A536: Real-Time Scheduling

Bidding

Concept of Operation

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1 INTRODUCTION

1.1 Goal Statement

Define the rules, parameters, obligations, and constraints associated with bids and requests in the real-time scheduling system. The term "bid" in this document is associated with a price sensitive offer, one that has a price. Thus an internal generator submits a bid to supply energy if the LBMP is at or above the price specified in the bid. The term "request" is not associated with price. A request for a pre-scheduled external transaction, for example, will be granted if ramp and capacity are available without regard for the price of energy.

1.2 Definitions, Acronyms, and Abbreviations

Term	Description
BME	Balancing Market Evaluation
LBMP	Locational based marginal price
RTC	Real-time commitment
RTD	Real-time dispatch
RTD-CAM	Real-time dispatch – corrective action mode
RTS	Real-time scheduling (RTC, RTD, and RTD-CAM)
SCUC	Security constrained unit commitment

2 DESCRIPTION

This document is not intended to be a comprehensive compendium of bid and request parameters. Rather it is intended to describe the parameters of bids and requests that are relevant to the RTS. Thus, this document will discuss the form and composition of the incremental energy bid of an internal energy supplier, but it will not discuss other parameters of the bidding organization such as address, contact, collateral requirement, etc. that are important only in another context.

Real-time bids and requests are accepted hourly from internal suppliers of energy and ancillary services. Similarly, hourly bids and requests are accepted for external transactions. Initially, full pre-scheduling and short notice external transactions will not be part of the real-time scheduling system. Some parameters may be adjusted hourly; some parameters may be adjusted far less frequently and may require a day or more to change. This document makes a distinction between "constant" parameters that change infrequently and "hourly" parameters.

Hourly adjustable bid parameters must be received by the close of the hourly market, which occurs ~~60~~75 minutes prior to the hour. For example, the incremental energy cost bid from a generating unit to supply energy for the hour beginning at 5:00 must be received by ~~4:00~~3:45.

2.1 Entities with Bids in RTS

2.1.1 Internal Resources

Internal generating units or qualified demand side resources may supply energy and/or ancillary service. Internal resources may be dispatchable or self-scheduled. Self-scheduled resources in turn may be fixed or flexible.

- **Dispatchable**: the resource follows a 5-minute base point, or, if providing regulation, follows a 6-second base point. These resources may provide ancillary services.
- **Self-Scheduled Flexible**: the resource is self-committed but has a dispatchable range. The resource follows a 5-minute base point within the dispatchable range, or, if providing regulation, follows a 6-second base point. These resources may provide ancillary services.

- **Self-Scheduled Fixed**: the resource is self-committed and has no dispatchable range. These resources may not provide ancillary services.

2.1.2 External Transactions

External transactions (imports, exports, and wheels) may be ~~pre-scheduled or~~ economically scheduled~~. In either case, the transaction would be~~ (EST) and will be evaluated and scheduled hourly~~. Pre~~. Economically scheduled transactions ~~may incorporate~~will have a single MW schedule ~~changes at 15-minute intervals; economically scheduled transactions may not change schedule during the~~for the entire hour~~. Pre-scheduled~~. Economic transactions are ~~approved solely on availability of capacity and ramp. Pre-scheduled transactions are evaluated hourly. Transactions are~~ scheduled if energy prices estimated by RTC are within the limits of the bid.

A limited form of pre-scheduled transactions (PST), on an hourly basis is being implemented to accommodate external ICAP deliverability rules. Full pre-scheduling is being considered as a future enhancement to RTS but will not be included in the initial implementation. If implemented, it is envisioned that a pre-scheduled transaction may specify a different MW schedule for each 15-minute interval within a given hour and would be approved solely on availability of capacity and ramp.

Short notice external transactions (SNETs) are not being considered for implementation in the initial RTS. If implemented, it is anticipated that a SNET request must be received and approved 30 minutes before flowing. SNET requests, like pre-scheduled transactions, would not be economically evaluated.

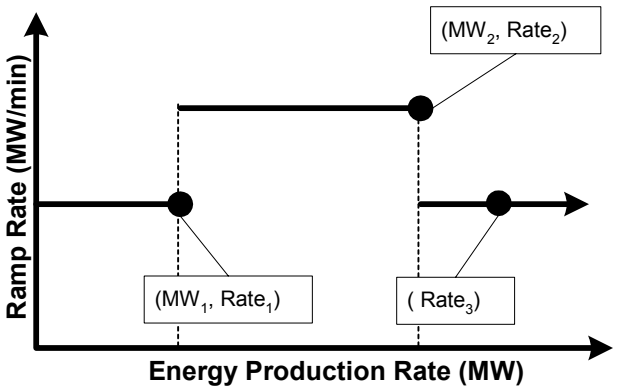
3 Bid from Internal Energy Suppliers

Bids to supply energy come from generation internal to the NYCA and demand-side resources internal to the NYCA. Upon demonstration of ability, qualified demand-side resources may offer energy, as do traditional generating resources. Bidding parameters will be identical for all internal resources.

