COO

Virtual Bidding

CONCEPT OF OPERATIONS (COO)

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April 30, 2001	Draft 1
May 4, 2001	Corrections to draft 1
June 18, 2001	For 6/21/01 presentation at BIC. Changes are (1) clarification of locations (super-zones); (2) clarification of formulas; (3) fixed load bid allowed for PL only

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.*

Table of Contents

Introduction 1

Definitions and Abbreviations 1

Detailed Description 1

Virtual Load Bid 1

Virtual Supply Bid 4

Mixed Bidding Is Not Supported 6

Allocation of Ancillary Service Costs 6

Allocation of Uplift Costs 6

Locations Used to Determine Cost Allocation 8

Forecast and Actual Deficiency in a Location 9

Deficiency of a Location Relative to Deficiency of Other Locations 10

Deficiency of a Bidder in a Location Relative to Others in the Same Location 10

Allocation of IU_{NYCA} to a Bidder 11

Remainder of IU_{NYCA} Allocated to Physical Loads 11

Other Market Changes 11

Tariff Issues 11

Preliminary Software Impact Identification 12

Appendix A 13

Example of the Allocation of Incremental Uplift 13

Calculation of K^{fe} 13

Calculation of K^{loc} 13

Calculation of K^{bidder} 14

Allocation of Incremental Uplift to Bidders 14

Allocation of Incremental Uplift Physical Load 14

Introduction

Day-ahead virtual bidding will permit virtual load to buy energy in the day-ahead (DA) market at day-ahead prices and sell it in the real-time (RT) market at real-time prices. Virtual supply (alternately referred to as negative virtual load or virtual generation) would sell energy in the DA market at day-ahead prices and buy energy to cover its sale in the RT market at real-time prices. Neither virtual load nor supply would affect real-time energy consumption or supply. Since virtual bidders have the ability to influence day-ahead prices, the ability to bid price-capped load in the DA market is a prerequisite to implementation of DA virtual bidding.

This document begins with definition and clarification of the various issues involved with DA virtual bidding. Thereafter aspects of DA virtual load or supply bidding, including a revised allocation of uplift costs, are described. Changes to Tariff and bidding, scheduling and billing systems are also discussed.

Definitions and Abbreviations

Item	**Description**
DA	Day-ahead
ICAP	Installed capacity
LRR	Local reliability rules
NYCA	New York control area
PG	Physical generator
PL	Physical load
RT	Real-time
TCC	Transmission congestion contract
VB	Virtual bid or virtual bidding
VS	Virtual supply
VL	Virtual Load

Detailed Description

The following sections describe virtual bidding, allocation of ancillary service costs, allocation of uplift costs, and limits placed on bidding, interaction with TCCs, etc. Additional market changes that may be desirable, but are not specifically required for implementation of virtual bidding are also mentioned.

Virtual Load Bid

Both VL and PL bids are offers in the DA market to acquire a specific amount of energy, in a particular hour, in a specific NYCA zone, at or below a specific price. The VL bid is labeled virtual because the bidding entity submitting the bid does not have the intent to consume the energy it seeks to buy in the day-ahead market; rather, the bidder intends to sell the energy in the RT market. In reality, from the perspective of the DA market, there is no difference between a PL bid and a VL bid. In RT, however, the PL will consume energy (to the extent that it has not over-bid in the DA market)[1] and the VL will not.

The parameters of a load bid are described in the table below. A load bid may have either a fixed block or up to three price-capped blocks.[2] All bids are for a specific hour of the next day so the parameters listed below are repeated for each hour of the day. A single bid may not contain both fixed and price-capped blocks. The price-capped load bid is illustrated in Figures 1 and 2. The ability to submit a fixed bid, that is a bid without a price cap, will be restricted with the introduction of VL bidding. Bids to purchase energy for consumption by physical loads will be allowed to use fixed blocks; other bids to purchase energy must use price-capped blocks.

Bidding Parameter	**Description**
Forecast MW	An estimate of RT energy consumption. The forecast MW is not a bid

[1] A physical load that buys more energy in the day-ahead market than it consumes in real-time is indistinguishable in its effects from a virtual load.

[2] MIS software currently supports a 3-block bid for energy.

