Enhanced Shortage Pricing

Shaun Johnson
Manager, Energy Markets Products
New York Independent System Operator

Market Issues Working Group
March 25, 2010

Agenda

- Purpose of the Initiative
  - *What the shortage values represent*
  - *Current shortage values considerations/guidelines*
    - Considerations going forward
- Review Historic Activations
- Proposed Approach
  - *Regulation Demand Curve Modified*
  - *Current Reserve Demand Curves Modified*
  - *New Total Reserves Demand Curve*
- Advantages of Revised Shortage Values
- Next Steps

**Appendix on Current Shortage Values and VOLL References Included*

Purpose of Initiative

- Assess the operation of the current reserve and regulation shortage values to confirm the continued applicability of the current set points and to consider needs for additional shortage values to determine prices during shortage conditions.

Purpose of Initiative

- What do the shortage values represent?
  - *The shortage values need to reflect the value of reserves during shortage conditions, consistent with operational practice and reserve scheduling requirements*
  - *Shortage pricing ensures appropriate pricing and scheduling results when the desired amount of reserves or regulation is unavailable*

History of Current Values

- Current shortage values were structured based on a variety of general guidelines/ considerations, including:
  - *Is the reserve target a NYSRC/PSC or a NERC requirement?*
  - *"Center the demand curves around an activation target that allows for the shadow prices of 0.05% of hours from the historical period to exceed the demand curve so that reserve [and regulation] requirements are violated very infrequently"**

** from "Demand Curve Definitions", Presented by Andrew P. Hartshorn, LECG, Market Structures Working Group, August 27, 2003*

History of Current Values

- Current shortage value guidelines – cont'd
  - *Define shortage values with some slope where appropriate*
  - *Reflect the higher value of higher quality products*
  - *Review of market conditions causing extreme prices in the historical data*
  - *Review of the additive impacts of the reserve demand curves*

Additional Considerations

- Review/analysis of current shortage values has shown additional areas of consideration and opportunities for improvement
  - *Market prices that better reflect the value of energy during shortage conditions*
  - *Consistency with operational practices*
    - Availability of emergency operational actions
    - Commitment of GTs to provide energy and reserves
  - *Consider the value of lost load and probability of a load shedding event*

Historic Shortage Activation

- This chart shows activation of shortage pricing in NYISO DA and RT markets for 2006-2009 as a percentage of total hours (DA) or total intervals (RT) for the time period.*

2006-2009		Day-Ahead				Real-Time	
	NYCA	East	LI		NYCA	East	LI
10 Min Spin	0.00%	1.93%	9.13%		0.01%	0.91%	7.46%
10 Min Total	0.00%	0.00%	0.00%		0.11%	0.19%	0.30%
30 Min Total	0.00%	0.00%	0.07%		0.08%	0.04%	0.54%
Regulation	0.44%				1.24%		

*See Appendix for yearly percentages.

Proposed Approach

- NYISO is proposing a three part modification of the current shortage pricing mechanism:
  - *Update Regulation Demand Curve Points and Values*
  - *Update Reserve Demand Curve Points and Values*
  - *Create New Demand Curve Reflecting*
    - Value of Lost Load (VOLL)
    - Likelihood of Actual Load Shedding

Proposal to Modify Regulation Demand Curve

Proposed New Regulation Demand Curve

- Today's Reg. demand curve is based on shortage values relative to 25 MW
  - *If shortage < 25 MW, Reg. price = $250*
  - *If shortage >= 25 MW, Reg. price = $300*
- NYISO is proposing to update the Regulation demand curve to base its shortage values relative to 80 MW, which is representative of the largest GT in the NYISO.
  - *Shortages of regulation typically occur as a trade-off of energy. 80MWs represents the point at which Operations may start a quick start unit to provide energy and create regulation supply.*

Proposed New Regulation Demand Curve

- When the shortage < 80 MW the NYISO is considering three options for the shortage price, to reflect the relative cost of energy:
  1. *The load-weighted NYISO average Day-Ahead LBMP since 2006*
  2. *The load-weighted NYISO average Day-Ahead LBMP since 2006 fuel indexed*

Proposed New Regulation Demand Curve

- When the shortage >= 80 MW:

  Reg. price will equal the average cost of a GT
  - *Average cost of GT*
    - Analogous to the current off-line GT calculation
    - Components based off of NYISO-maintained references

Proposal to Modify Reserve Demand Curves

Proposal to Modify Reserve Demand Curves

- The NYISO is proposing to modify the pricing points for three of the existing reserve demand curves:
  1. *NYCA Total 10 minute*
  2. *LI 10 minute Spin*
  3. *LI 30 minute*