3.1 Constant Parameters

Timing parameters define constraints that are modeled in SCUC and RTC. Each parameter may have one value that is used by SCUC and another value that is used by RTC. The two values need not be the same. In some cases, parameter values for RTC must be in a range that is more restricted than the range allowed for SCUC.

Parameter	Description
Minimum run time	The minimum amount of time for which an energy resource can be committed. The maximum value allowed in RTC is one hour.
Startup time	The time needed to 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.
Minimum down time	Minimum time that must elapse between decommittment (shutdown) of an energy resource and its next commitment (startup). Value must be in the range zero to 168 hours (up to one week).
Maximum stops per day	RTC will monitor, but not ~~recognize or honor~~enforce the "maximum stops per day" parameter. This parameter is used only by SCUC.
Normal ramp rate	Up to three response rates (MW/min) can be specified for normal operations as shown in Figure 1~~Figure 1~~. The applicable operating range must be given if more than one normal response is specified.

	 **Figure 1. Normal Response Rates**
Emergency ramp rate	The emergency response rate (MW/min) is used during the corrective actions of reserve pickup and max gen pickup. The emergency rate may be no less than the largest normal response rate.

3.2 Hourly Parameters

Hourly parameters related to energy bidding are illustrated in Figure 2~~Figure 2~~ and include minimum generation level and cost, steps of incremental energy, and various operating limits.

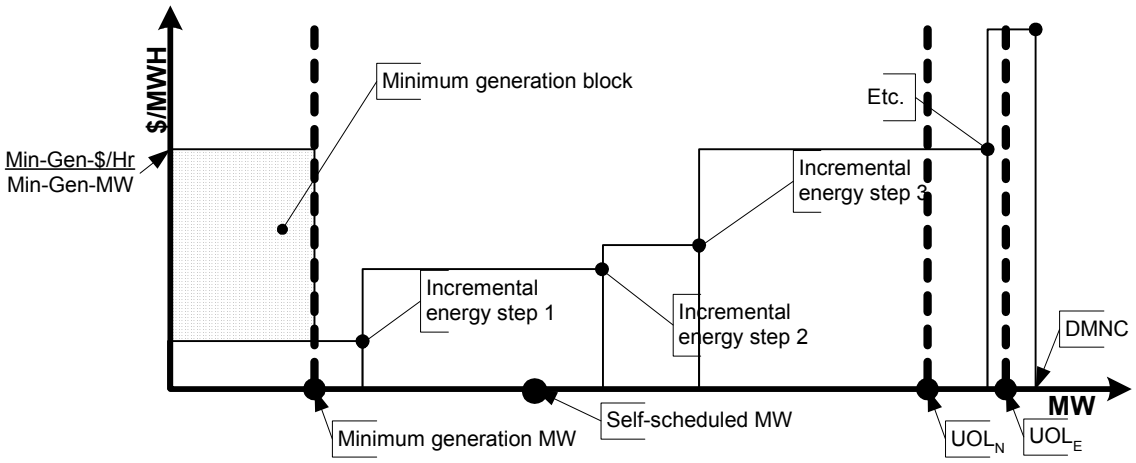


Figure 2. Energy Bidding Parameters

New features include the ability to specify both normal and emergency upper operating limits. Self-scheduled resources will be able to specify output level independently of upper and lower operating limits. Also, the incremental energy cost curve will be specified using up to 12 constant cost steps ; currently the incremental energy cost curve may contain up to three steps or 5 piece-wise linear segments. A unique start up cost may be defined for each hour of the day. Alternately, start up cost may be defined as a function of the number of hours since shutdown.

3.2.1.1 Incremental Energy Parameters

Incremental energy bids are represented by up to 12 steps as shown in Figure 2~~Figure 2~~. Each "step" is defined by a pair of numbers that give the energy output rate (MW) and incremental cost ($/MWH). The steps must be monotonically increasing and must cover the full operating range of the resource.

3.2.1.2 Minimum Generation Parameters

The minimum generation operating level is defined by a MW amount. This level may change hourly. The minimum generation cost is defined by a total minimum generation cost in dollars for one hour of operation at the minimum generation level.

Parameter	Description
Minimum generation level	Minimum operating level, or energy output rate, of the resource (MW). Neither RTC nor RTD will dispatch the resource below this minimum level.
Minimum generation cost	Cost, in dollars per hour, to operate at the minimum generation level.

