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Real-Time Scheduling Architecture Concept of Operation[1]

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[1] This document is a working document designed to form the basis of ongoing and iterative discussions with the market place and NYISO staff.

Table of Contents

Purpose & Limitations of this Document

The Concept of Operations (COO) is the first document in the lifecycle of a software system implementation or enhancement. The COO generally describes the proposed functionality in plain terms (a.k.a. White Paper). It does not attempt to provide detailed explanations of requirements or implementation details, but rather explains the functionality in conceptual terms for discussion prior to detailed design.

Changes to the functionality or appearance of software that is described in the COO may be introduced in subsequent design, implementation, testing or maintenance phases. In addition, the software system or enhancement may evolve over time as other software systems and enhancements are introduced. The COO is not updated to reflect these changes. That is, the COO is not intended to document the software system or enhancement "as built." Other documents, specifically ***Technical Bulletins*** *and* ***Manuals****, describe the "as built" software system or enhancement. In short, the COO will become obsolete at some point during the lifecycle of a software system implementation or enhancement.*

1 Introduction

This document addresses the concept of operations of a wholly redesigned Real Time Scheduling software package to be employed at the New York Independent System Operator to replace the current method of real-time scheduling using BME and SCD.

1.1 Terminology and Abbreviations

Term	Description
BME	Balancing Market Evaluation
DAM	Day-ahead market
RTS	Real-Time Scheduling
RTC	Real-Time Commitment
RTD	Real-Time Dispatch
LBMP	Locational Based Marginal Price
LRR	Local reliability rules
MIS	Market Information System
MMP	Market Monitoring and Performance unit
NYC	New York City
HMI	Human Machine Interface
OOM	Out of merit
RTS	Real-Time Scheduling
SCD	Security Constrained Dispatch
SCUC	Security Constrained Unit Commitment
TO	Transmission Owner

2 Discussion

2.1 Background

On December 1, 1999, the New York Power Pool (NYPP) ceased to exist and the New York Independent System Operator (NYISO) took over control of the bulk power system of the New York State. The NYISO was formed as part of the restructuring of New York State's electric power industry. Its mission is to ensure the reliable, safe and efficient operation of the State's major transmission system and to administer an open, competitive and nondiscriminatory wholesale market for electricity in New York State. It utilizes a bid process for electricity and transmission usage, which enables the State's utilities, and other market participants, to offer electricity at competitive prices, rather than regulated rates. Being a two-settlement system, the NYISO utilizes a single vendor (ABB) designed Commitment system for the Day-Ahead and Hour-Ahead timeframes that is linked to a NYPP designed Security Constrained Dispatch (SCD) program package for use in the real time (spot) market. The replacement of the SCD package and the integration of the Hour-Ahead functionality into a single package that will run on a common platform and model consistent with Day-Ahead program is what this document will address.

3 High Level Design Goals

The overall objective is to create a real-time dispatch function that integrates the scheduling functions of BME with the actual real-time dispatch in order to eliminate the inherent mismatch between prices created by the dispatch software and schedules produced by a separate process (BME) that is conducted at a different time and assuming different conditions. The Real-Time Scheduling function should consist of two main sub-functions Real-Time Commitment (RTC) and Real-Time Dispatch (RTD) which working together will:

- Be scalable and fast enough to support the real-time (5 minute) security constrained economic dispatch of a Northeast Regionregion made up of PJM, NY, and NENYISO, NEISO, Maritime, and IMO (Approximately 15000 LF busses). 150000 busses)
- Insure that there is sufficient capacity available to meet load and reserve requirements including locational requirements
- Perform a security constrained dispatch whose objective function continues to be minimization of production cost.
- Incorporate the following functionality:
  a) real-time ancillary service scheduling and management
  b) GT scheduling.
  c) Hourly real-time bidding.
  d) Hourly transaction scheduling
- Create a financially based scheduling process that is consistent with real time prices.
- Support a full two part (conduct and impact) real-time mitigation.
- Accommodate expanded demand response mechanisms including the future support of real-time dispatchable load
- Ability to handle 2 settlements (Day ahead and Real-time) for ancillary services (reserve and regulation)
- Ability to handle ¼ hour external transaction scheduling
- Ability to control real and reactive devices
  Real Power : Generators MW output, Dispatchable Load , Pars

  Reactive Power : Generator Var Output, SVCs, Cap banks, Inductors, Transformer Tap changes
- Include the optimization of PARs and other controllable lines, if not initially at least in later deployment.

4 Overview of Real Time Scheduling (RTS) Architecture Design

RTS has three component parts – Real-Time Commitment, Real-Time Dispatch and Real-Time Dispatch – Corrective Action Mode. The following matrix shows which components are responsible for the major RTS tasks.

