PRICE VERIFICATION AND SCREENING IN THE DAY-AHEAD AND REAL-TIME MARKETS

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Prepared for New York Independent System Operator Management Committee

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AGENDA

- Overview
- Price Replication
- Equilibrium Conditions for Dispatch
- Additional SCUC Screens
 - Uplift
 - Hypothetical Dispatch
 - Ad hoc screens
- Additional SCD Screens
 - Ad hoc screens
 - Known price calculation problems
- Summary

The three primary functions of the Market Monitoring Unit include:

- Identification of market flaws
- Market mitigation
- Price verification

The price verification process was designed during market trials to verify the prices, identify flaws in the software and help identify any potential market flaws.

PRICE REPLICATION

All LBMP energy prices calculated in SCD and SCUC are recalculated and validated based on their components for each generator for each SCUC hour and each SCD interval:

- Generator $LBMP_i = [Ref_p] + [pen_i \times Ref_p] + [\Sigma_j SF_{ij} SP_j]$
 - ³ Ref_{p} = Price at the Reference Bus
 - ³ $Pen_i = Penalty factor of location i$
 - ³ $SF_{ij} = Shift factor of location i on constraint j$
 - ³ SP_j = Shadow price of constraint j
 - ³ j = Set of binding constraints

PRICE REPLICATION

All of the Zonal LBMP prices calculated in SCD and SCUC are recalculated and validated based on the underlying LBMP prices:

$$- Z_t = \Sigma_i W_i LBMP_i$$

- ³ i = Bus in zone t
- ³ $W_i = Normalized zonal weight$

All of the day-ahead ancillary service prices are recalculated and validated by stacking the availability bids of the scheduled providers of each service and setting the price to the highest cleared availability bid.

GEN NAME	STATUS	ACTUAL	FINAL BP	IDEAL BP	LOWER LIM	UPPER LIM	DISPATCH	LBMP	INC COST	BP PLACE	ERR CHECK	IC SLOPE
A	ON	91.23	92.96	92.96	82.46	100.00	FLEXIBLE	36.13	36.13	INTERIOR		2.070
В	ON	85.82	95.82	95.82	70.92	100.00	FLEXIBLE	36.02	36.02	INTERIOR		0.010
С	ON	92.42	98.25	98.25	84.85	100.00	FLEXIBLE	35.71	35.70	INTERIOR		0.030
D	ON	79.77	86.48	86.48	80.92	100.00	FLEXIBLE	35.87	35.87	INTERIOR		3.734
E	ON	100.00	97.42	97.42	92.95	100.00	FLEXIBLE	35.05	35.04	INTERIOR		9.336
F	ON	89.93	97.47	97.47	78.52	100.00	FLEXIBLE	35.25	35.25	INTERIOR		0.117
G	ON	95.46	93.31	93.31	88.38	100.00	FLEXIBLE	31.72	31.72	INTERIOR		0.308
Н	ON	85.00	83.33	83.33	83.33	100.00	FLEXIBLE	36.32	52.50	LOWER		0.150
I	ON	95.03	100.00	100.00	88.82	100.00	FLEXIBLE	36.08	33.98	UPPER		2.090
J	ON	94.44	100.00	100.00	91.67	100.00	FLEXIBLE	36.38	1.52	UPPER		0.032
К	ON	95.92	100.00	100.00	91.84	100.00	FLEXIBLE	36.54	1.62	UPPER		0.021
L	ON	102.19	100.00	100.00	97.81	100.00	FLEXIBLE	36.30	19.58	UPPER		2.060
М	ON	87.74	100.00	100.00	81.29	100.00	FLEXIBLE	35.89	33.79	UPPER		2.080
N	ON	87.10	100.00	100.00	80.65	100.00	FLEXIBLE	35.87	33.72	UPPER		2.090
0	ON	79.21	100.00	100.00	74.26	100.00	FLEXIBLE	36.31	35.62	UPPER		0.000
Р	ON	95.19	100.00	100.00	88.15	100.00	FLEXIBLE	35.95	33.20	UPPER		0.650
Q	ON	88.84	100.00	100.00	86.27	100.00	FLEXIBLE	35.88	34.85	UPPER		0.216
R	ON	86.90	100.00	100.00	70.74	100.00	FLEXIBLE	35.25	33.35	UPPER		0.080
S	ON	101.28	100.00	100.00	96.15	100.00	FLEXIBLE	34.12	17.30	UPPER		0.079
Т	ON	104.08	100.00	100.00	95.92	100.00	FLEXIBLE	32.25	18.18	UPPER		0.061
U	ON	102.17	100.00	100.00	96.74	100.00	FLEXIBLE	32.26	14.32	UPPER		0.031
V	ON	102.80	100.00	100.00	96.50	100.00	FLEXIBLE	32.19	14.08	UPPER		0.019
W	ON	102.72	100.00	100.00	96.60	100.00	FLEXIBLE	32.18	13.68	UPPER		0.015
Х	ON	102.34	100.00	100.00	96.11	100.00	FLEXIBLE	31.59	12.95	UPPER		0.005
Υ	ON	103.30	100.00	100.00	96.70	100.00	FLEXIBLE	31.52	20.06	UPPER		0.188
Z	ON	96.84	100.00	100.00	91.58	100.00	FLEXIBLE	31.52	19.75	UPPER		0.250
AA	ON	94.74	100.00	100.00	89.47	100.00	FLEXIBLE	31.99	19.00	UPPER		0.025
AB	ON	101.33	100.00	100.00	94.67	100.00	FLEXIBLE	32.06	16.67	UPPER		0.667
AC	ON	77.50	100.00	100.00	71.25	100.00	FLEXIBLE	32.06	18.50	UPPER		0.300
AD	ON	104.04	100.00	100.00	94.95	100.00	FLEXIBLE	31.34	0.10	UPPER		0.100
AE	ON	92.44	100.00	100.00	88.00	100.00	FLEXIBLE	31.97	19.63	UPPER		0.262

