

Reserve Demand Curves

Presented by Andrew P. Hartshorn



Business Issues Committee

Agenda #11

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The scheduling and pricing functions in SCUC and BME have always included reserve demand curves. The reserve demand curves are analogous to the penalty function costs included in the objective function that allow the reserve constraints to be violated in order to obtain feasible solutions when not enough of a particular reserve is available.

BME on numerous occasions has calculated energy prices and reserve shadow prices well in excess of \$1,000 because of reserve constraint violations. However, these BME prices are not used to settle the energy or reserves scheduled in BME.

SCD does not solve (or value) these reserve constraints, but rather receives the reserve schedules from BME and calculates LMPs that do not include the full shortage or scarcity value of the reserves.

The fundamental goal of including demand curves in the RTS/SMD2 software calculation of reserves is to recognize the shortage or scarcity value of reserves, thereby implementing a more robust and tightly integrated method of pricing reserves and energy during scarcity conditions relative to the current interim approach in today's legacy system.

The demand curves need to reflect appropriate scarcity values while maintaining consistency with operational practice and reserve scheduling requirements (i.e., maintain scheduling objectives such that it has a negligible effect on the number of times or the magnitude by which reserve requirements might be violated without impacting system reliability).

The demand curves do not limit the actions that can be taken by operations staff to create or procure additional reserves if those reserves that are necessary to meet the requirements are available but not scheduled.

There are two distinct types of reserve constraints modeled in today's SCUC and BME.

- There are those that are based on reserve requirements that correspond to specific reliability rules, e.g., NYCA spinning reserve, NYCA 10-minute total reserve, NYCA 30-minute total reserve, Eastern 10-minute total reserve and the Long Island 30-minute total reserve.
- There are other reserve constraints in SCUC and BME that are based on guidelines that the NYISO is not required to maintain, e.g., Long Island spinning reserve, Long Island 10-minute total reserve, Eastern spinning reserve, Eastern 30-minute total reserve.

SCUC and BME currently do not distinguish between these two types of reserve constraints and all of these constraints are modeled using very high violation costs.

The implementation of the reserve demand curves will allow the reserve guidelines (as opposed to requirements) to be treated in a manner more consistent with the manner in which real-time operation would treat these reserve constraints.

The same reserve demand curves will be applied in SCUC, RTC (the replacement for BME) and RTD (the replacement for SCD).

DEVELOPMENT OF THE DEMAND CURVES

The internal development and review of the demand curves has included operations staff, SMD 2.0 project staff, LECG, MMU and David Patton.

A detailed description of the derivation of the demand curves was presented to the Market Structures Working Group on August 27th, 2003. This presentation also contains a detailed discussion of the form, function and characteristics of demand curves generally and how they work.

A revised set of demand curves, and a discussion of the modifications to the demand curves, was presented to the Market Structures Working Group on September 5th, 2003. Those same demand curves are included in this presentation today.

DEVELOPMENT OF THE DEMAND CURVES

Many issues were considered during the process of developing the demand curves including:

- Analysis of reserve shadow prices from SCUC and BME for the period of time following the implementation of the Export as Reserves mechanism.
 - ✧ In how many hours would demand curves have triggered below the historical reserve shadow prices – a 0.05% benchmark was used to inform the initial demand curve definitions
 - ✧ The pattern and magnitude of the reserve shadow prices in the historical hours with very high prices
 - ✧ Review of market conditions causing extreme prices in the historical data

DEVELOPMENT OF THE DEMAND CURVES

Issues in developing the demand curves, cont'd.:

- Do the demand curves make sense relative to the current definition and MW quantity for each locational reserve requirement?
- Do the demand curves make sense relative to the \$500 EDRP cost and the existing \$1,000 10-minute reserve shortage costs?
- What are the additive impacts of the reserve demand curves?

DEVELOPMENT OF THE DEMAND CURVES

Issues in developing the demand curves, cont'd.:

- Are the curves consistent with how operations would actually operate the system?
- Importance of the NYCA spinning reserve and Eastern 10-minute total reserve constraints;
- Relative importance of the individual location and reserve product quality constraints;
- How does the regulation demand curve relate to the reserve demand curves?

The table below summarizes the regulation demand curve and the nine operating reserve demand curves that have been proposed and discussed with the Market Structure Working Group.