Proposal to Modify NYCA Total 10 Minute

- The current demand curve value of NYCA total 10 minute reserves is $150
- This value is less than the cost to start quick start resources
- Operational practice would indicate that the ISO should start a 30 minute GT to back down an on-line flexible resource and create the 10 minute reserve product
- NYISO proposes:
  - *NYCA 10 minute total reserve demand curve be increased to reflect the cost of starting a GT (similar to the Regulation demand curve proposal)*

Proposal to Modify LI 10 Minute Spin

- The current demand curve value of LI 10 minute spin is $25
- NYISO has been short of 10 minute spin on Long Island ~7.5% of all intervals since 2006
- There is no specific reliability requirement for this product in this location
- NYISO proposes:
  - *LI 10 minute spin demand curve be decreased to a lower value; reflecting the fact there is no associated reliability requirement*

Proposal to Modify LI 30 Minute

- The current demand curve value of LI 30 minute reserve is $300
- Original intent of this high shadow price was to reflect the reliability requirement
- Current level is similar to the costs of starting quick start resources
  - *Creates an indicator these resources would be started to meet this requirement*
- NO resources need to be committed to meet this requirement; it is satisfied by both 30 minute spin and non-spin resources
- NYISO proposes:
  - *LI 30 minute reserve demand curve be reduced to level consistent with value of the product*
    - Proposed value still to be determined

Proposal for NEW Demand Curve

Reasons for New Curve

- No mechanism exists which reflects the VOLL in our markets
  - *Current shortage demand curves represent the value for a specific product*
- Prices representing the VOLL incents behavior which may avert the need to shed load
  - *VOLL prices provide a price signal for demand response*
  - *Incent extraordinary supply measures by suppliers*

New Total Reserves Demand Curve

- Create a new Total Reserves demand curve
  - *Will incorporate the total NYCA reserves scheduled and the resources available to the operators before they would shed load*
    - Resources available to operators include options outlined in Section 4.4.2 of Emergency Operations Manual, such as:
      - Curtail external energy sales made by NYISO ICAP providers
      - Count the load reduction available from quick response voltage reduction as 10-minute reserve
      - Purchase emergency energy from sources outside NYISO
    - These emergency MW values would be included in the shortage pricing calculation

Value of Lost Load

- Pricing points on Total Reserves demand curve will be directly correlated to value of lost load (VOLL)
  - *VOLL is defined as the value an average consumer puts on an unsupplied MWh of energy*
  - *Literature review of VOLL studies & survey results (References included in Appendix)*

New Total Reserves Demand Curve Methodology

- Methodology:
  - *Compare sum of total NYCA reserves scheduled and emergency actions available to the operators to total NYCA reserve requirements*
  - *Use the results of this MW value to determine a load shedding factor*
    - Details to be determined
  - *Multiply this factor by value of lost load (VOLL)*

New Total Reserves Demand Curve Equation

- *Reserve prices for each reserve product and location will be set to:*

  Max (∑ Reserves Demand Curve Shadow Prices,
  New Total Reserves Demand Curve Shadow Price)

- *See following example*

New Total Reserves Demand Curve Example

- *<u>Example</u>:*
  - Shortage exists in NYCA and East of 10 Min Spin, 10 Min Total, and 30 Min Total
  - Assume SP1=$50, SP2=$150, SP3=$500, SP4=$25, SP5=$500, SP6=$25, and New Total Reserves Demand Curve SP=$300 *(Note: Prices are for illustration purposes only)*
  - *Reserve price for East 10 Min Spin will be calculated as follows:*