3.2.1.3 Upper Operating Limit Parameters

Each internal energy supplier must specify a normal upper operating limit (UOL_N) and an emergency upper operating limit (UOL_E). These limits will be recognized both day-ahead and in real-time. Emergency ratings will be chosen for the day-ahead commitment and scheduling if the ISO determines, prior to the day-ahead market, that those ratings are required. A switch from normal to emergency limits can also be made in real-time with prior notification.

Parameter	Description
UOL_N	Normal upper operating limit (MW)
UOL_E	Emergency upper operating limit (MW)

3.2.1.4 Self-Scheduled MW Parameters

Energy providers fall into three categories: dispatchable, self-scheduled flexible, and self-scheduled fixed. The first two of these receive dispatch instructions from the ISO. Self-scheduled fixed resources do not receive dispatch instructions and must advise the ISO of expected energy output levels for the upcoming hour using the self-scheduled MW parameters. The self-scheduled MW parameters are ignored for resources that are dispatchable or self-scheduled flexible.

The four self-scheduled MW parameters specify the energy output level of the resource at the beginning of the first, second, third, and fourth quarter hour periods. It is the bidder's responsibility to insure that the change in output level from one quarter hour period to the next is consistent with the ramp rate of the resource. When scheduled changes are consistent with ramp rate, the profile of the actual energy output rate for the hour will be determined by applying the applicable ramp rate. When incompatible, the specified output level takes precedence over the ramp rate of the unit.

Parameter	Description
$MW_{:00}$	Energy output rate (MW) at the beginning of the hour (:00)
$MW_{:15}$	Energy output rate (MW) at quarter past the hour (:15)
$MW_{:30}$	Energy output rate (MW) at half past the hour (:30)
$MW_{:45}$	Energy output rate (MW) at three quarters past the hour (:45)

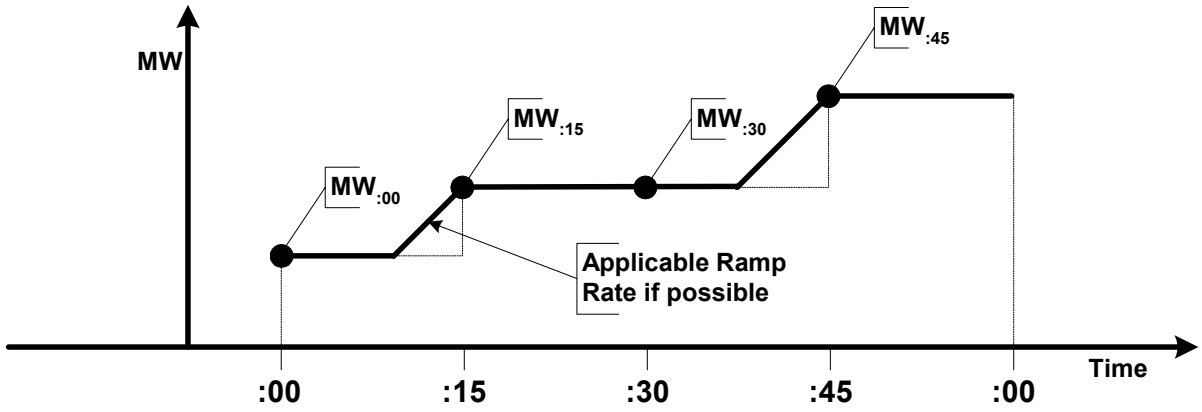


Figure 3. Self-Scheduled MW

3.2.1.5 Startup Cost Parameters

Startup cost (dollars per start) will be recognized by RTC in making commitment decisions. Startup cost can be specified by hour of the day or by elapsed time since the most recent shut down. The bidding resource can switch between the two representations hourly.

3.2.1.5.1 Hour of Day

Startup cost may be specified uniquely for each hour of the day.

Parameter	Description
SU_{hh}	Startup cost for hour beginning 'hh'. Where 'hh' is the hour during which the resource is first scheduled to be available. Note that the unit may have to begin its startup process during the previous hour so that it will be available at some time during hour 'hh.'

3.2.1.5.2 Elapsed Time since Shutdown

Startup cost may be calculated automatically using the elapsed time since the last shutdown and a curve , Figure 4~~Figure 4~~, supplied by the bidder. Up to six points pairs may be specified that define a piece-wise linear curve. Each point pair defines the hours off-line and corresponding startup cost. The curve need not be monotonic.