EQUILIBRIUM CONDITIONS FOR DISPATCH

Once the commitment in SCUC has been established the LBMPs in both SCUC and SCD are determined by a least-cost dispatch of the available units.

Certain equilibrium conditions apply for each and every generator scheduled in the dispatch:

- For generators scheduled at an upper limit
 - LBMP \geq Generator's bid at that upper limit
- For generators scheduled between an upper and lower limit
 - LBMP = Generator's bid at the scheduled energy level
- For generators scheduled at a lower limit
 - LBMP \leq Generators bid at that lower limit

GEN NAME	STATUS	ACTUAL	FINAL BP	IDEAL BP	LOWER LIM	UPPER LIM	DISPATCH	LBMP	INC COST	BP PLACE	ERR CHECK	IC SLOPE
A	ON	91.23	92.96	92.96	82.46	100.00	FLEXIBLE	36.13	36.13	INTERIOR		2.070
В	ON	85.82	95.82	95.82	70.92	100.00	FLEXIBLE	36.02	36.02	INTERIOR		0.010
С	ON	92.42	98.25	98.25	84.85	100.00	FLEXIBLE	35.71	35.70	INTERIOR		0.030
D	ON	79.77	86.48	86.48	80.92	100.00	FLEXIBLE	35.87	35.87	INTERIOR		3.734
E	ON	100.00	97.42	97.42	92.95	100.00	FLEXIBLE	35.05	35.04	INTERIOR		9.336
F	ON	89.93	97.47	97.47	78.52	100.00	FLEXIBLE	35.25	35.25	INTERIOR		0.117
G	ON	95.46	93.31	93.31	88.38	100.00	FLEXIBLE	31.72	31.72	INTERIOR		0.308
Н	ON	85.00	83.33	83.33	83.33	100.00	FLEXIBLE	36.32	52.50	LOWER		0.150
I	ON	95.03	100.00	100.00	88.82	100.00	FLEXIBLE	36.08	33.98	UPPER		2.090
J	ON	94.44	100.00	100.00	91.67	100.00	FLEXIBLE	36.38	1.52	UPPER		0.032
К	ON	95.92	100.00	100.00	91.84	100.00	FLEXIBLE	36.54	1.62	UPPER		0.021
L	ON	102.19	100.00	100.00	97.81	100.00	FLEXIBLE	36.30	19.58	UPPER		2.060
М	ON	87.74	100.00	100.00	81.29	100.00	FLEXIBLE	35.89	33.79	UPPER		2.080
N	ON	87.10	100.00	100.00	80.65	100.00	FLEXIBLE	35.87	33.72	UPPER		2.090
0	ON	79.21	100.00	100.00	74.26	100.00	FLEXIBLE	36.31	35.62	UPPER		0.000
Р	ON	95.19	100.00	100.00	88.15	100.00	FLEXIBLE	35.95	33.20	UPPER		0.650
Q	ON	88.84	100.00	100.00	86.27	100.00	FLEXIBLE	35.88	34.85	UPPER		0.216
R	ON	86.90	100.00	100.00	70.74	100.00	FLEXIBLE	35.25	33.35	UPPER		0.080
S	ON	101.28	100.00	100.00	96.15	100.00	FLEXIBLE	34.12	17.30	UPPER		0.079
Т	ON	104.08	100.00	100.00	95.92	100.00	FLEXIBLE	32.25	18.18	UPPER		0.061
U	ON	102.17	100.00	100.00	96.74	100.00	FLEXIBLE	32.26	14.32	UPPER		0.031
V	ON	102.80	100.00	100.00	96.50	100.00	FLEXIBLE	32.19	14.08	UPPER		0.019
W	ON	102.72	100.00	100.00	96.60	100.00	FLEXIBLE	32.18	13.68	UPPER		0.015
Х	ON	102.34	100.00	100.00	96.11	100.00	FLEXIBLE	31.59	12.95	UPPER		0.005
Y	ON	103.30	100.00	100.00	96.70	100.00	FLEXIBLE	31.52	20.06	UPPER		0.188
Z	ON	96.84	100.00	100.00	91.58	100.00	FLEXIBLE	31.52	19.75	UPPER		0.250
AA	ON	94.74	100.00	100.00	89.47	100.00	FLEXIBLE	31.99	19.00	UPPER		0.025
AB	ON	101.33	100.00	100.00	94.67	100.00	FLEXIBLE	32.06	16.67	UPPER		0.667
AC	ON	77.50	100.00	100.00	71.25	100.00	FLEXIBLE	32.06	18.50	UPPER		0.300
AD	ON	104.04	100.00	100.00	94.95	100.00	FLEXIBLE	31.34	0.10	UPPER		0.100
AE	ON	92.44	100.00	100.00	88.00	100.00	FLEXIBLE	31.97	19.63	UPPER		0.262