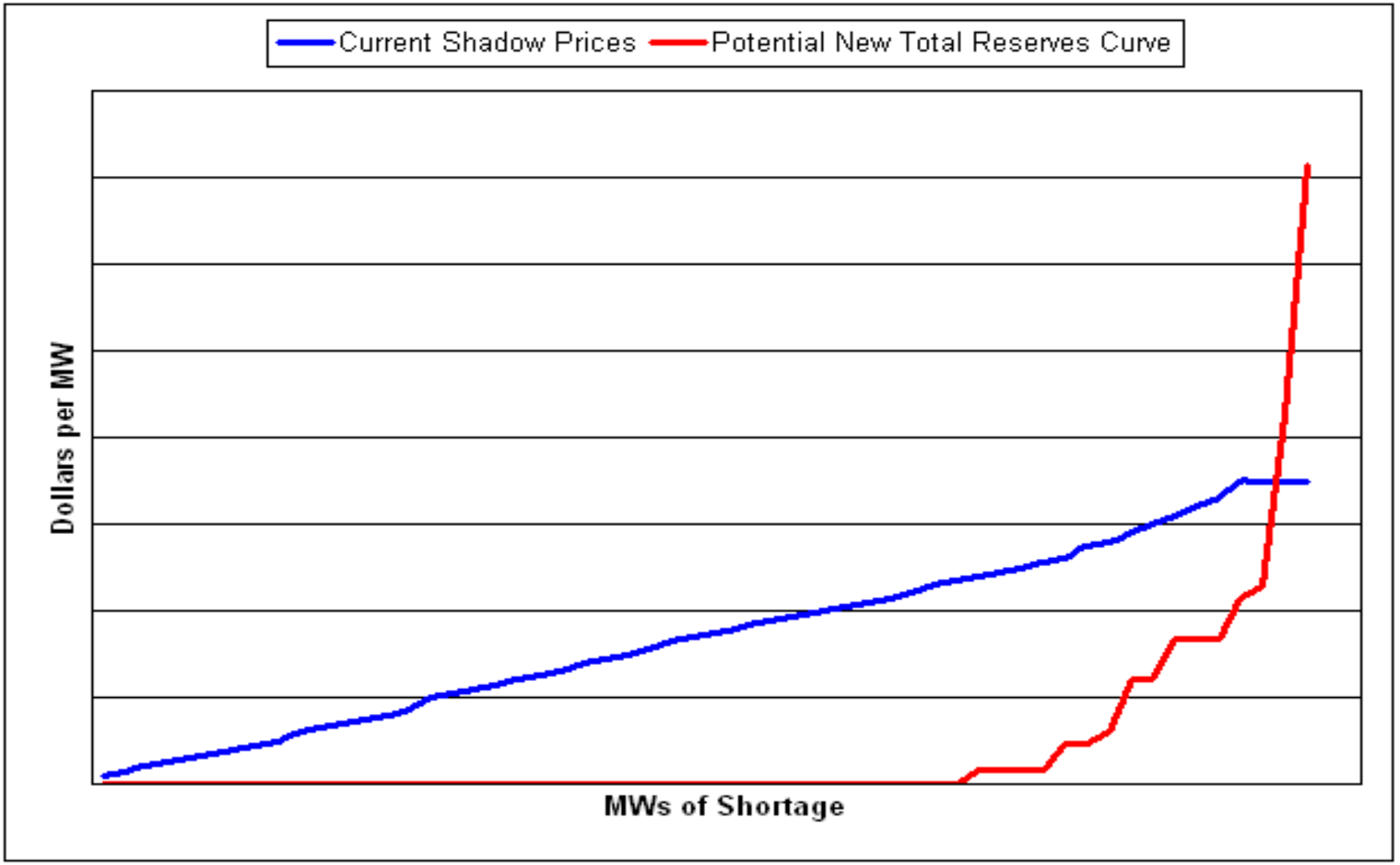
    Max (∑ Reserves Demand Curve Shadow Prices, New Total Reserves Demand Curve Shadow Price)

    = Max ($1250 , $300)

    = $1250

Visualization Tool for New Total Reserves Curve

(Values for visualization, not to indicate proposed points)



Benefits & Next Steps

Advantages of Revised Shortage Values

- Would provide a greater energy market price incentive for generator performance, generator location, demand response, and transmission expansion
  - *Shortage revenues are only received by resources that are online and available during shortage hours, providing performance incentives during shortage conditions*

Advantages of Revised Shortage Values

- Locational shortage revenues provide an incentive for capacity to be located where it can be dispatched during shortage conditions
- Shortage prices provide a price signal for demand response, the scheduling of imports, dispatchable generation, and for extraordinary supply measures by suppliers

What Do Our Neighbors Do?

- NE-ISO
  - *Shortage prices capped at $1000*
- PJM
  - *Undertaking a review of shortage pricing, using many of the same concepts*
- MISO
  - *Similar pricing mechanisms to the new proposed curve, shortage values up to ~$3500.*

Next Steps for Future MIWGs

- Consider needs for additional flexibility in shortage pricing methodology
- Incorporate feedback into concept design proposal
  - *Please send feedback to sjohnson@nyiso.com*
- Continue discussion at future MIWGs

NEW YORK INDEPENDENT SYSTEM OPERATOR

The New York Independent System Operator (NYISO) is a not-for-profit corporation that began operations in 1999. The NYISO operates New York's bulk electricity grid, administers the state's wholesale electricity markets, and provides comprehensive reliability planning for the state's bulk electricity system.

www.nyiso.com

Appendix

Current Shortage Pricing (Demand Curves)

	NYCA	EAST	LI
10 Min Spin	500	25	25
10 Min Total	150	500	25
30 Min Total	200MW @$50 200MW @ $100 200 MW @ $200	25	300