	NYCA	East	LI
Spin	\$500	\$25	\$25
10-Total	\$150	\$500	\$25
30-Total	200 MW @ \$50, 200 MW @ \$100 and remainder @ \$200	\$25	\$300
Regulation	25 MW @ \$250 and remainder @ \$300		

Min		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	
Max		\$ 7,102.41	\$ -	\$ -	\$ 143.23	\$ 3,986.74	\$ 831.72	\$ 552.51	\$ 100.00	\$ 4,019.54	\$ 8,008.80	6.00		\$ -
Ave		\$ 2.04	\$ -	\$ -	\$ 0.40	\$ 5.54	\$ 5.04	\$ 0.45	\$ 0.36	\$ 7.32	\$ 21.14	1.91		\$ 15.27
StdDev		\$ 82.60	\$ -	\$ -	\$ 5.32	\$ 58.69	\$ 17.67	\$ 8.01	\$ 4.15	\$ 46.82	\$ 133.53	1.50		\$ 50.73

Date	Hour	EAST 10	EAST 30	EAST SPIN	LI 10	LI 30	LI SPIN	NYPP 10	NYPP 30	NYPP SPIN	SUM	Non-zero SPs	NYPP REGUL
9/3/02	20	\$ 1	\$ -	\$ -	\$ -	\$ 3,987	\$ -	\$ -	\$ 1	\$ 4,020	\$ 8,009	5	4023
7/23/02	18	\$ 7,102	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 553	\$ -	\$ -	\$ 7,655	3	1090
3/10/03	14	\$ 3	\$ -	\$ -	\$ -	\$ 3,017	\$ -	\$ -	\$ -	\$ -	\$ 3,019	3	0
6/26/02	15	\$ 2,336	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 2,336	2	0
8/2/02	15	\$ 21	\$ -	\$ -	\$ -	\$ 889	\$ -	\$ -	\$ 50	\$ -	\$ 961	4	50
8/2/02	16	\$ 48	\$ -	\$ -	\$ -	\$ -	\$ 832	\$ 2	\$ 56	\$ -	\$ 937	5	56
7/3/02	16	\$ 571	\$ -	\$ -	\$ 3	\$ -	\$ -	\$ 49	\$ -	\$ -	\$ 623	4	49
2/17/03	21	\$ 563	\$ -	\$ -	\$ -	\$ 33	\$ -	\$ -	\$ 23	\$ -	\$ 619	4	67
2/18/03	16	\$ 1	\$ -	\$ -	\$ -	\$ 325	\$ -	\$ -	\$ 1	\$ 266	\$ 594	5	341
1/2/03	18	\$ 1	\$ -	\$ -	\$ -	\$ 511	\$ -	\$ -	\$ 1	\$ 7	\$ 520	5	15
2/17/03	15	\$ -	\$ -	\$ -	\$ -	\$ 253	\$ -	\$ -	\$ 50	\$ 211	\$ 514	4	229
2/17/03	11	\$ 82	\$ -	\$ -	\$ -	\$ 203	\$ -	\$ 137	\$ 89	\$ -	\$ 510	5	226
2/17/03	10	\$ 81	\$ -	\$ -	\$ -	\$ 207	\$ -	\$ 155	\$ 3	\$ -	\$ 446	5	158
2/17/03	7	\$ -	\$ -	\$ -	\$ -	\$ 1	\$ -	\$ -	\$ 3	\$ 382	\$ 386	4	393
2/17/03	16	\$ -	\$ -	\$ -	\$ -	\$ 156	\$ -	\$ -	\$ 50	\$ 127	\$ 333	4	214
2/17/03	9	\$ -	\$ -	\$ -	\$ -	\$ 156	\$ -	\$ -	\$ 3	\$ 174	\$ 332	4	195
2/17/03	17	\$ -	\$ -	\$ -	\$ -	\$ 143	\$ -	\$ 122	\$ 50	\$ -	\$ 316	4	177
2/17/03	12	\$ -	\$ -	\$ -	\$ -	\$ 168	\$ -	\$ -	\$ 3	\$ 133	\$ 304	4	117
2/17/03	14	\$ -	\$ -	\$ -	\$ -	\$ 166	\$ -	\$ -	\$ 3	\$ 123	\$ 292	4	107
1/27/03	18	\$ 29	\$ -	\$ -	\$ -	\$ 151	\$ -	\$ 96	\$ 1	\$ -	\$ 278	5	131
2/18/03	17	\$ -	\$ -	\$ -	\$ -	\$ 162	\$ -	\$ -	\$ 3	\$ 112	\$ 277	4	47
2/17/03	18	\$ 23	\$ -	\$ -	\$ -	\$ 134	\$ -	\$ 78	\$ 33	\$ -	\$ 267	5	147
7/30/02	8	\$ 244	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 244	2	8
6/26/02	16	\$ 243	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 243	2	0
4/17/03	11	\$ 23	\$ -	\$ -	\$ -	\$ 1	\$ -	\$ 206	\$ 3	\$ -	\$ 233	5	209
9/20/02	13	\$ -	\$ -	\$ -	\$ -	\$ 1	\$ -	\$ -	\$ 3	\$ 228	\$ 231	4	185
2/17/03	8	\$ -	\$ -	\$ -	\$ -	\$ 97	\$ -	\$ -	\$ 3	\$ 121	\$ 221	4	155
4/8/03	10	\$ 0	\$ -	\$ -	\$ -	\$ 116	\$ -	\$ -	\$ 2	\$ 92	\$ 211	5	3
8/12/02	17	\$ -	\$ -	\$ -	\$ -	\$ 48	\$ -	\$ -	\$ 100	\$ 62	\$ 210	4	177
2/18/03	20	\$ -	\$ -	\$ -	\$ -	\$ 123	\$ -	\$ -	\$ -	\$ 86	\$ 209	3	165
1/28/03	18	\$ -	\$ -	\$ -	\$ -	\$ 159	\$ -	\$ -	\$ 3	\$ 47	\$ 209	4	61
2/17/03	19	\$ -	\$ -	\$ -	\$ -	\$ 129	\$ -	\$ 76	\$ 3	\$ -	\$ 208	4	114
8/13/02	17	\$ 53	\$ -	\$ -	\$ -	\$ 53	\$ -	\$ -	\$ 100	\$ -	\$ 207	4	153
8/1/02	17	\$ 80	\$ -	\$ -	\$ -	\$ -	\$ 1	\$ 26	\$ 100	\$ -	\$ 206	5	206
8/14/02	15	\$ 24	\$ -	\$ -	\$ -	\$ 79	\$ -	\$ -	\$ 100	\$ -	\$ 203	4	100