EQUILIBRIUM CONDITIONS FOR DISPATCH

These equilibrium conditions provide a powerful test of the accuracy of the dispatch and price calculations.

If the equilibrium conditions hold, there should be no incremental energy that could have been scheduled at that location at a bid price less than the LBMP.

Similarly, there should be no incremental energy scheduled at that location at a bid price higher than the LBMP.

Any circumstances identified by these equilibrium conditions are investigated and if necessary reserved within 24 hours. The source of the inconsistency is then identified and if necessary the prices are corrected.

As we will discuss later, analysis of these equilibrium conditions is only one component of the price review process.

ADDITIONAL SCUC SCREENSCommitment Screens

The equilibrium conditions test the consistency of the prices and schedules from the dispatch given a particular unit commitment.

We have additional screens that enable us to review the optimality of the commitment decisions that were made by the SCUC software:

- uplift screens
- hypothetical commitment screens

Generator	Hour 1	Hour 2	Hour 3	Hour 4	Hour 5	Hour 6	Hour 7	Hour 8	Hour 9	Hour 10	Hour 11	Hour 12
Gen 1	-	(4,162)	(4,556)	(4,056)	(4,064)	(4,470)	-	-	-	-	-	-
Gen 2	-	-	(4,554)	(4,053)	(4,062)	-	-	-	-	-	-	-
Gen 3	-	-	(4,554)	(4,053)	(4,062)	-	-	348	348	348	348	348
Gen 4	(5,702)	(4,162)	(4,554)	(4,053)	(4,062)	(4,467)	-	-	-	-	-	-
Gen 5	-	-	-	-	-	-	-	-	(351)	(422)	1	(80)
Gen 6	-	-	-	-	-	-	(1,586)	51	60	59	69	72
Gen 7	-	-	-	-	-	-	-	-	-	(27)	(21)	(21)
Gen 8	-	-	-	-	-	-	-	-	(14)	(15)	(8)	(9)

Generator	Hour 13	Hour 14	Hour 15	Hour 16	Hour 17	Hour 18	Hour 19	Hour 20	Hour 21	Hour 22	Hour 23	Hour 24	Total	Uplift
Gen 1	-	-	1,758	1,705	1,470	1,442	-	-	-	-	-	-	(14,934)	14,934
Gen 2	-	-	-	-	132	358	-	-	-	-	-	-	(12,179)	12,179
Gen 3	348	348	348	348	348	348	348	348	348	348	348	-	(7,094)	7,094
Gen 4	2,379	4,412	3,356	3,052	2,818	2,790	1,008	1,962	-	-	-	-	(5,224)	5,224
Gen 5	1	1	(0)	3	(92)	(98)	(164)	(424)	-	-	-	-	(1,628)	1,628
Gen 6	76	74	75	75	71	71	71	59	60	64	64	75	(439)	439
Gen 7	(20)	(20)	(20)	(20)	(21)	(21)	(22)	(27)	(27)	(25)	(26)	(21)	(338)	338
Gen 8	(8)	(8)	(8)	(8)	(10)	(10)	(11)	(15)	(15)	(13)	(14)	(10)	(175)	175

Units committed by SCUC that do not receive sufficient energy and ancillary service revenues to cover their as-bid costs are paid an uplift to make them whole.

Uplift on units may indicate that:

- a unit was committed sub-optimally;
- a unit was committed "out of merit" to meet a reserve, forecast load or local reliability constraint;
- prices in the final dispatch may be different than the prices against which the units were evaluated against in the commitment passes of SCUC (e.g. due to units committed to meet forecast load or local reliability).

Uplift generally arises due to commitment of units to meet reserve constraints, to meet forecast load, or as a result of price differences between the commitment and dispatch passes of the software created by the addition of capacity in the forecast load and local reliability commitment passes of SCUC. We investigate every significant uplift payment as these instances can be symptoms of problems in SCUC.