	parameter. It is used for initial billing purposes only. A VL must always enter a forecast of zero since it does not consume energy in RT.
Fixed MW	A positive number specifying the amount of energy (MWH) to be purchased during the hour regardless of price.
Block #1 amount	A positive number specifying the additional amount of energy (MWH) to be purchased during the hour if the zonal market clearing price is equal to or below the value set in Block #1 cap. This parameter is described on the current bid forms as “Price Cap #1 MW.”
Block #1 cap	The maximum price ($/MWH) to be paid for the energy in the first block. The energy block will be purchased if the zonal LBMP is less than or equal to the price cap value. Otherwise the first block of energy will not be purchased. This parameter is described on the current bid forms as “Price Cap #1 $/MW.”
Block #2 amount	A positive number specifying the additional amount of energy (MWH) to be purchased during the hour if the zonal market clearing price is equal to or below the value set in Block #2 cap. This parameter is described on the current bid forms as “Price Cap #2 MW.” The parameter need be entered only if the bid contains two or more blocks at different prices.
Block #2 cap	The maximum price ($/MWH) to be paid for the energy in the second block. The energy block will be purchased if the zonal LBMP is less than or equal to the price cap value. Otherwise the second block of energy will not be purchased. When used, the Block 2 price cap must be greater than the Block 1 price cap. This parameter is described on the current bid forms as “Price Cap #2 $/MW.”
Block #3 amount	A positive number specifying an additional amount of energy (MWH) to be purchased during the hour if the zonal market clearing price is equal to or below the value set in Block #3 cap. This parameter is described on the current bid forms as “Price Cap #3 MW.” The parameter need be entered only if the bid contains three blocks at different prices.
Block #3 cap	The maximum price ($/MWH) to be paid for the energy in the third block. The purchase of the energy block will be made if zonal LBMP is less than or equal to the price cap. Otherwise the purchase will not be made. When used, the Block 3 price cap must be greater than the Block 2 price cap. This parameter is described on the current bid forms as “Price Cap #3 $/MW.”

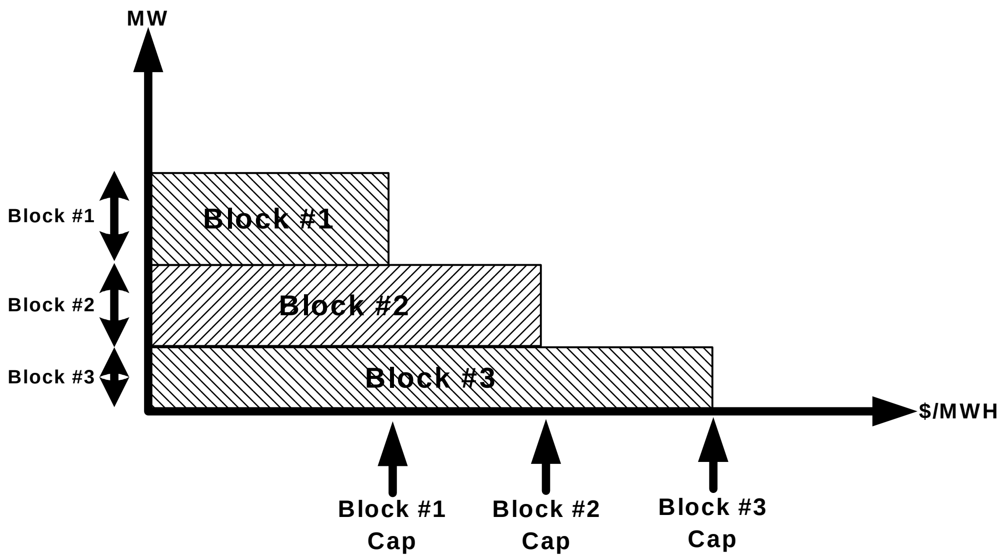

Figure 1. Price-Capped Load Bid

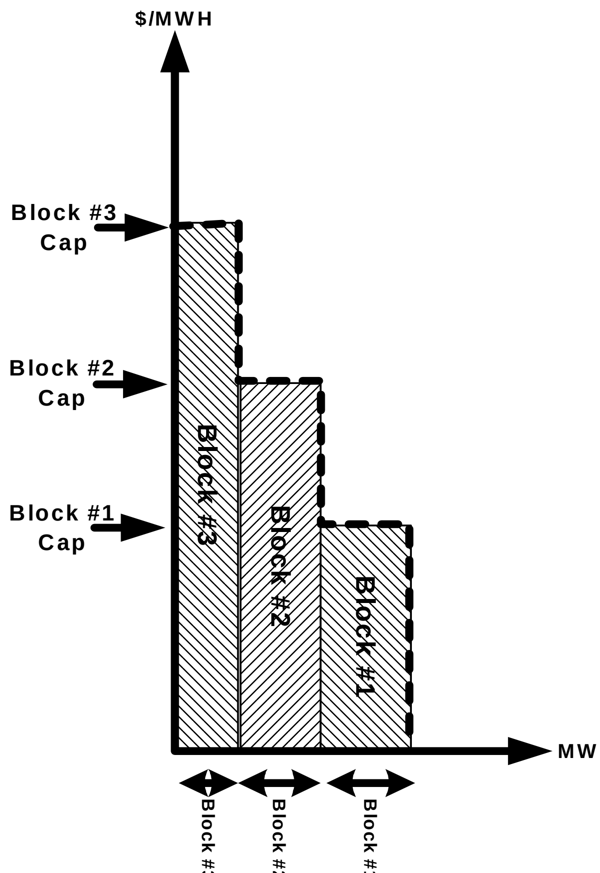

Figure 2. Price-Capped Load Bid Represented as a Demand Curve

Virtual Supply Bid

A VS bid is an offer in the DA market to provide a specific amount of energy, in a particular hour, in a specific NYCA zone, at or above a specific price. The VS bid is inherently different than a PG bid because: (i) The VS does not necessarily intend to supply energy in real-time;[3] rather, the sale will generally be covered by purchasing energy in the RT market; (ii) the VS must be bid in blocks; (iii) the VS cannot provide ancillary services; (iv) the VS does not qualify for ICAP payments; and (v) VS is not considered when evaluating system reliability in the forecast load or local reliability passes of the SCUC.