4.1 Real Time Scheduling tasks and component responsibility matrix

Component RTS Task	Real-Time Commitment (RTC)	Real-TimeDispatch (RTD)	RTD Corrective Action Mode (RTD-CAM)
External Transaction Scheduling and Posting	Yes	No	No
Gas Turbine Scheduling	Yes	No	Yes (Commit on only)
Unit dispatching	No	Yes	Yes
Security Monitoring and Constraining	Yes	Yes	Yes
Reserve Pickup	No	No	Yes
Maximum Generation Pickup	No	No	Yes
Price Mitigation Process	Yes	Yes	No
Thunder Storm Alert Process	Yes	Yes	No
Phase Angle Regulator Scheduling	Yes	Yes	No
10 minute Reserve Constraining	Yes	Yes	No/RPU Yes/Security
10 minute Reserve Monitoring	Yes	Yes	Yes
30 Reserve Constraining	Yes	Yes	Yes
30 Reserve Monitoring	Yes	Yes	Yes
Regulation Margin Constraining	Yes	Yes	No/RPU Yes/Security
Study Mode	Yes	Yes	Yes
Unit commitments	Yes	No	Yes

5 Components

5.1 Real-Time Commitment (RTC)

The Real-Time Commitment (RTC) is a new process that shall perform a 2 ½-hour economic study constrained by network limitations to produces more accurate estimates of unit output based upon expected Real-Time network limitations. RTC will be a ten quarter-hour rolling commitment process that commits resources and schedules all economic external transactions. It will ensure energy and reserve requirements are met at least as bid cost over the duration of the optimization. RTC will run every 15 minutes on the quarter hour.

The bidding for this market is finalized 60 minutes prior to the beginning of the Operating Hour. RTC shall balance an updated load forecast (performed by the NYISO) with generation commitment from the Day-Ahead Market plus energy bidding.

After the Day-Ahead schedule is published, and up to 60 minutes prior to each Operating Hour, Eligible Customers and Suppliers may:

1) Submit additional bids to the NYISO for Energy from:

   a) Generators or other resources that are dispatchable within five minutes and that can be included in and respond to the NYISO's RTD program

   b) Generators or other resources that are self scheduling into the real-time

2) Change their Bid Price for additional Energy from Generators that were committed by the NYISO in the Day-Ahead Market

3) Modify Bilateral Transactions that were accepted by the NYISO in the Day-Ahead schedule

4) Propose new Bilateral Transactions

5) Submit Bids to purchase Energy from the Real-Time Market.

The Bids submitted up to 60 minutes before the Operating Hour are referred to as Hour-Ahead-Bids. The NYISO uses the RTC before each Operating Hour to determine schedules for the LBMP Market and Bilateral Transactions including Exports, Imports and Wheels-Through. In developing these schedules, the RTC shall consider updated Load forecasts and evaluate the impact on reliability of the proposed schedules and commitments.

A generator which needs to remain on-line past the end of the Dispatch Day or Operating Hour to fulfill its minimum run time will have the responsibility to structure its bid in such a way as to continue to be economic as evaluated by SCUC or RTC, respectively, so it is scheduled to remain on-line.

Solution Process
The RTC function shall execute on a 15-minute periodic basis with a look-ahead horizon of up to 2 ½ hours in 15-minute increments as illustrated in Figure 1.1.

5.2 Real-Time Dispatch (RTD)

The RTD function shall normally execute with a 5-minute periodicity beginning at the top of the hour and following every 5 minutes after that.. RTD shall have an optimization look-ahead horizon of up to 60 minutes at 5-minute intervals. Optimization shall observe constraints, including: generation response rates, transmission security, reserve and gas turbine constraints, and external transaction ramp rates. The solution algorithms shall be identical to that incorporated in the RTC function and shall be subject to the same AC power system modeling conditions and constraints.

Solution Process

RTD shall calculate short-term generation schedules, referred to as a “base points”, for each of the generating units. The process that shall be used by RTD in performing this calculation can be described generally as follows (based on the existing SCD program). The RTD will be designed to with similar features while incorporating the new look-ahead aspect of the solution process:

1) NYISO databases. This information includes incremental bid cost curves of the generating units, telemetry data, and other data needed to model each of the constraints as previously described for SCUC and RTC.

2) RTD determines the initial conditions to begin the dispatch calculation. These initial conditions include:

   a) A snapshot of the telemetry values of generation output and power flows on the transmission system and load bus consumption, which represents the present state of the NYCA.

   b) Initial values of total system generation, load, actual net interchange, and transmission losses are computed based on the snapshot of telemetry data.

   c) Initial values of power flows associated with the transmission constraints are calculated.

   d) Generation “penalty factors” (i.e.: “delivery factors”, which are the reciprocal of penalty factors) are calculated, and are used to approximate the effects of changes in generation on system transmission losses. These penalty factors are updated throughout the RTD solution process.

   e) The allowable dispatch range (maximum and minimum limits) of the dispatchable generating units for each five-minute period are determined, during the solution process, considering maximum and minimum limits specified by the Market Participants, regulation constraints, and the response rates of the steam units.

3) RTD sets up the dispatch problem in a manner similar to that of SCUC and RTC. The cost objective function and all constraints are also expressed in a similar manner.

When the RTD program has completed the solution process, the final base points are sent to the on-line ORACLE database and to the Transmission Owners and/or individual generating units. Data concerning the active security and reserve constraints, and a list of the units that were used to solve the security constraints are also audited for use by the billing program and archived.

When the RTD program is not able to solve all the constraints, alarm messages are issued to the NYISO Shift Supervisor, or his designee. The NYISO Shift Supervisor, or his designee, may elect to take alternative action, if necessary, to bring the constraints under control.