GEN_NAME	Start Cost	Total Net Revenue	Min Load Block Check
Generator 1	3000	500	0
Generator 2	3000	900	0
Generator 3	3000	700	0
Generator 4	2500	1000	0
Generator 5	2200	0	721.05
Generator 6	11600	15000	0
Generator 7	8000	0	0
Generator 8	0	4000	0
Generator 9	6000	200	0
Generator 10	8500	0	0

The equilibrium conditions and uplift screens look at all units that were committed and scheduled by SCUC.

The hypothetical dispatch screen tests all units that were not scheduled by SCUC for energy or reserves to see if they could have made money, given their bids, given the prices that resulted from SCUC, and assuming complete flexibility of intertemporal constraints.

Most outcomes are explained by the startup cost being greater than the incremental revenues. This screen yields many "false positive" outcomes that upon investigation are explained by startup times, minimum run times, other intertemporal constraints. Occasionally a unit is not committed because the addition of a large minimum load block on the unit in question would depress LBMPs to the extent that committing the unit would not be profitable.

Date	Hour Ending	WEST	GENESE	CENTRL	NORTH	MHK VL	CAPITL	HUD VL	MILLWD	DUNWOD	N.Y.C.	LONGIL	ΗQ	NPX	ОН	PJM
6/25/00	0	42.65	43.33	44.25	44.71	46.08	46.89	48.77	49.71	50.35	52.41	51.04	44.87	46.56	42.79	43.42
6/26/00	1	13.59	13.62	13.92	14.04	14.45	14.65	15.34	15.59	15.77	16.07	47.05	14.07	14.58	13.58	13.77
6/26/00	2	13.42	13.44	13.74	13.86	14.26	14.45	15.13	15.39	15.56	15.86	45.27	13.89	14.39	13.4	13.59
6/26/00	3	13.59	13.62	13.92	14.04	14.45	14.65	15.34	15.59	15.77	16.07	44.86	14.07	14.58	13.58	13.77
6/26/00	4	13.59	13.62	13.92	14.04	14.45	14.65	15.34	15.59	15.77	16.07	44.52	14.07	14.58	13.58	13.77
6/26/00	5	12.2	12.22	12.5	12.6	12.97	13.15	13.77	14	14.16	14.43	44.51	12.63	13.09	12.19	12.36
6/26/00	6	13.42	13.44	13.74	13.86	14.26	14.45	15.13	15.39	15.56	15.86	45.27	13.89	14.39	13.4	13.59
6/26/00	7	38.44	38.5	39.37	39.69	40.85	41.41	43.36	44.08	44.58	45.44	45.38	39.79	41.22	38.39	38.93
6/26/00	8	28.5	27.46	28.1	7.39	16.99	189.81	151.74	150.79	152.42	152.65	66.62	10.77	177.8	29.92	42.57
6/26/00	9	31.63	30.01	30.99	-2.61	11.04	280.71	220.77	219.07	221.24	206.79	186.94	3.48	262.14	33.66	53.49
6/26/00	10	90.14	86.88	89.48	21.78	50.16	595.67	475.83	472.88	477.6	479.16	392.42	34.15	558.02	94.2	134.67
6/26/00	11	59.92	55.03	57.22	-42.35	-3.02	793.24	614.45	608.79	614.75	615.41	501.27	-24.45	738.56	65.93	124.07
6/26/00	12	114.57	110.32	113.65	25.54	62.39	772.04	616.01	612.11	618.22	620.19	505	41.62	723.07	119.84	172.47
6/26/00	13	127.44	124.78	128.13	71.49	96.96	557.64	459.2	457.68	462.34	464.8	380.89	82.04	525.64	130.8	165.64
6/26/00	14	97.94	89.96	93.53	-69.28	-4.96	1296.93	1004.61	995.36	1005.1	1006.19	813.25	-40.01	1207.53	107.77	202.85
6/26/00	15	102.72	94.79	98.47	-63.3	0.79	1294.78	1004.51	995.41	1005.18	1006.38	813.4	-34.2	1205.89	112.48	207.05
6/26/00	16	108.17	103.29	106.57	5.91	47.25	863.14	941.37	991.9	1007.42	1009.16	815.54	24.2	925.8	114.21	173.89
6/26/00	17	117.58	116.1	119.03	88.81	103.87	371.25	869.23	987.79	1009.63	1012.05	817.75	94.36	606.3	119.26	138.97
6/26/00	18	160.61	153.38	157.72	55.42	104.17	955.67	957.29	993.53	1007.61	1010.46	816.5	72.3	983.19	162.26	235.54
6/26/00	19	57.53	52.14	53.21	-43.52	-0.5	794.4	614.35	608.6	614.56	615.16	501.07	-27.86	739.35	63.15	123.98
6/26/00	20	26.22	22.15	22.57	-50.1	-18.35	577.34	441.49	436.88	441.12	437.26	362.2	-38.4	536.15	30.44	75.82
6/26/00	21	33.39	31.31	31.97	-5.49	11.55	320.34	250.98	248.96	251.42	227.11	211.04	0.62	298.91	35.55	59.32
6/26/00	22	57.64	56.25	57.5	31.61	44.53	260.81	214.08	213.32	215.48	212.49	182.81	35.96	245.66	59.12	76.21
6/26/00	23	30.5	29.19	29.82	6.01	17.14	214.27	170.5	169.38	171.06	171.51	128	9.92	200.56	31.87	47.16
6/26/00	24	48.24	48.33	49.41	49.83	51.27	51.98	54.42	55.33	55.96	57.04	59.01	49.95	51.74	48.19	48.87