The parameters of a VS bid are described in the table below and illustrated in Figures 3 and 4. These parameters apply to the VS bid but do not apply to the PG bid. A VS bid can specify up to three energy blocks, each with a price cap. All bids are for a specific hour of the next day so the parameters listed below are repeated for each hour of the day. While it is theoretically possible to specify a VS bid using the VL form with negative block amounts, the practice will not be allowed. Instead, a new form will be created specifically for VS bidding to avoid the confusion of negative numbers.

Block #1 amount	A positive number specifying the amount of energy (MWH) to be sold during the hour if the zonal market clearing price is equal to or above the value set in Block #1 cap.
Block #1 cap	The minimum price ($/MWH) that will be accepted for the energy in the first block. The first energy block will be available for sale if the zonal LBMP is greater than the price cap. If the price equals the price cap, it is available for sale but might not all be scheduled. Otherwise the energy block will not be sold.
Block #2 amount	A positive number specifying an additional amount of energy (MWH) available for sale during the hour if the zonal market clearing price is equal to or above the value set in Block #2 cap. The parameter need be entered only if the bid contains two or more blocks at different prices.
Block #2 cap	The minimum price ($/MWH) that will be accepted for the energy in the second block. The second energy block will be available for sale if the zonal LBMP is greater than or equal to the price cap. Otherwise the energy block will not be sold. When used, the Block #2 price cap must be greater than the Block #1 price cap.
Block #3 amount	A positive number specifying an additional amount of energy (MWH) available for sale during the hour if the zonal market clearing price is equal to or above the value set in Block #3 cap. The parameter need be entered only if the bid contains three blocks at different prices.
Block #3 cap	The minimum price ($/MWH) that will be accepted for the energy in the third block. The sale of the energy block will be made if zonal LBMP is greater than or equal to the price cap. Otherwise the sale will not be made. When used, the Block #3 price cap must be greater than the Block #2 price cap.

[3] Entities submitting virtual supply offers may, however, intend to cover their position by scheduling an import or internal bilateral should the expected real-time price rise.