5.3 Real-Time Dispatch-Corrective Action Mode (RTD-CAM)

Real-Time Dispatch-Corrective Action Mode is a specialized version of RTD that will only be run under extraordinary circumstances at the request of the system operators. RTD-CAM will have the capability to commit 10 minute (Fast Start) Gas Turbines. RTD-CAM will be run on demand and have a requirement to produce schedules in under 30 seconds from kickoff and will look ahead 15 minutes. It will be able to be run in continuous cycling mode if deemed necessary by operations staff and have the following selectable operational modes:

- Reserve Pickup
- Reserve Restoration
- Maximum Generation Pickup
- Basepoints ASAP (with the following options)
  - Allowing additional commitments
  - Utilizing existing on-line units.

5.4 Mitigation

RTS will be designed to implement the NYISO's conduct-impact based mitigation. There are a number of mitigation options under consideration. This will be discussed in detail in the automated Mitigation Process Concept of Operation.

5.5 Ancillary Services

There will be a two-settlement system for reserve and regulation ancillary services. The key elements of the two-settlement system are:

- Prices for all reserves and regulation will be set by the shadow prices of the reserve constraints out of the SCUC and RTS models. These shadow prices include the opportunity cost of reserves of the marginal reserve provider.
- Separate lost opportunity cost payments will no longer be paid.
- Reserve providers scheduled day-ahead will be paid the day-ahead reserve clearing prices.
- Reserve providers with net real time reserve and regulation schedules will be settled at real time prices.

5.5.1 Reserves

The key elements of the reserve market are:

- Real time reserves will be modeled in RTC and commitments will be made to meet those requirements.
- Reserve Sharing agreements with our neighbors will be recognized.
- The same reserve requirements will be modeled in RTD and actual reserve schedules will be determined by RTD.
- Consistent demand curves will be applied in SCUC, RTC and RTD.
- Special bidding rules for pumped storage units will be maintained so that appropriate levels of reserves are considered in each of the possible commitment states - pumping, off, synchronized and generating.
- Loads will be eligible to participate with appropriate quality metering and demonstrable performance.
- Locational pricing of reserves will be maintained including the LI reserve price mitigation.
- Model real-time locational reserve requirements for the NYCA, East of Central East, and LI.
- Reserve prices are set using the shadow prices that will be an output of SCUC and RTD.

5.5.2 Regulation

The key elements of regulation market are:

- Real time regulation will be modeled in RTC and commitments will be made to meet those requirements.
- Regulation Sharing agreements with our neighbors will be recognized.
- RTC and RTD will recognize a consistent set of resources.
- The same regulation requirements will be modeled in RTD and actual regulation schedules will be determined by RTD.
- Loads will be eligible to participate with appropriate quality metering and demonstrable performance

6 Notable Implications of RTS Design

1) GT's will have either 10 or 30 minute starts

2) On a special case emergency basis some may be started with a 10 minute10-minute notice by the dispatch function.

3) All units will be given 5-minute basepoints (via the web and where possible via TO direct communication) and 1 hour of 15-minute advisory look-ahead basepoints (via the web or where possible via direct communication). In any case, no more forward information will be provided to generators than will be provided to other Participants.

4) Those that want to operate at a fixed point and not be moved should bid accordingly. In practice we will be providing a profile of currently expected future basepoints on the web for those units not equipped to receive control signals from a TO so all should be able to follow. In fact it should improve a unit's ability to follow economic signals since we will be providing a trail of expected 15-minute basepoints.

5) Self-commit and self-scheduling will be provided, subject to operator approval.

6) Ex-ante and ex-post pricing modules will be provided but settlement will take place on ex-post prices only.

7) Pricing methods within the scheduling and dispatch components of SCUC and RTD will utilize the same logic as the ex-ante module.

8) Preliminary ex-ante prices will be calculated and posted as advisory prices.

9) Preliminary Ex-post prices will be calculated and posted in Real-time.

10) Bids into the RT market will close 1 hour prior to the dispatch hour.

11) Ex-post prices will be verified prior to daily billing.

12) Advisory schedules for RT external transactions will be posted 45 minute prior to the hour and external transactions will be confirmed upon completing checkout.

The following Figures describes the timings of the RTC and RTD functions:

6.1 RTC and RTD Coordination Timeline

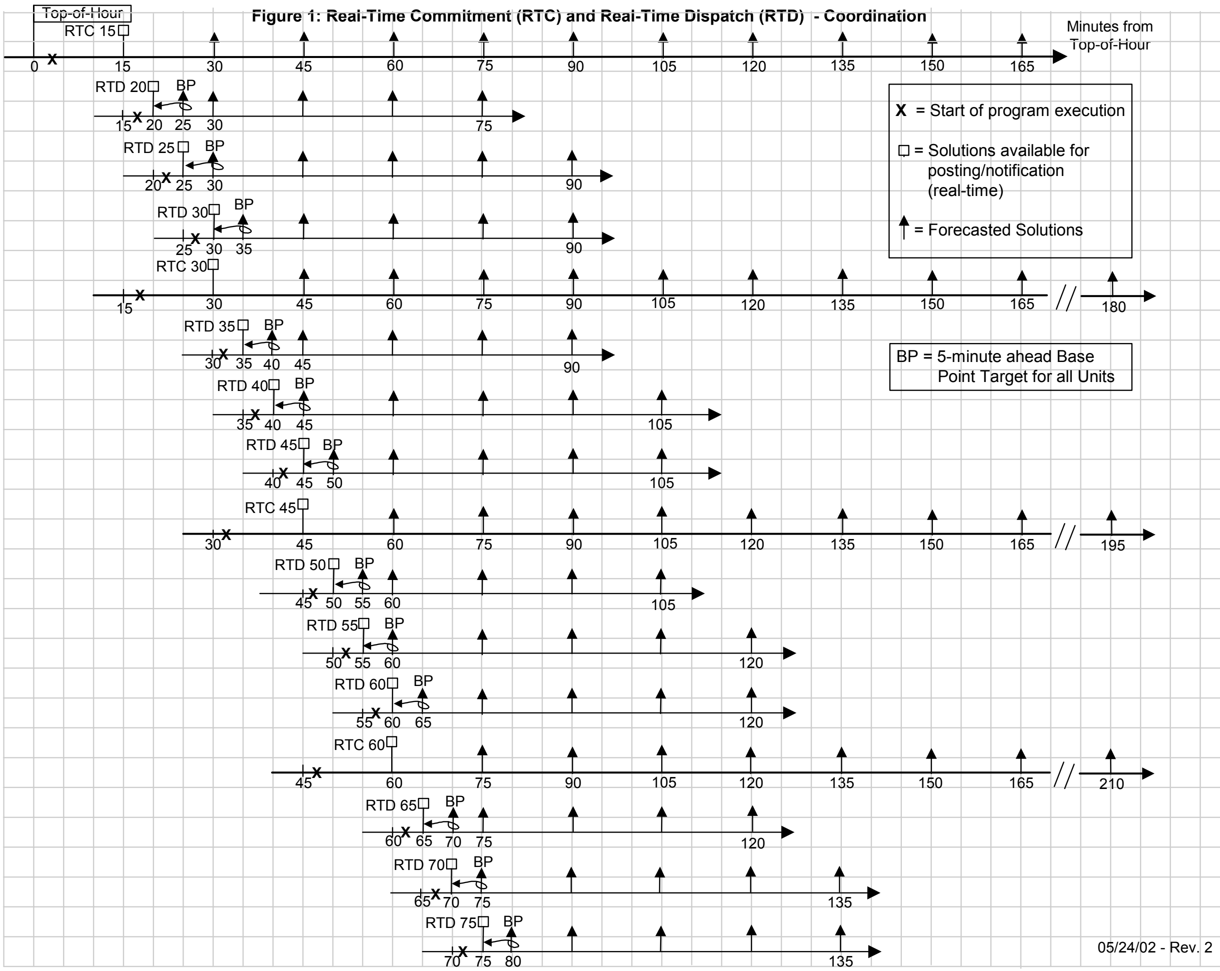
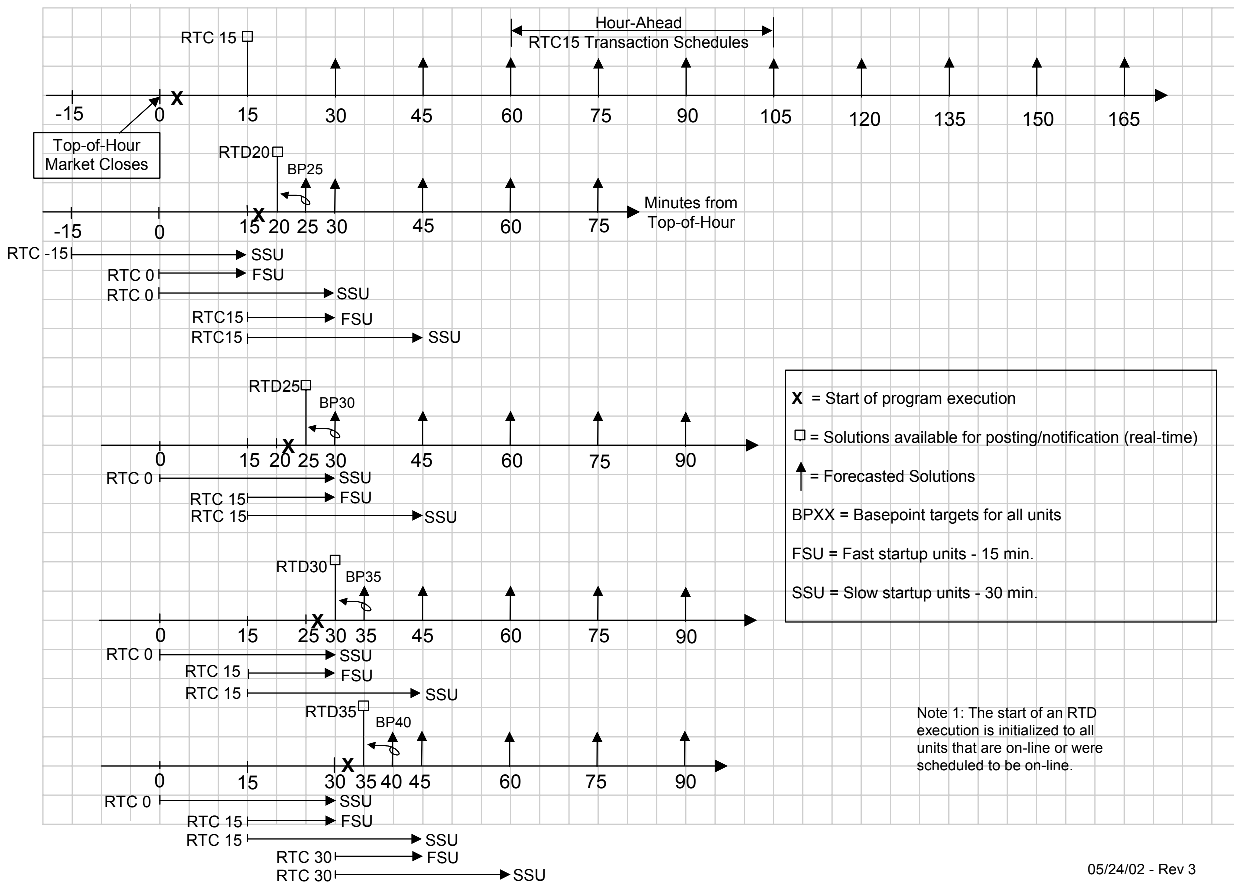