Hour 0 contains zonal prices for the last hour on 6/25/00. Hours in Yellow Indicate prices greater than \$100 or lower than \$0. Hours in Orange Indicate an absolute price change by more than \$50. Hours in Green Indicate prices greater than \$100 or lower than \$0 and an absolute price change by more than \$50.

Tests based on the equilibrium conditions do not identify prices that are incorrectly calculated due to incorrect data in the price calculation dispatch , such as incorrect limits, or incorrect grid configuration. There are various ad hoc checks that are performed:

- Can prices greater than \$100 or less than \$0 be accounted for by system conditions?
- Can price changes from hour to hour in excess of \$50 be accounted for by changes in system conditions?
- Given the binding constraints and system conditions are the zonal price patterns observed reasonable?
- Is the progression of prices consistent with the progression of loads?

We do not compare Tuesday 10th at 3 p.m. with Tuesday 3rd at 3 p.m. or Monday 9th at 3 p.m. There are so many day to day differences in internal load levels, internal generator bids, transmission outages, generator outages and scheduled imports and exports that any comparison of this nature would be of virtually no value.

\$1000 6:45 20.34 19.50 19.67 18.62 48.42 42.77 42.93 43.10 245.08 45.18 17.00 46.77 20.90 21.75 6/26/00 6:48 20.01 19.09 19.45 16.15 17.69 48.88 42.99 43.02 43.50 245.08 45.30 16.15 46.73 19.82 21.15 6/26/00 6:51 21.34 20.55 20.96 18.18 19.81 47.95 42.80 43.00 43.49 91.66 45.35 18.30 45.64 22.81 6/26/00 6:51 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:00 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:16 (19.10) 24.303 (25.39) (26.37) 29.42 28.13 31.95 32.35 91.33 45.51	Time Stamp	WEST	GENESE	CENTRL	NORTH	MHK VL	CAPITL	HUD VL	MILLWD	DUNWOD	N.Y.C.	LONGIL	ΗQ	NPX	ОН	PJM
6/26/00 6:46 19.68 118.79 19.14 16.00 17.69 48.88 42.89 43.02 43.50 245.08 45.30 16.13 46.53 19.82 21.15 6/26/00 6:46 20.01 19.09 19.45 16.15 17.89 50.65 44.33 44.44 44.94 245.08 45.35 16.29 48.18 20.16 21.56 6/26/00 6:55 27.74 27.66 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:08 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:08 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7.16 (19.10) (24.30) (25.99 (39.34) 132.58 99.38 91.22 247.53 <	6/26/00 6:45	20.34	19.50	19.87	16.87	18.52	48.42	42.77	42.93	43.41	245.10	45.18	17.00	46.17	20.49	21.77
6/26/00 6:54 20.01 19.09 19.45 16.15 17.89 50.65 44.33 44.44 44.49 24.508 45.35 16.29 48.18 20.16 21.56 6/26/00 6:55 27.74 27.56 28.21 28.44 29.99 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 6:58 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:08 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:16 (19.10) (24.30) (25.39) (43.92) (39.34) 132.58 92.33 90.36 91.22 247.53 91.01 (43.85) 119.72 (18.99) (13.22 6/26/00 7:21 15.46 11.61 90.66 90.26 91.19 91.42 91.47 12.42 104.22 <td>6/26/00 6:46</td> <td>19.68</td> <td>18.79</td> <td>19.14</td> <td>16.00</td> <td>17.69</td> <td>48.88</td> <td>42.89</td> <td>43.02</td> <td>43.50</td> <td>245.08</td> <td>45.30</td> <td>16.13</td> <td>46.53</td> <td>19.82</td> <td>21.15</td>	6/26/00 6:46	19.68	18.79	19.14	16.00	17.69	48.88	42.89	43.02	43.50	245.08	45.30	16.13	46.53	19.82	21.15