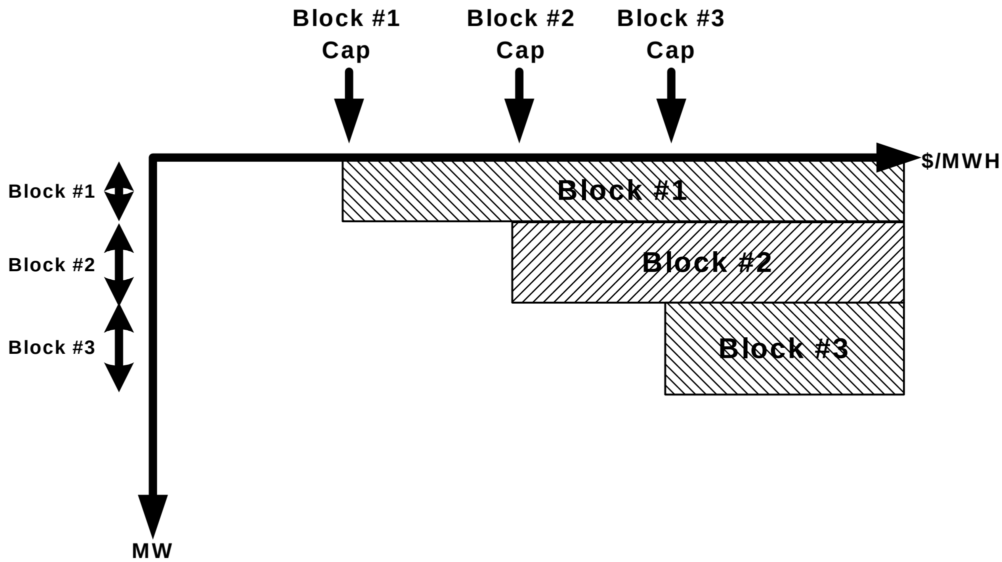

Figure 3. Virtual Supply Bid

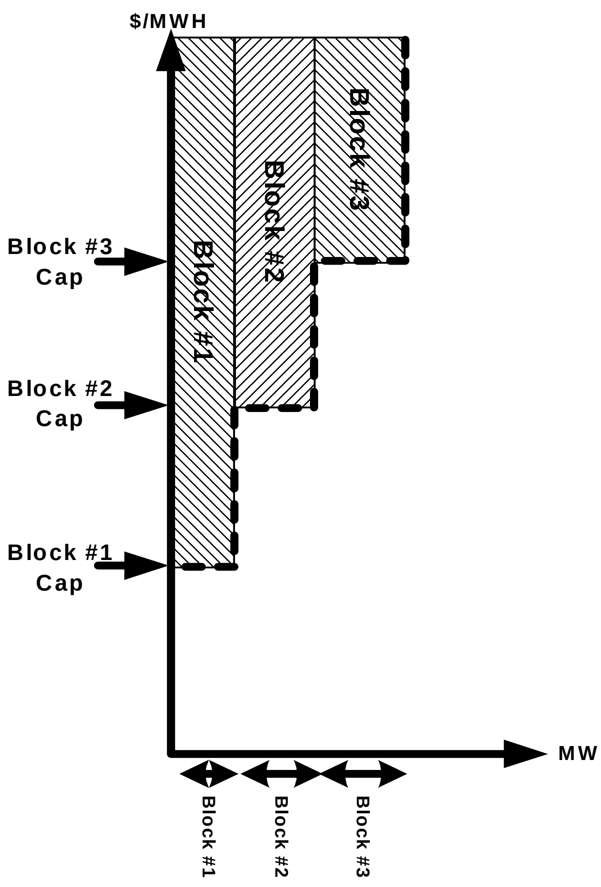

Figure 4. Virtual Supply Bid Represented as a Supply Curve

Mixed Bidding Is Not Supported

It is theoretically possible to make a VS bid by entering negative numbers in the VL bidding form. Indeed it is theoretically possible to combine VL and VS bids, using a combination of positive and negative numbers as shown in Figure 5. Such a bid would purchase energy if the price were low enough and sell energy if the price were high enough. Such mixed bidding will not be supported. Separate forms will be provided for VL and VS bidding.

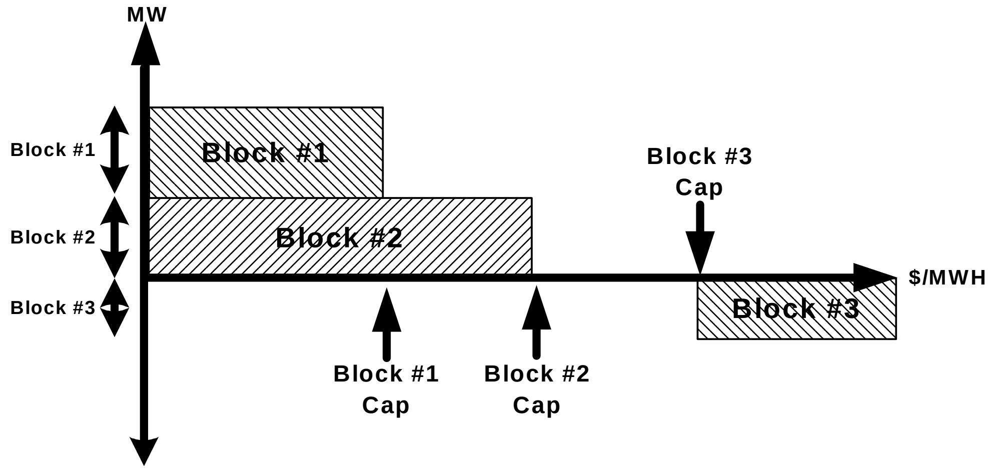

Figure 5. Mixed Bid

Allocation of Ancillary Service Costs

Under the current rules the physical loads pay for all ancillary service costs. No change in the allocation of ancillary service costs will be made for the implementation of VB. The cost of ancillary services would continue to be allocated to PL based on actual consumption in RT (by load weighted share).

Allocation of Uplift Costs

Under the current rules the physical loads pay for all components of uplift, with the LRR portions paid by only the physical load entities affected by the LRR. A new uplift allocation scheme that will be implemented in conjunction with the introduction of virtual supply bidding will improve the current allocation scheme because it aims at a fairer cost distribution. In particular, it offers an additional incentive for physical loads to bid their forecast load in the DAM to avoid paying for the incremental uplift due to the difference in the bid and actual load (as well as covering their imbalances at possibly quite high real-time prices) and recognizes the potential for virtual supply bids to give rise to uplift costs.

Virtual supply bidding and physical load underbidding in the DAM have the potential to increase the uplift cost by requiring the commitment of additional resources to secure system reliability. To allocate the uplift costs more fairly among the market participants, and further deter a variety of bidding strategies intended to capture above market uplift payments, a change to the current methodology of uplift allocation will be made when VS bidding is implemented. This change will entail the separation of uplift into components and an allocation of the cost of those components to specific market segments. The various uplift components in the DAM and RT are identified in Figure 6.