Figure 1: Real-Time Commitment (RTC) and Real-Time Dispatch (RTD) - Coordination

The above is a graphical depiction of RTS components RTC and RTD coordination. Each RTD run receives a label in terms of our description of the model that indicates the time at which the results of the run are posted. Similarly, each RTC run receives a label in terms of our description of the model that indicates the time at which the results of the run are posted. The execution time of the RTC component will be less than 15 minutes and the forecast can be seen to be out 3 hours in 15 minute intervals. The execution time of the concurrent running RTD component is approximately 3 minutes and the forecast can be seen to be out 1 hour with one 5 minute, basepoints setting interval, and the following 4 15 minute intervals setting advisory basepoints.

6.2 Real-Time Commitment Time Line

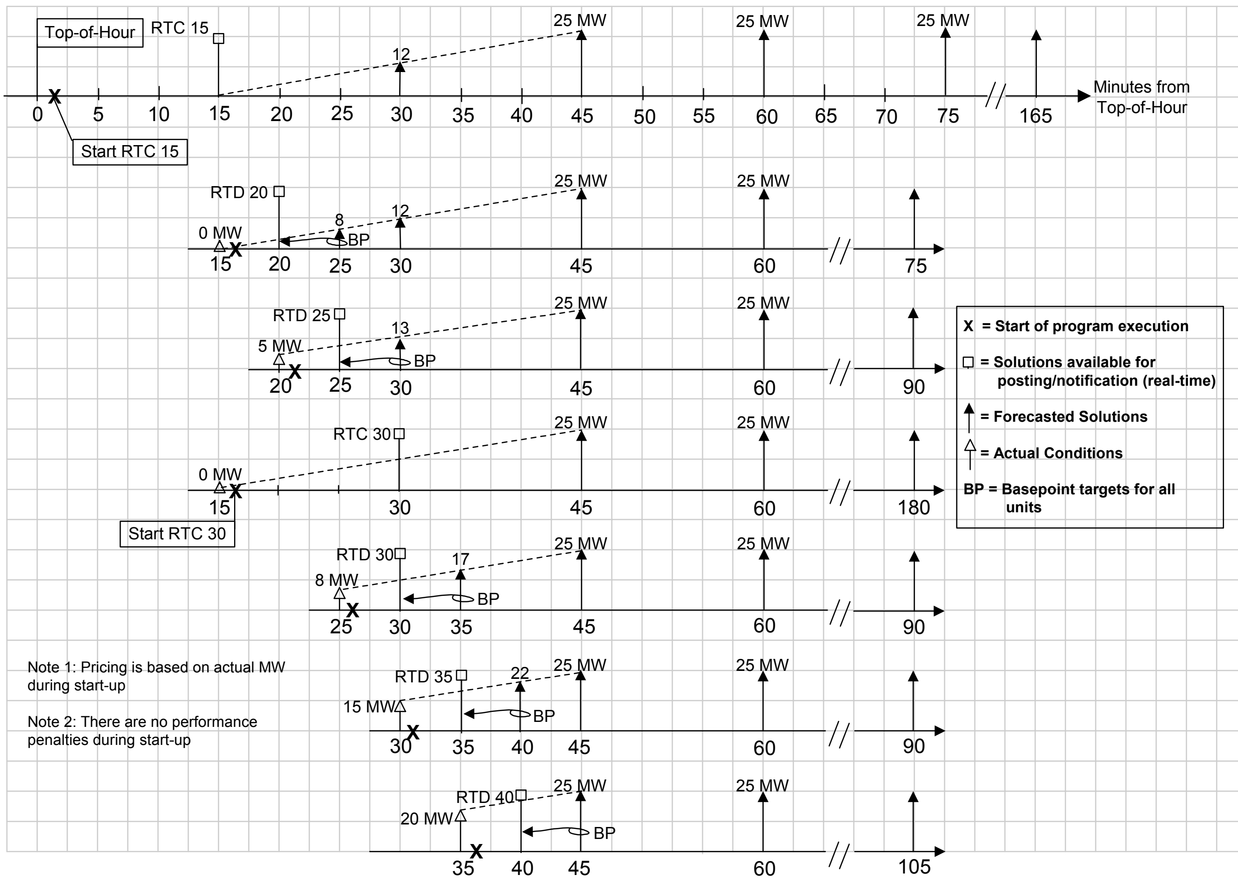
Figure 2: Real-Time Commitment (RTC) and Real-Time Dispatch (RTD) - Time Line Sequence