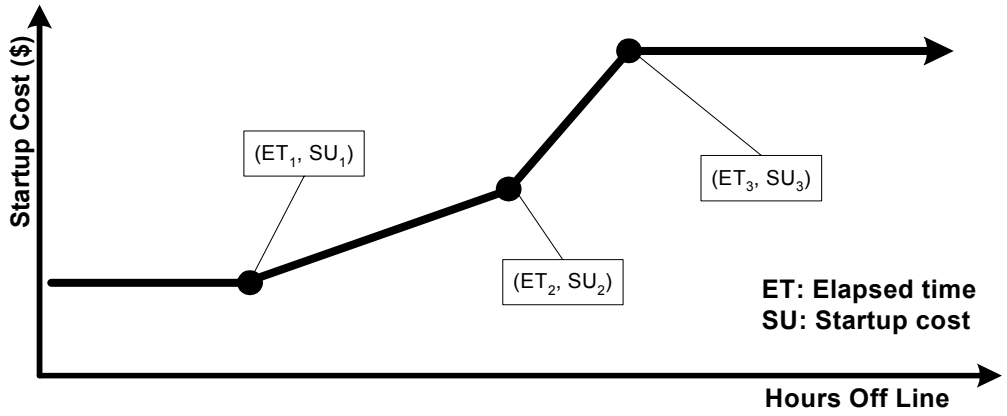


Figure 4. Startup Cost Curve

4 Bid from Suppliers of Ancillary Service

Internal generating units and qualified demand-side resources may supply ancillary service as indicated in the table below. For the purposes of providing reserves, off-line resources include demand response providers and generation units that can be started with 10 or 30 minutes notice.

Status	Start-Up	10-Spin	10-NS	30-Spin	30-NS	Regulation
On-Dispatch		✓		✓		✓
Self-Scheduled Flexible		✓		✓		✓
Self-Scheduled Fixed						
Off-line	10-minute		✓			
	30-minute				✓	

4.1 Reserve

Suppliers of both nonsynchronous and spinning reserve will be chosen automatically from among qualified ~~on-line~~ energy resources. The reserve capability in MWs will be determined based on the supplier's stated ramp rate. No availability bids will be permitted in the real-time market and a value of $0 will be used by the RTS software.

4.2 Regulation

Suppliers participating in the regulation market must specify both the maximum amount of regulation offered (MW change in 10 minutes) and an availability bid.

5 Bid for Economically Evaluated External Transactions

Bids for economically evaluated external transactions (import, export, wheel, or bilateral) must be submitted one hour before flowing. Duration of the transaction must be one hour. As shown in Figure 5~~Figure 5~~, the transaction must start and stop on the hour and have constant magnitude for the hour. Schedule changes during the hour will not be accommodated. Additionally the bid (sink price cap or decremental bid) associated with the transaction must be constant for the entire hour.

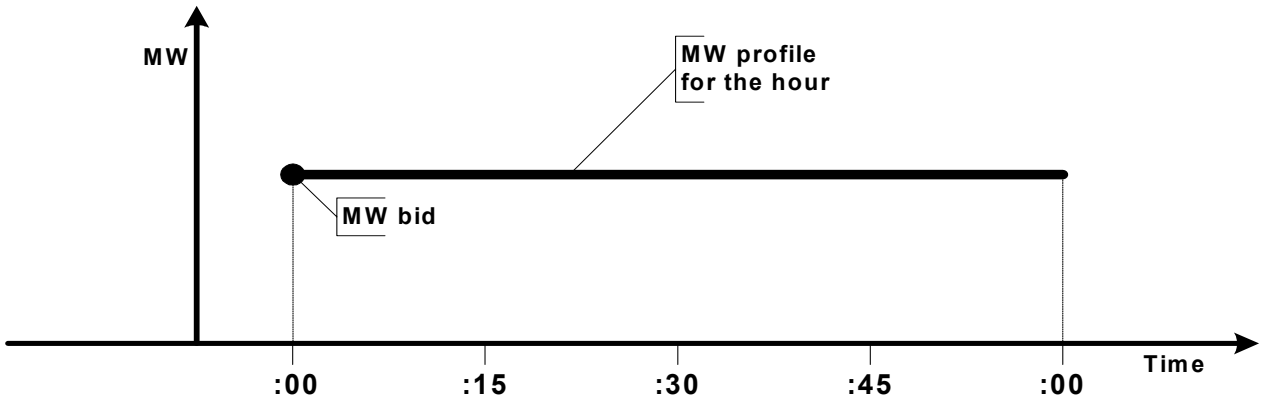


Figure 5. Profile of Economically Evaluated External Transaction

6 Request for Pre-Scheduled External Transaction

A limited form of pre-scheduled transactions (PST), on an hourly basis is being implemented to accommodate external ICAP deliverability requirements. Full pre-scheduling is being considered as a future enhancement as part of the OSS development but will not be included in the initial deployment of the RTS. If and when full pre-scheduling capability is made available, it is envisioned that transactions could be submitted hourly with energy profiles containing schedule changes at 15-minute intervals on the quarter hour.

7 Request for Short Notice External Transactions

Short notice external transactions will not be accommodated in the initial deployment of the RTS. If and when short notice external transactions are made available, it is anticipated that requests for such transactions must be received and approved at least 30 minutes prior to flowing.