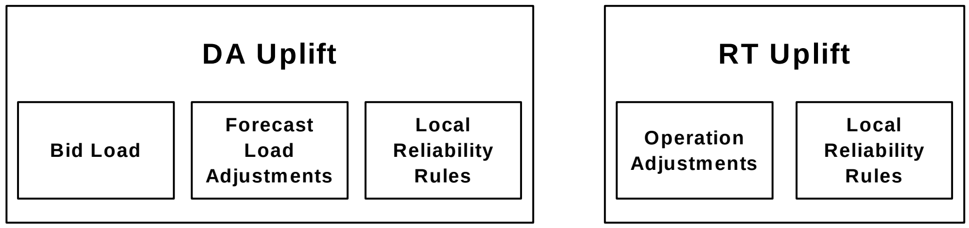

Figure 6. Uplift Components

The three DA components of uplift cost are:

1. Uplift attributable to bid load, including physical and virtual loads and virtual supply. This portion of the uplift will be allocated to physical loads by load-weighted share as is currently done.

2. Incremental uplift cost attributable to the commitment of additional physical supply and imports to secure system reliability based on forecast load. This portion of the uplift will be allocated to two market segments:

   - To the extent that the NYISO forecast does not exceed actual load, to bidding entities that are short in real time. These are loads whose actual consumption is more than they have acquired DA, and virtual suppliers;

   - To physical loads, by load-weighted share, to the extent that the NYISO load forecast exceeds actual load.

3. Uplift attributable to the commitment of additional generators to meet local reliability rules (LRR). This portion of the uplift will be assigned to the physical loads impacted by the LRR as is currently done.

In RT, the two uplift cost components are:

1. Costs associated with dispatching generators to secure system reliability against actual system operating conditions such as line outage not accounted for in the DA SCUC runs, errors in the NYISO load, block loading of GTs.

2. Costs associated with dispatching generators to secure system reliability against actual system operating conditions to meet LRR. This portion of the uplift will be assigned to the physical loads impacted by the LRR as is currently done.

Of the five uplift cost components listed above, a change will be made only to the allocation of incremental uplift caused by the commitment of additional resources required to secure the system based on the NYISO load forecast. This aspect of the uplift allocation is explained in the following sections and uses the symbols of the following table:

Symbol	**Description**
$Def_{b,L}$	Deficiency of bidder “b” in location “L.”
$FCST_{z,h}$	NYISO Forecast of total energy withdrawal for zone “z” for hour “h” (MWH)
IU_b	Portion of incremental uplift ($) charged to bidder “b.”

IU_{NYCA}	Total incremental uplift ($) resulting from the commitment of generators to meet the difference between bid and forecast load.
$K_{b,L}^{bidder}$	One of the scale factors used to determine the portion of IU_{NYCA} allocated to bidder "b." This scale factor estimates how much of the deficiency in location "L" is due to bidder "b." • Must be in the range [0,1]
K_{L}^{fe}	One of the scale factors used to determine the portion of IU_{NYCA} allocated to bidders in location "L" who are short in real time. This scale factor estimates the portion of IU_{NYCA} that cannot be attributed to forecast error. • Must be in the range [0,1]
K_{L}^{loc}	One of the scale factors used to determine the portion of IU_{NYCA} allocated to bidders in location "L" who are deficient in real time. This scale factor estimates the deficiency in location "L" relative the accumulated deficiencies of all locations.
LD	Accepted load bid. Each accepted load bid has the following attributes: • LD.actual(h) is the actual energy consumption (MWH) in hour "h" • LD.bidder is the bidder of the load • LD.da(h) is the DA purchase of energy (MWH) in hour "h" • LD.location is the location (super-zone) where the load bid is placed.
$LDef_{L}^{act}$	Actual deficiency of location "L" for the day
$LDef_{h,L}^{act}$	Actual deficiency of location "L" in hour "h"
$LDef_{L}^{fcst}$	Forecast deficiency of location "L" for the day
$LDef_{h,L}^{fcst}$	Forecast deficiency of location "L" for hour "h"
VS	Accepted virtual supply bid. Each accepted virtual supply bid has the following attributes: • VS.bidder is the bidder of the virtual supply • VS.da(h) is the DA sale of energy (MWH) in hour "h" • VS.location is the location (super-zone) where the virtual supply bid is placed.

Locations Used to Determine Cost Allocation
The NYCA will be divided into locations (super-zones) for purpose of determining the allocation of DA incremental uplift resulting from the commitment of generators to meet the difference between bid load and NYISO forecast load. The locations are chosen to reflect the major bottlenecks in the NYCA transmission system. Each location is composed of one or more LBMP zones; a single zone may not be divided among multiple locations. The NYISO will periodically review the number and composition of the locations and make changes as needed. Reasonable advanced notification is required before the NYISO may change the number of locations or the composition of locations.

The degree of under-bidding, virtual supply bidding, and NYISO over-forecasting will be evaluated using these locations. Initially the NYCA will be divided into four locations as illustrated in Figure 7. The formulations below are independent of the number of locations into which the NYCA is divided.