Current Shortage Pricing (Demand Curves) cont'd

- SP1 = Shadow Price for total 30-Minute Reserve requirement constraint for the hour
- SP2 = Shadow Price for total 10-Minute Reserve requirement constraint for the hour
- SP3 = Shadow Price for total Spinning Reserve requirement constraint for the hour
- SP4 = Shadow Price for Eastern or L.I. 30-Minute Reserve requirement constraint for the hour
- SP5 = Shadow Price for Eastern or L.I. 10-Minute Reserve requirement constraint for the hour
- SP6 = Shadow Price for Eastern or L.I. Spinning Reserve requirement constraint for the hour
- SP7 = Shadow Price for Long Island 30-Minute Reserve requirement constraint for the hour
- SP8 = Shadow Price for Long Island 10-Minute Reserve requirement constraint for the hour
- SP9 = Shadow Price for Long Island Spinning Reserve requirement constraint for the hour

Current Shortage Pricing (Demand Curves) cont'd

Cascading Shadow Prices			
Location/ Product	West	East	LI
10 min Spin	SP1 + SP2 + SP3	SP1 + SP2 + SP3 + SP4 + SP5 + SP6	SP1 + SP2 + SP3 + SP4 + SP5 + SP6 + SP7 + SP8 + SP9
10 Min Total	SP1 + SP2	SP1 + SP2 + SP4 + SP5	SP1 + SP2 + SP4 + SP5 + SP7 + SP8
30 min Total	SP1	SP1 + SP4	SP1 + SP4 + SP7

Current Shortage Pricing (Demand Curves) cont'd

Maximum Demand Curve Prices			
Location/ Product	West	East	LI
10 min Spin	$850	$1400	$1750
10 Min Total	$350	$875	$1200
30 min Total	$200	$225	$525

Current Shortage Pricing (Demand Curves) cont'd

Regulation Demand Curve Prices	
Shortage	NYCA
Less then 25MWs	$250
Greater then or Equal to 25MWs	$300

Historic Shortage Activation

- The following charts show activation of shortage pricing in NYISO DA and RT markets for years 2006-2009 as a percentage of total hours (DA) or total intervals (RT) for the given year.

2006		Day-Ahead				Real-Time	
	NYCA	East	LI		NYCA	East	LI
10 Min Spin	0.00%	1.62%	3.26%		0.01%	0.97%	5.78%
10 Min Total	0.00%	0.00%	0.00%		0.11%	0.33%	0.48%
30 Min Total	0.00%	0.00%	0.29%		0.15%	0.11%	1.03%
Regulation	0.23%				1.79%		

2007		Day-Ahead				Real-Time	
	NYCA	East	LI		NYCA	East	LI
10 Min Spin	0.00%	0.18%	9.45%		0.02%	0.98%	6.80%
10 Min Total	0.00%	0.00%	0.00%		0.21%	0.22%	0.39%
30 Min Total	0.00%	0.00%	0.00%		0.15%	0.05%	0.63%
Regulation	0.53%				1.24%		

Historic Shortage Activation – cont'd

2008		Day-Ahead				Real-Time	
	NYCA	East	LI		NYCA	East	LI
10 Min Spin	0.00%	5.79%	7.67%		0.01%	1.41%	4.32%
10 Min Total	0.00%	0.00%	0.00%		0.13%	0.17%	0.15%
30 Min Total	0.00%	0.00%	0.00%		0.03%	0.00%	0.19%
Regulation	0.84%				1.02%		

2009		Day-Ahead				Real-Time	
	NYCA	East	LI		NYCA	East	LI
10 Min Spin	0.00%	0.10%	16.15%		0.00%	0.29%	12.95%
10 Min Total	0.00%	0.00%	0.00%		0.01%	0.03%	0.20%
30 Min Total	0.00%	0.00%	0.00%		0.00%	0.00%	0.31%
Regulation	0.17%				0.91%		

Value of Lost Load References

- http://www.iso-ne.com/committees/comm_wkgrps/inactive/rsvsrmoc_wkgrp_Literature_Survey_Value_of_Lost_Load.rtf
- AIP, "The Value of Lost Load, the Market Price Cap and the Market Price Floor - A Response and Decision Paper", Sept. 18, 2007, AIP-SEM-07-484
- "Customer Cost of Electric Service Interruptions", Garry Wacker, Member IEEE, and Roy Billinton, Fellow IEEE, *Proceedings of the IEEE,* Vol. 77, No. 6, June 1989
- "Value of Lost Load", Peter Cramton and Jeffrey Lien, University of Maryland, Feb. 14, 2000

Value of Lost Load References cont'd

- "Household Response to Dynamic Pricing of Electricity – A Survey of the Experimental Evidence", Ahmad Faruqui and Sanem Sergici (from The Brattle Group), Jan. 10, 2009
- "Applications of customer outage costs in system planning, design and operation", K.K. Kariuki and R.N. Allan, *IEEE Proc.-Gener. Transm. Distrib.,* Vol. 143, No. 4, July 1996
- "Electricity supply reliability – Estimating the value of lost load", K.G. Willis and G.D. Garrod, *Energy Policy,* Vol. 25, No. 1, pp. 97-103, 1997