6/26/00 6:51 21.34 20.53 20.96 18.18 19.81 47.95 42.80 43.00 43.49 91.66 45.35 18.31 45.84 21.51 22.81 6/26/00 6:55 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:06 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:06 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:21 15.48 12.64 12.65 0.99 5.10 115.56 91.05 90.36 91.29 140.42 91.47 12.24 104.20 24.29 28.33 6/26/00 7:31 23.56 21.31 21.52 11.49 15.66 11.151 90.74 90.36 91.29<	6/26/00 6:48	20.01	19.09	19.45	16.15	17.89	50.65	44.33	44.44	44.94	245.08	45.35	16.29	48.18	20.16	21.56
6/26/00 6:55 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 6:58 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:08 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:08 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:26 19.01 (24.30) (25.39) (43.92) (93.94) 125.58 90.38 91.22 247.53 91.01 (43.95) 119.72 (18.99) (13.22 62.60 73.35 28.14 10.42 91.47 14.24 14.14 107.18 15.72 20.13 <td< td=""><td>6/26/00 6:51</td><td>21.34</td><td>20.53</td><td>20.96</td><td>18.18</td><td>19.81</td><td>47.95</td><td>42.80</td><td>43.00</td><td>43.49</td><td>91.66</td><td>45.35</td><td>18.31</td><td>45.84</td><td>21.51</td><td>22.81</td></td<>	6/26/00 6:51	21.34	20.53	20.96	18.18	19.81	47.95	42.80	43.00	43.49	91.66	45.35	18.31	45.84	21.51	22.81
6/26/00 6:58 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:00 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:08 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:16 (19.10) (24.30) (25.39) (43.92) (39.34) 132.58 92.33 90.38 91.22 247.53 91.01 (43.85) 119.72 (18.99) (13.22 6/26/00 7:26 24.01 21.80 22.04 12.07 16.04 111.51 90.74 90.36 91.23 91.68 91.33 11.45 104.25 23.83 27.87 6/26/00 7:31 23.56 21.31 21.57 16.53 111.79 91.63 90.30 91.23 <td>6/26/00 6:55</td> <td>27.74</td> <td>27.56</td> <td>28.21</td> <td>28.44</td> <td>29.39</td> <td>29.67</td> <td>31.35</td> <td>31.95</td> <td>32.35</td> <td>91.33</td> <td>45.51</td> <td>28.60</td> <td>29.65</td> <td>27.90</td> <td>28.14</td>	6/26/00 6:55	27.74	27.56	28.21	28.44	29.39	29.67	31.35	31.95	32.35	91.33	45.51	28.60	29.65	27.90	28.14
6/26/00 7:00 27.74 27.76 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:16 (19.10) (24.30) (25.39) (43.92) (39.34) 132.58 92.33 90.38 91.22 247.53 91.01 (43.85) 119.72 (18.99) (13.22 6/26/00 7:26 24.01 21.80 22.04 12.07 16.04 111.51 90.74 90.36 91.27 141.22 91.42 1.14 107.18 115.25 23.83 27.87 6/26/00 7:36 25.57 23.42 23.65 13.99 17.92 110.73 90.63 90.30 91.23 91.68 91.33 11.65 104.25 23.83 27.87 6/26/00 7:38 24.52 22.28 22.50 12.57 16.53 111.79 91.12 90.74 91.68 92.11 91.80 12.74 104.50 24.79 28.83 6/26/00 7:43 24.10 21.85 22.04 12.06 16.01 111.79 90.4	6/26/00 6:58	27.74	27.56	28.21	28.44	29.39	29.67	31.35	31.95	32.35	91.33	45.51	28.60	29.65	27.90	28.14
6/26/00 7:08 27.74 27.56 28.21 28.44 29.39 29.67 31.35 31.95 32.35 91.33 45.51 28.60 29.65 27.90 28.14 6/26/00 7:21 15.48 12.64 12.55 0.99 5.10 115.56 91.03 91.22 247.55 91.01 (43.85) 119.72 (18.99) (13.22 6/26/00 7:26 24.01 21.80 22.04 12.07 16.04 111.51 90.74 90.36 91.22 140.42 91.47 12.24 104.20 24.39 23.83 27.87 6/26/00 7:31 23.56 21.31 21.52 11.49 15.46 111.61 90.66 90.25 91.19 91.58 91.33 11.65 104.25 23.83 27.87 6/26/00 7:35 25.57 23.42 23.65 13.99 17.92 110.73 90.63 90.30 91.23 91.68 91.37 14.15 103.60 28.84 29.74 6/26/00 7:38 24.10 21.85 22.04 12.06 16.01 111.67 90.86 90.40	6/26/00 7:00	27.74	27.56	28.21	28.44	29.39	29.67	31.35	31.95	32.35	91.33	45.51	28.60	29.65	27.90	28.14