Min		\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -
Max		\$ 500.00	\$ -	\$ -	\$ 25.00	\$ 300.00	\$ 25.00	\$ 150.00	\$ 100.00	\$ 500.00	\$ 802.52	6.00
Ave		\$ 1.01	\$ -	\$ -	\$ 0.17	\$ 4.68	\$ 2.96	\$ 0.40	\$ 0.36	\$ 6.90	\$ 16.47	1.91
StdDev		\$ 12.96	\$ -	\$ -	\$ 1.97	\$ 19.31	\$ 7.26	\$ 5.28	\$ 4.15	\$ 17.06	\$ 34.77	1.50

\$ -
\$ 250.00
\$ 14.68
\$ 22.36

Date	Hour	EAST 10	EAST 30	EAST SPIN	LI 10	LI 30	LI SPIN	NYPP 10	NYPP 30	NYPP SPIN	SUM	Non-zero SPs	
													NYPP REGUL
9/3/02	20	\$ 1	\$ -	\$ -	\$ -	\$ 300	\$ -	\$ -	\$ 1	\$ 500	\$ 803	5	\$ 250
7/23/02	18	\$ 500	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 150	\$ -	\$ -	\$ 650	3	\$ 250
3/10/03	14	\$ 3	\$ -	\$ -	\$ -	\$ 300	\$ -	\$ -	\$ -	\$ -	\$ 303	3	\$ -
6/26/02	15	\$ 500	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 500	2	\$ -
8/2/02	15	\$ 21	\$ -	\$ -	\$ -	\$ 300	\$ -	\$ -	\$ -	\$ 50	\$ 371	4	\$ 50
8/2/02	16	\$ 48	\$ -	\$ -	\$ -	\$ -	\$ 25	\$ -	\$ 2	\$ 56	\$ 131	5	\$ 56
7/3/02	16	\$ 500	\$ -	\$ -	\$ -	\$ 3	\$ -	\$ 49	\$ -	\$ -	\$ 552	4	\$ 49
2/17/03	21	\$ 500	\$ -	\$ -	\$ -	\$ 33	\$ -	\$ -	\$ 23	\$ -	\$ 556	4	\$ 67
2/18/03	16	\$ 1	\$ -	\$ -	\$ -	\$ 300	\$ -	\$ -	\$ 1	\$ 266	\$ 569	5	\$ 250
1/2/03	18	\$ 1	\$ -	\$ -	\$ -	\$ 300	\$ -	\$ -	\$ 1	\$ 7	\$ 310	5	\$ 15
2/17/03	15	\$ -	\$ -	\$ -	\$ -	\$ 253	\$ -	\$ -	\$ 50	\$ 211	\$ 514	4	\$ 229
2/17/03	11	\$ 82	\$ -	\$ -	\$ -	\$ 203	\$ -	\$ 137	\$ 89	\$ -	\$ 510	5	\$ 226
2/17/03	10	\$ 81	\$ -	\$ -	\$ -	\$ 207	\$ -	\$ 150	\$ 3	\$ -	\$ 442	5	\$ 158
2/17/03	7	\$ -	\$ -	\$ -	\$ -	\$ 1	\$ -	\$ -	\$ 3	\$ 382	\$ 386	4	\$ 250
2/17/03	16	\$ -	\$ -	\$ -	\$ -	\$ 156	\$ -	\$ -	\$ 50	\$ 127	\$ 333	4	\$ 214
2/17/03	9	\$ -	\$ -	\$ -	\$ -	\$ 156	\$ -	\$ -	\$ 3	\$ 174	\$ 332	4	\$ 195
2/17/03	17	\$ -	\$ -	\$ -	\$ -	\$ 143	\$ -	\$ 122	\$ 50	\$ -	\$ 316	4	\$ 177
2/17/03	12	\$ -	\$ -	\$ -	\$ -	\$ 168	\$ -	\$ -	\$ 3	\$ 133	\$ 304	4	\$ 117
2/17/03	14	\$ -	\$ -	\$ -	\$ -	\$ 166	\$ -	\$ -	\$ 3	\$ 123	\$ 292	4	\$ 107
1/27/03	18	\$ 29	\$ -	\$ -	\$ -	\$ 151	\$ -	\$ 96	\$ 1	\$ -	\$ 278	5	\$ 131
2/18/03	17	\$ -	\$ -	\$ -	\$ -	\$ 162	\$ -	\$ -	\$ 3	\$ 112	\$ 277	4	\$ 47
2/17/03	18	\$ 23	\$ -	\$ -	\$ -	\$ 134	\$ -	\$ 78	\$ 33	\$ -	\$ 267	5	\$ 147
7/30/02	8	\$ 244	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 244	2	\$ 8
6/26/02	16	\$ 243	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ -	\$ 243	2	\$ -