The above is a graphical depiction focusing on the RTC component scheduling of external transactions, slow start units and fast start units. The RTC runs that post at 15 minutes past each hour determine the economically evaluated external transactions scheduled for the following hour, i.e., RTC 15 determines the economically evaluated external transaction schedules for time 60 through 120. All units in RTC will receive binding startup notifications consistent with startup time included in their real-time bids. Units that submit a 30-minute start-up time will receive a binding startup notification from the RTC that posts its results 30 minutes before the scheduled start of the unit. Units that submit a 10-minute start-up time will receive a binding startup notification from the RTC that posts its results 15 minutes before the scheduled start of the unit. A unit that is scheduled to start at time 60 with a 30-minute startup time will be given a binding commitment by RTC 30. RTC-15 may have indicated that the unit was likely to start at time 60 but that commitment is only advisory. RTC-45 will not re-evaluate that commitment but rather will take the commitment of that unit as a given for time 60 and for the duration of the units minimum run time. A unit that is scheduled to start at time 60 with a 15-minute or less startup time will be given a binding commitment by RTC-45. RTC-30 may have indicated that the unit was likely to start at time 60 but that commitment is only advisory.

6.3 Slow Start Unit Scheduling Example

Figure 3: RTC/RTD - Slow Start Unit (SSU) Scheduling Example

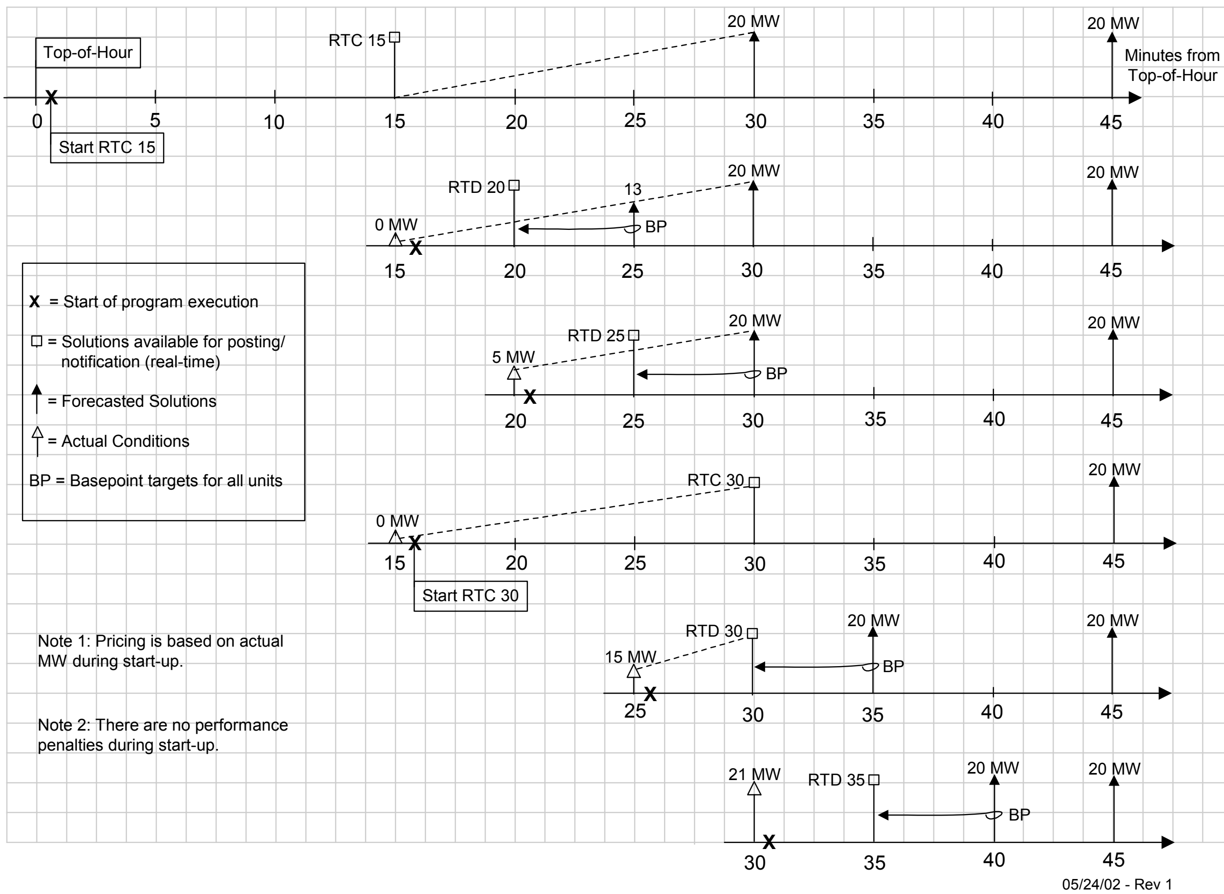


05/24/02 - Rev 3

The above figure details the RTC scheduling of Slow Start Units (SSUs) and the how the underlying RTD runs utilize the passed SSU schedules.

6.4 Fast Start Unit Scheduling Example

Figure 4: RTC/RTD - Fast Start Unit (FSU) Scheduling Example



The above figure details the RTC scheduling of Fast Start Units (FSUs) and the how the underlying RTD runs utilize the passed FSU schedules.

