    - Incremental cost curve
- Ignore non-GT startup times

Generation Scheduling

- Ancillary Service Scheduling
  - Where to schedule real-time obligation?
    - Every 15 minutes in RTC?
    - Every 5 minutes in RTD?

Generation Scheduling

- Self Scheduling
  - Recognitions:
    - Fixed operating point?
    - Increased lower limit?
  - Costs:
    - Minimum allowable bid?
    - Other?