4/17/03	11	\$ 23	\$ -	\$ -	\$ -	\$ 1	\$ -	\$ 150	\$ 3	\$ -	\$ 177	5	\$ 209
9/20/02	13	\$ -	\$ -	\$ -	\$ -	\$ 1	\$ -	\$ -	\$ 3	\$ 228	\$ 231	4	\$ 185
2/17/03	8	\$ -	\$ -	\$ -	\$ -	\$ 97	\$ -	\$ -	\$ 3	\$ 121	\$ 221	4	\$ 155
4/8/03	10	\$ 0	\$ -	\$ -	\$ -	\$ 116	\$ -	\$ -	\$ 2	\$ 92	\$ 211	5	\$ 3
8/12/02	17	\$ -	\$ -	\$ -	\$ -	\$ 48	\$ -	\$ -	\$ 100	\$ 62	\$ 210	4	\$ 177
2/18/03	20	\$ -	\$ -	\$ -	\$ -	\$ 123	\$ -	\$ -	\$ -	\$ 86	\$ 209	3	\$ 165
1/28/03	18	\$ -	\$ -	\$ -	\$ -	\$ 159	\$ -	\$ -	\$ 3	\$ 47	\$ 209	4	\$ 61
2/17/03	19	\$ -	\$ -	\$ -	\$ -	\$ 129	\$ -	\$ 76	\$ 3	\$ -	\$ 208	4	\$ 114
8/13/02	17	\$ 53	\$ -	\$ -	\$ -	\$ 53	\$ -	\$ -	\$ 100	\$ -	\$ 207	4	\$ 153
8/1/02	17	\$ 80	\$ -	\$ -	\$ -	\$ -	\$ 1	\$ 26	\$ 100	\$ -	\$ 206	5	\$ 206
8/14/02	15	\$ 24	\$ -	\$ -	\$ -	\$ 79	\$ -	\$ -	\$ 100	\$ -	\$ 203	4	\$ 100

The table below shows the cascaded sum of the reserve demand curves by product and location where LI spinning reserve is calculated as the sum of all the demand curve values.

The \$1,750 value is very high. However, when historical shadow prices in extreme hours (slide 10) are capped at the shadow prices defined by the demand curves (slide 9) the modified observed aggregate shadow prices (slide 11) never reach this level. It is very unusual for more than 3 or 4 of the reserve requirements to be violated at any one time and a \$1,750 value would require a violation of all 9 locational reserve requirements .

	NYCA	East	LI
Spin	\$850	\$1,400	\$1,750
10-Total	\$350	\$875	\$1,200
30-Total	\$200	\$225	\$525

MODIFICATION OF THE DEMAND CURVES

If the demand curves result in reserves not being scheduled when those reserves are available, operations may take action to create those reserves. When this occurs the MPs and NYISO are discussing the options, which include:

- A NYISO review of the market conditions that resulted in the reserve shortage and the implied cost of the reserves that were available but not scheduled with a recommendation that a set of modifications to the demand curves be implemented together with.
- Either an immediate FERC filing with the changes included or a notice to the market that the changes to the demand curves will be applied by the NYISO after a prescribed notice period has expired or some combination of the above procedures.