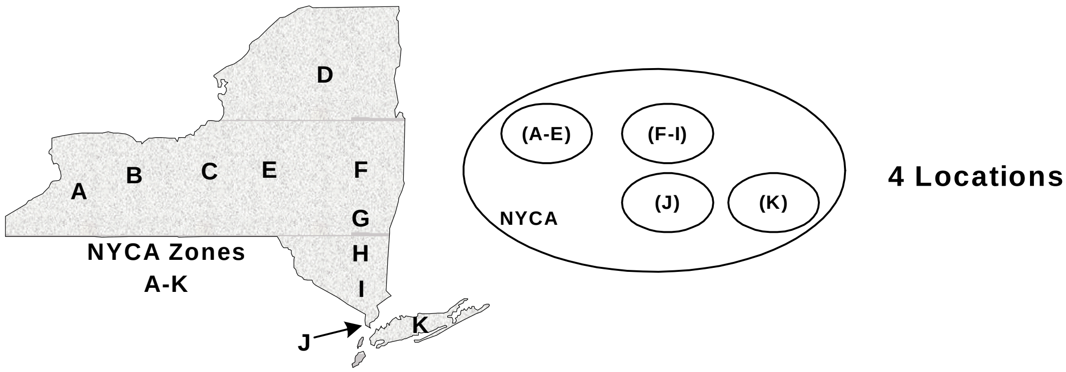

Figure 7. Locations for Uplift Cost Allocation

Forecast and Actual Deficiency in a Location

The term "deficient" is used to mean that the forecast or actual real-time energy withdrawal exceeds the DA net energy purchase (load minus virtual supply). Total daily deficiency of a location is determined by accumulating the hourly deficiency the location. Expression 1 and Expression 2 give the hourly forecast deficiency and hourly actual deficiency for hour "h." Both are constrained to be greater than zero. That is, a "surplus" is counted as zero so that, when accumulated over all hours of the day, hours with a "surplus" will not offset other hours with a deficit.

$$LDef_{h,L}^{fcst} = \left.\left(\sum_{z \in L} FCST_{z,h} + \sum_{VS.location=L} VS.da(h) - \sum_{LD.location=L} LD.da(h) \right)\right|_0$$

Expression 1

$$LDef_{h,L}^{act} = \left.\left(\sum_{LD.location=L} LD.actual(h) + \sum_{VS.location=L} VS.da(h) - \sum_{LD.location=L} LD.da(h) \right)\right|_0$$

Expression 2

The daily forecast and actual deficit for location "L" is found by summing the deficits for each hour of the day. This is shown in Expression 3 and Expression 4 respectively. Neither can be less than zero because of the constraint placed on hourly locational deficits above.

$$LDef_L^{fcst} = \sum_{h \in day} LDef_{h,L}^{fcst}$$

Expression 3

$$LDef_L^{act} = \sum_{h \in day} LDef_{h,L}^{act}$$

Expression 4

The ratio of these two is a scale factor used in the apportionment of IU_{NYCA} to entities in the location. The calculation of the scale factor is shown in Expression 5 and is restricted to have a value no less than zero and more than 1. The scale factor is assigned the value 0 (zero) in the event that the denominator of the expression is zero.

$$K_L^{fe} = \left.\frac{LDef_L^{act}}{LDef_L^{fcst}}\right|_0^1$$

Expression 5

For example, if the forecast deficiency in location "L" is 1000 MWH based on the NYISO forecast, but the actual deficiency turns out to be only 800 MWH, then

Expression 6

$$K_L^{fe} = \frac{800}{1000} = 0.8$$

Deficiency of a Location Relative to Deficiency of Other Locations
The ratio of a location's deficiency in to the accumulated deficiency of all locations in NYCA gives another scale factor used in the apportionment of IU_{NYCA} to accepted bids. The location's deficiency for a particular hour is given above in Expression 2and is constrained to be no less than zero. The accumulation of the deficiencies for all hours of the day is shown in Expression 3and also cannot be less than zero. The scale factor is calculated in Expression 7. The scale factor is assigned the value 1 (one) in the event that the denominator of the expression is zero. The scale factor is applied to all bidders with accepted load bids or accepted virtual supply bids in the location.

Expression 7

$$K_L^{loc} = \frac{LDef_L^{act}}{\sum_{L \in NYCA} LDef_L^{act}}$$

As an example the table below uses the tabulated deficiencies (surpluses) to calculate a scale factor for each location. Each deficiency (surplus) is based on actual consumption rather than forecast. A surplus (negative number) is replaced by zero in the calculation of the scaling factor.