6/26/00 7:16 (19.10) (24.30) (25.39) (43.92) (39.34) 132.58 92.33 90.38 91.22 247.53 91.01 (43.85) 119.72 (18.99) (13.22 6/26/00 7:26 24.01 21.80 22.04 12.07 16.04 111.51 90.74 90.36 91.27 141.22 91.42 1.14 107.18 15.72 20.13 6/26/00 7:31 23.56 21.31 21.52 11.49 15.46 111.61 90.66 90.25 91.19 91.58 91.33 11.65 104.25 23.83 27.87 6/26/00 7:35 25.57 23.42 23.65 13.99 17.92 110.73 90.63 90.30 91.23 91.88 91.33 11.65 104.25 23.83 27.87 6/26/00 7:38 24.52 22.28 22.50 12.57 16.53 111.79 91.12 90.74 91.68 92.11 91.80 12.74 104.50 24.79 28.79 6/26/00 7:43 24.10 21.85 22.04 12.06 16.01 111.67 90.86 90.	6/26/00 7:08	27.74	27.56	28.21	28.44	29.39	29.67	31.35	31.95	32.35	91.33	45.51	28.60	29.65	27.90	28.14
6/26/00 7:21 15.48 12.64 12.65 0.99 5.10 115.56 91.05 90.36 91.27 141.22 91.42 1.14 107.18 15.72 20.13 6/26/00 7:26 24.01 21.80 22.04 12.07 16.04 111.51 90.74 90.36 91.29 140.42 91.47 12.24 104.20 24.29 28.33 6/26/00 7:31 23.56 21.31 21.52 11.49 15.46 111.61 90.66 90.25 91.19 91.58 91.33 11.65 104.25 23.84 27.87 6/26/00 7:35 25.57 23.42 23.65 13.99 17.92 110.73 90.63 90.30 91.23 91.68 91.37 141.5 103.60 25.84 27.87 6/26/00 7:43 24.10 21.85 22.04 12.06 16.01 111.67 90.86 90.46 91.40 91.81 91.50 12.22 104.34 24.35 28.81 6/26/00 7:43 24.10 21.85 22.04 14.53 18.43 110.40 90.49 90.15 <td< td=""><td>6/26/00 7:16</td><td>(19.10)</td><td>(24.30)</td><td>(25.39)</td><td>(43.92)</td><td>(39.34)</td><td>132.58</td><td>92.33</td><td>90.38</td><td>91.22</td><td>247.53</td><td>91.01</td><td>(43.85)</td><td>119.72</td><td>(18.99)</td><td>(13.22)</td></td<>	6/26/00 7:16	(19.10)	(24.30)	(25.39)	(43.92)	(39.34)	132.58	92.33	90.38	91.22	247.53	91.01	(43.85)	119.72	(18.99)	(13.22)
6/26/00 7:26 24.01 21.80 22.04 12.07 16.04 111.51 90.74 90.36 91.29 140.42 91.47 12.24 104.20 24.29 28.33 6/26/00 7:31 23.56 21.31 21.52 11.49 15.46 111.61 90.66 90.25 91.19 91.58 91.33 11.65 104.25 23.83 27.87 6/26/00 7:35 25.57 23.42 23.65 13.99 17.92 110.73 90.63 90.30 91.23 91.68 91.37 14.15 103.60 25.84 29.74 6/26/00 7:38 24.52 22.28 22.04 12.06 16.01 111.67 90.63 90.46 91.40 91.81 91.50 12.24 104.32 24.35 28.79 6/26/00 7:38 24.10 21.85 22.04 12.06 16.01 111.67 90.86 90.46 91.40 91.81 91.50 11.22 104.34 24.35 28.33 6/26/00 7:53 27.24 24.88 25.06 14.41 18.69 120.99 98.79 98.37 <	6/26/00 7:21	15.48	12.64	12.65	0.99	5.10	115.56	91.05	90.36	91.27	141.22	91.42	1.14	107.18	15.72	20.13
6/26/00 7:31 23.56 21.31 21.52 11.49 15.46 111.61 90.66 90.25 91.19 91.58 91.33 11.65 104.25 23.83 27.87 6/26/00 7:35 25.57 23.42 23.65 13.99 17.92 110.73 90.63 90.30 91.23 91.68 91.37 14.15 103.60 25.84 29.74 6/26/00 7:38 24.52 22.28 22.50 12.57 16.53 111.79 91.68 92.11 91.80 12.74 104.50 24.79 28.79 6/26/00 7:43 24.10 21.85 22.04 12.06 16.01 111.67 90.86 90.46 91.40 91.81 91.50 12.22 104.34 24.35 28.31 6/26/00 7:43 25.99 23.89 24.08 14.53 18.43 110.40 90.49 90.15 91.09 91.66 91.16 14.70 103.33 26.24 30.05 6/26/00 7:55 105.52 107.82 109.12 109.92 113.94 116.61 120.03 121.91 123.33 126.03	6/26/00 7:26	24.01	21.80	22.04	12.07	16.04	111.51	90.74	90.36	91.29	140.42	91.47	12.24	104.20	24.29	28.33