7 Inputs

7.1 Load Forecast

A load forecast function will supply the RTC component with subzonezonal load forecasts. The Load Forecast must be produced for 15-minute intervals, beginning ½ out and running three hours out. For example, an RTC forecast would be generated at 9:00 a.m. and exported to the RTC. This forecast would contain eleven forecasts for the System and each of the eleven zones. These eleven forecasts would be for: 9:30 a.m., 9:45 a.m., 10:00 a.m., 10:15 a.m., 10:30 a.m., 10:45 a.m., 11:00 a.m., 11:15 a.m., 11:30 a.m., 11:45 a.m. and 12:00 noon. It is presently contemplated that these forecasts will be instantaneous forecasts.

7.2 Load Predictor

A load predictor function will supply the RTD and RTD-CAM components with subzonezonal load forecasts. For RTD the Load Predictor must be produced for 5-minute intervals, beginning ten-minutes out and running for one hour. For example, an RTD forecast would be generated at 9:00 a.m. and exported to the RTD. This forecast would contain eleven forecasts for the System and each of the eleven zones. These eleven forecasts would be for: 9:10 a.m., 9:15 a.m., 9:20 a.m., 9:25 a.m., 9:30 a.m., 9:35 a.m., 9:40 a.m., 9:45 a.m., 9:50 a.m., 9:55 a.m., and 10:00 a.m. It is presently contemplated that these forecasts will be instantaneous forecasts.

For RTD-CAM the load predictor must be available on demand, and must be available on a rolling five-minute basis for a fifteen-minute period. For example, if an RTD-CAM was invoked at 9:04 a.m. by the Operator, an RTD-CAM forecast would be need to be available immediately. This forecast would contain three forecasts for the System and each of the eleven zones. These three forecasts would be for: 9:09 a.m., 9:14 a.m., and 9:19 a.m. The RTD-CAM forecasts would need to be developed so that the RTD-CAM could be run in a continuous cycling mode if deemed necessary by operations staff.

7.3 State Estimated Values

A state estimator function will supply all initial real time values of generation and line flows. If there is a problem with the state estimator the real time telemetered values will be used as required.

7.4 Security Inputs

The security function, described later in this document, will supply all necessary line, contingency and transfer constraint information.

7.5 Market Information System

The market information system will provide the following data to RTS:

- Generator Block Bids
- Self Scheduled Generator schedules
- Generator Upper and Lower Economic Limits
- Generator Response Rates (Normal and Emergency)
- Generator Statuses (On-dispatch, On-control, Self Scheduled)
- Physical Maximum Generation
- Physical Minimum Generation
- Ancillary Services Data (Reserves and Regulation)
- Start up costs, min gen , min down, min up, start-up time

7.6 Interchange Scheduler (IS+)

The interchange scheduler package will provide all prescheduled and short notice external transactions to RTC for the time horizon being considered.

8 Outputs

8.1 Schedules

The RTD component will output the following after each execution:

- Five-minute basepoints (set points) for all NYISO qualified generating units and dispatchable loads
- Ten-minute basepoints (set points) for all NYISO qualified generating units and dispatchable loads during a reserve pickup event.
- Fifteen minute advisory schedules for all NYISO qualified generating units and dispatchable loads for the entire RTD time horizon (minimum 1 hour)

The RTC component will output the NYISO Desired Net Interchange (DNI) schedule values for each quarter hour of the RTC time horizon for use by RTD (or RTD-CAM) and the MIS. It will send to RTD GT schedules.

8.2 System State Information

The RTS will output System State Flags (SSF) to the Transmission Operators and the public NYISO Web site indicating the following:

- Normal ISO Operation and rules in effect
- Major Emergency has been declared
- Reserve Pickup event in progress (flag sent to generators along with basepoint)
- Maximum Generation Pickup event in progress
- Warning and Alert State

8.3 Constraint and Price Information

The RTD component will output the following for the most current run

- Shadow Prices for Line Constraints
- Constraint and Flow Information

- Shadow Prices for providing 10 minute synchronized reserve for the three super zones
- Shadow Prices for providing 10 minute total reserve for the three super zones
- Shadow Prices for providing 30 minute total reserve for the three super zones
- Shadow Price for providing regulation for ISO
- System Lambda (Marcy bus centered)

The LBMP calculation function will use the above information to calculate real-time bus prices using ex-ante pricing methodology. Advisory The RTD module will calculate the ex-ante LBMPs internal to the program for the 1-hour time horizon being considered. The corresponding advisory LBMPs zonal prices will be output for the 1-hour RTD time horizon using the above outputs to the appropriate parties. The above data will be output to the LBMP Calculation module for use in the calculation of the ex-post prices.

9 Security and Reserve Functions

9.1 Overview of Security Functions

All three components (RTD-CAM included) will be required to monitor and if necessary adjust generations to accomplish the following:

1. Keep all pre-contingency real power flows within normal ratings for all monitored bulk power transmission facilities.
2. Keep all post-contingency real power flows within the appropriate emergency ratings for all monitored bulk power transmission facilities for any contingency defined under NYISO's current operating criteria.
3. Keep all real power flows across the transfer interfaces within the appropriate transfer limits.