Location	**Deficiency (Surplus)**	**Scale Factor**
A-E	90	$K_{A-E}^{loc} = \frac{90}{90+0+10+0} = 0.9$
F-I	(50)	$K_{F-I}^{loc} = \frac{0}{90+0+10+0} = 0.0$
J	10	$K_{J}^{loc} = \frac{10}{90+0+10+0} = 0.1$
K	(5)	$K_{K}^{loc} = \frac{0}{90+0+10+0} = 0.0$

Deficiency of a Bidder in a Location Relative to Others in the Same Location
A scale factor calculated from the deficiency of a bidder's accepted bids in a location relative to the deficiency of the accepted bids of other bidders in the same location is applied to that bidder in that location.

A bidder may have multiple accepted load bids in a particular location in an hour. For example, a bidder in the western location may have accepted load bids in one or more of the zones A, B, C, D, and E in each hour of the day. Further, a bidder may have multiple accepted load bids in a single zone and hour. In any hour, the "surplus" of one accepted load bid may offset the deficiency of another accepted load bid from the same bidder in the same location (but possibly a different zone). However, a surplus from one hour may not offset the deficiency of another hour. That is, the accumulated deficiency of a bidder's accepted load bids is considered zero for any hour that shows a surplus.

A bidder's accepted virtual supply bids in a location are accumulated separately from the bidder's accepted load bids in the same location. An accepted virtual supply bid, which is 100% deficient by definition, may not be offset by the "surplus" in an accepted load bid by the same bidder, in the same hour, and in the same location. The accumulation of the deficiencies within an hour for bidder "b" and subsequent accumulation of those deficiencies over all hours of the day are shown in Expression 8 for location "L."

$$Def_{b,L} = \sum_{h \in day} \left[\left| \left(\sum_{\substack{LD.location=L\& \\ LD.bidder=b}} LD.actual(h) - LD.da(h) \right) \right|_0 + \sum_{\substack{VS.loaction=L\& \\ VS.bidder=b}} VS.da(h) \right]$$

Expression 8

The ratio of the deficiency of bidder "b" to the accumulated deficiencies of all bidders in location "L" is shown in Expression 9 and gives another scale factor used in the apportionment of IU_{NYCA} to a bidder.

$$K_{b,L}^{bidder} = \frac{Def_{b,L}}{\sum_{b \in L} Def_{b,L}}$$

Expression 9

Allocation of IU_{NYCA} to a Bidder

Each bidder of load and/or virtual supply will be charged a portion of the incremental uplift incurred by the commitment of additional resources to secure system reliability. The amount ($) is given in Expression 10 for bidder "b."

$$IU_b = IU_{NYCA} \times \sum_{L \in NYCA} \left(K_L^{fe} \times K_L^{loc} \times K_{b,L}^{bidder} \right)$$

Expression 10

Remainder of IU_{NYCA} Allocated to Physical Loads

The portion of the incremental uplift incurred by the commitment of additional resources to secure system reliability, that is not charged to entities deficient in real-time, is charged to all physical loads on a load-weighted share basis. That amount is shown in Expression 11.

$$IU_{NYCA} - \sum_{b \in NYCA} IU_b$$

Expression 11

Other Market Changes

Other market changes have been suggested including (i) establishment of trading hubs; (ii) settlement of the DA market before the NYISO system is secured for forecast load; (iii) introduction of a two-settlement system for ancillary services; etc. These market changes will be pursued independently of VB. VB will be implemented in a manner that does not make these additional market improvements impossible.

Tariff Issues

The tariff does not contain a provision that explicitly bars participation by "non-physical" entities, however a number of provisions only provide for participation by "physical" participants and simply do not include language to handle virtual bids. Thus, tariff changes would be needed to implement VB. These changes consist mainly of adding language to permit virtual bidding, rather than dropping language that bars it.

Some of the clearest "physicality" language is set forth in Attachment B of the Services Tariff ("LBMP Calculation Method"), which notes that the LBMPs for "Generators and Loads" will be based on system marginal costs produced by SCD or SCUC. (Original Sheet No. 161). Attachment B also specifies that "External Generators and Loads can bid into the LBMP Market or participate in Bilateral Transactions." (First Revised Sheet No. 164). Additional language indicating that participation is limited to Generators and Loads can be found at Original Sheet No. 167 and First Revised Sheet No. 168, which describe DAM and RTM LBMP payments to "Suppliers" that own generation and charges to LSEs. (Attachment J to the OATT is identical to Attachment B to the Services Tariff and would also have to be fixed prior to implementing virtual bidding.)

In addition, Section 4.6 of the Services Tariff restricts the submission of load forecasts, bids and bilateral schedules to LSEs and to suppliers that control physical generators. Section 4.9, describing the operation of the SCUC, focuses on physical generators and demand-side resources to the exclusion of other kinds of suppliers. Section 4.11, when read in conjunction with Section 4.6) appears to limit DAM schedules to LSE load schedules/forecasts and Generator bids/outputs. Finally, Sections 4.16 and 4.18, which address day-ahead and real-time LBMP settlements may need revision.

Additionally, changes must be made to sections of the tariff where the allocation of uplift charges are defined.