Both RTC and RTD will use a common Security Analysis (SA) function in which new contingency cases will be able to be created by operations staff in real time as conditions dictate. RTC and RTD will have separate but identical sets of displays to show both actual and predicted security constraint flows for all constraints that are within 90% of the appropriate limit for multiple look ahead periods. It would be desirable to be able to present both RTC and RTD time dependant sets of constraints such that known (or expected) system changes could be considered in the appropriate time frames. The SA associated with the RTD-CAM component will include the Security Monitoring function. It will run on a 30 second cycle, evaluating all real and contingency flows and displaying the most critical facilities to the dispatchers.

9.2 Overview of Reserve Functions

All three components (RTD-CAM included) will be required to monitor and if necessary adjust generations to maintain necessary reserve requirements. RTC and RTD will have separate but identical sets of displays to show the forecasted reserve amounts and requirements for their multiple look ahead periods. The Reserve Monitor for RTD-

CAM will replace the current Reserve Comparator function and be able to alert and alarm any real-time reserve shortages.

9.3 Dynamic Line Limits

The Security Function will be able to accept dynamic line rating updates from the Transmission Operators

9.4 Delivery Factors

All scheduling processes will calculate delivery factors based upon the same methodology using the expected system configuration and loadings for the time horizons being evaluated.

9.5 Shift Factors

All scheduling processes will use generation and line shift factors calculated internally on a consistent basis on the expected system configuration for the time horizons being evaluated.

9.6 Interface Limits

There will be a consistent function to calculate interface transfer limits for all of the predetermined NYISO transfer interfaces.

9.7 Thunderstorm Alerts

The NYISO shall operate the ISO Secured Transmission System during adverse conditions, including but not limited to thunderstorms, hurricanes, tornadoes, solar magnetic flares and threat of terrorist activities, in accordance with the Reliability Rules, inclusive of Local Reliability Rules and related PSC orders. Consistent with such Rules, the NYISO shall maintain reliability of the ISO Secured Transmission System by directing the adjustment of the Generator output levels in certain areas of the system to reduce power flows across transmission lines vulnerable to outages due to these adverse conditions, thereby reducing the likelihood of major power system disturbances. The NYISO shall have the sole authority to declare that adverse conditions are imminent or present and invoke the appropriate operating procedure(s) affecting the ISO Secured Transmission System in response to those conditions. Activation of a procedure in compliance with a Local Reliability Rule shall involve a two step process. The Transmission Owner, directly involved with such Local Reliability Rule, such as Storm Watch shall advise the NYISO that adverse conditions are imminent or present and recommend to the NYISO the activation of applicable procedures in support of that rule. Consistent with the Local Reliability Rule, the NYISO shall declare the activation of the appropriate procedures. The Transmission Owner and the NYISO shall coordinate the implementation of the applicable procedures to the extent that ISO Secured Transmission System facilities are impacted. Records pertaining to the activation of such procedures and the response in accordance with those procedures shall be maintained and made available upon request.

Thunderstorm alerts will cause a predetermined set of constraints to be added to the SA functions of both RTC and RTD to be evaluated by the next execution of each. If a thunder storm alert or any other unplanned event causes any type of overload there will be an option for the operators to run an the on-demand RTD-CAM which will produce new schedules in under 30 seconds to relieve the overload. Dispatchers will have the capability to adjust system limits for system security.

10 Phase Angle Regulator Optimization

Phase Angle Regulator optimization and/or scheduling will be a feature of RTS, but will initially be disabled due to current operating practices. PAR schedules will be determined consistent with an overall least as bid cost commitment and dispatch. Specific point-to-point schedules across PARs or controllable elements are not considered by the optimization. The PAR schedules are determined by the dispatch of all resources on the system. When activated the following will apply:

a. The RTC program shall be initialized by the telemetered flows and settings of the phase angle regulators (PARs)
b. Software will be able to support individual selection of PARs to optimize
c. PAR scheduling would be used with limited movement (only ± 10 to 25 MWs range) per study period to represent actual tap movement
d. PAR scheduling would not be used in RTD-CAM

The user shall be able to select individual (or all) PARs to:

1) Hold the flow (block loaded) at the telemetered value, or

2) Adjust (optimize) the flow, or

3) Hold the PAR at the telemetered or user entered fixed tap setting.

11 Controllable Facility Operation

Controllable Facility Operation is under review by the RTs team and MSWG.s

12 Study Mode

There will be a Study Mode version of RTS that will enable system operators and Market Monitoring Unit to conduct 'What If' studies. This feature will have a user selectable look ahead time of up to 3 hours. The study Mode will incorporate all the features needed to create whatever scenarios deemed necessary by operations staff. All HMI's will have the same look and feel of the production RTS. The Study Mode RTS will have access the MIS database.

13 GT Management Start/Stop

There will be a feature that will allow ISO operations staff to start or stop, or delay the turning on or turning off of gas turbines. This facility will normally operate in a mode where all first time GT basepoints are held back until the system operators give an explicit approval for the basepoint to be sent to the unit. Additionally all GT turbine itsstartups or shutdowns must be first approved by system operators. There will be messages sent to the operators indicating when a GT has met it's minimum run time and is not economic. In the RTD-CAM functions RPU and MAX Gen Pickup the default will be for GT schedules to be sent out without operator approval due to the emergency nature of the event .