Preliminary Software Impact Identification

MIS	
Bid & Schedule Data	1. Modification of load bid form 2. Creating of virtual supply bid form
Pre & Post SCUC/BME	1. Update information sent to SCUC to include VS bids 2. Acquisition of uplift information from SCUC needed to support BAS
IS+	
Outages & Derates	
Downloads/Updates	
Other	

BAS	
Billing	1. New allocation of uplift charges

Mainframe	
SCD	
RTSA	
93 Day Audit	
Host Data Exchange	
Other	

SPIDER	
SCUC	1. Output additional data to support new allocation of uplift costs
BME	
PTS	
Host Data Exchange	
Other	

Other	

Appendix A

Example of the Allocation of Incremental Uplift

The example below uses a hypothetical control area composed of two locations (A and B), three bidders (BLUE, RED, and GREEN), six load bids, and four virtual supply bids. In the interest of simplicity, the example contains only one time period and therefore does not illustrate various accumulations over all hours of the day. Data for the example are shown in the following three tables; an incremental uplift of $100.00 is used. Ultimately a portion of the incremental uplift will be charged to the three bidders and the remainder to physical load by load weighted share. The purpose of this example is to calculate the amount of incremental uplift assigned to the three bidders.

Energy Consumption		
Location	**Forecast**	**Actual**
A	300	290
B	300	330

Accepted Load Bids				
ID	**Bidder**	**Location**	**Day-Ahead Energy Purchase**	**Actual Consumption**
LD1	BLUE	A	100	90
LD2	BLUE	A	100	110
LD3	BLUE	B	100	110
LD4	BLUE	B	100	110
LD5	RED	A	100	90
LD6	RED	B	100	110

Accepted Virtual Supply Bids			
ID	**Bidder**	**Location**	**Day-Ahead Energy Sale**
VS1	GREEN	A	10
VS2	GREEN	B	10
VS3	RED	A	10
VS4	RED	B	10

Calculation of K^{fe}

The example shows that a portion of incremental uplift in location A can be attributed to over-forecast of the actual energy consumption. Consumption was not over-forecast in location B.

For Location A	For Location B
$LDef_A^{fcst} = 300 + 20 - 300 = 20$ $LDef_A^{act} = 290 + 20 - 300 = 10$ $K_A^{fe} = \frac{10}{20} = 0.5$	$LDef_B^{fcst} = 300 + 20 - 300 = 20$ $LDef_B^{act} = 330 + 20 - 300 = 50$ $K_B^{fe} = \left. \frac{50}{20} \right\|_0^1 = 1.0$

Calculation of K^{loc}

The example shows that the forecast deficiency of locations A & B are the same.

For Location A	For Location B
$K_A^{loc} = \frac{10}{10 + 50} = 0.16667$	$K_B^{loc} = \frac{50}{10 + 50} = 0.83333$

Calculation of K^{bidder}

Bidder deficiencies (from Expression 8) are shown in the following table:

For Location A	For Location B
$Def_{BLUE,A} = 200 - 200 + 0 = 0$ $Def_{RED,A} = (90 - 100)\|_0 + 10 = 10$ $Def_{GREEN,A} = 0 - 0 + 10 = 10$	$Def_{BLUE,B} = 220 - 200 + 0 = 20$ $Def_{RED,B} = 110 - 100 + 10 = 20$ $Def_{GREEN,B} = 0 - 0 + 10 = 10$

Bidder specific coefficients (from Expression 9) are shown in the following table:

For Location A	For Location B
$K_{BLUE,A}^{bidder} = \frac{0}{0+10+10} = 0$ $K_{RED,A}^{bidder} = \frac{10}{0+10+10} = 0.5$ $K_{GREEN,A}^{bidder} = \frac{10}{0+10+10} = 0.5$	$K_{BLUE,B}^{bidder} = \frac{20}{20+20+10} = 0.4$ $K_{RED,B}^{bidder} = \frac{20}{20+20+10} = 0.4$ $K_{GREEN,B}^{bidder} = \frac{10}{20+20+10} = 0.2$

Allocation of Incremental Uplift to Bidders

Bidder allocations (from Expression 10) are shown in the following table:

$$IU_{BLUE} = \$100.00 \times [(0.5 \times 0.16667 \times 0.0) + (1.0 \times 0.83333 \times 0.4)] = \$33.33$$
$$IU_{RED} = \$100.00 \times [(0.5 \times 0.16667 \times 0.5) + (1.0 \times 0.83333 \times 0.4)] = \$37.50$$
$$IU_{GREEN} = \$100.00 \times [(0.5 \times 0.16667 \times 0.5) + (1.0 \times 0.83333 \times 0.2)] = \$20.83$$

Allocation of Incremental Uplift Physical Load

The remainder of the incremental uplift is allocated to physical load (see Expression 11).

$$[\$100.00 - (\$33.33 + \$37.50 + \$20.83)] = \$8.34$$