6/26/00 7:35 25.57 23.42 23.65 13.99 17.92 110.73 90.63 90.30 91.23 91.68 91.37 14.15 103.60 25.84 29.74 6/26/00 7:38 24.52 22.28 22.20 12.57 16.53 111.79 91.12 90.74 91.68 92.11 91.80 12.74 104.50 24.79 28.79 6/26/00 7:43 24.10 21.85 22.04 12.06 16.01 111.67 90.86 90.46 91.40 91.81 91.50 12.22 104.34 24.35 28.31 6/26/00 7:48 25.99 23.89 24.08 14.53 18.43 110.40 90.49 90.15 91.09 91.56 91.16 14.70 103.33 26.24 30.05 6/26/00 7:55 105.52 107.82 109.12 109.92 113.94 116.61 120.03 121.91 123.33 126.03 99.39 110.28 115.59 106.15 107.44 6/26/00 8:00 105.52 107.82 109.12 109.92 113.94 116.61 120.03	6/26/00 7:31	23.56	21.31	21.52	11.49	15.46	111.61	90.66	90.25	91.19	91.58	91.33	11.65	104.25	23.83	27.87
6/26/00 7:38 24.52 22.28 22.28 22.50 12.57 16.53 111.79 91.12 90.74 91.68 92.11 91.80 12.74 104.50 24.79 28.79 6/26/00 7:43 24.10 21.85 22.04 12.06 16.01 111.67 90.86 90.46 91.40 91.81 91.50 12.22 104.34 24.35 28.31 6/26/00 7:48 25.99 23.89 24.08 14.53 18.43 110.40 90.49 90.15 91.09 91.56 91.16 14.70 103.33 26.24 30.05 6/26/00 7:53 27.24 24.88 25.06 14.41 18.69 120.99 98.79 98.37 99.41 99.89 93.26 14.59 113.14 27.55 31.78 6/26/00 7:55 105.52 107.82 109.12 109.92 113.94 116.61 120.03 121.91 123.33 126.03 99.39 110.28 115.59 106.15 107.44 6/26/00 8:00 114.24 117.03 118.70 119.68 123.99 126.44 13	6/26/00 7:35	25.57	23.42	23.65	13.99	17.92	110.73	90.63	90.30	91.23	91.68	91.37	14.15	103.60	25.84	29.74
6/26/00 7:43 24.10 21.85 22.04 12.06 16.01 111.67 90.86 90.46 91.40 91.81 91.50 12.22 104.34 24.35 28.31 6/26/00 7:48 25.99 23.89 24.08 14.53 18.43 110.40 90.49 90.15 91.09 91.56 91.16 14.70 103.33 26.24 30.05 6/26/00 7:53 27.24 24.88 25.06 14.41 18.69 120.99 98.79 98.37 99.41 99.89 93.26 14.59 113.14 27.55 31.78 6/26/00 7:55 105.52 107.82 109.12 109.92 113.94 116.61 120.03 121.91 123.33 126.03 99.39 110.28 115.59 106.15 107.44 6/26/00 8:00 15.52 107.82 109.92 113.94 116.61 120.03 121.91 123.33 126.03 99.39 110.28 115.59 106.15 107.44 6/26/00 8:00 114.24 117.03 118.70 119.68 123.99 126.84 130.67 132.78	6/26/00 7:38	24.52	22.28	22.50	12.57	16.53	111.79	91.12	90.74	91.68	92.11	91.80	12.74	104.50	24.79	28.79
6/26/00 7:48 25.99 23.89 24.08 14.53 18.43 110.40 90.49 90.15 91.09 91.56 91.16 14.70 103.33 26.24 30.05 6/26/00 7:53 27.24 24.88 25.06 14.41 18.69 120.99 98.79 98.37 99.41 99.89 93.26 14.59 113.14 27.55 31.78 6/26/00 7:55 105.52 107.82 109.12 109.92 113.94 116.61 120.03 121.91 123.33 126.03 99.39 110.28 115.59 106.15 107.44 6/26/00 8:00 105.52 107.82 109.12 109.92 113.94 116.61 120.03 121.91 123.33 126.03 99.39 110.28 115.59 106.15 107.44 6/26/00 8:00 114.24 117.03 118.70 119.68 123.99 126.84 130.67 132.78 134.32 137.29 101.98 120.06 125.69 114.84 116.77 Hour 0 contains zonal prices for the last hour on 6/25/00. Image: solid	6/26/00 7:43	24.10	21.85	22.04	12.06	16.01	111.67	90.86	90.46	91.40	91.81	91.50	12.22	104.34	24.35	28.31
6/26/00 7:53 27.24 24.88 25.06 14.41 18.69 120.99 98.79 98.37 99.41 99.89 93.26 14.59 113.14 27.55 31.78 6/26/00 7:55 105.52 107.82 109.12 109.92 113.94 116.61 120.03 121.91 123.33 126.03 99.39 110.28 115.59 106.15 107.44 6/26/00 8:00 105.52 107.82 109.12 109.92 113.94 116.61 120.03 121.91 123.33 126.03 99.39 110.28 115.59 106.15 107.44 6/26/00 8:00 114.24 117.03 118.70 119.68 123.99 126.84 130.67 132.78 134.32 137.29 101.98 120.06 125.69 114.84 116.77 6/26/00 8:00 114.24 117.03 118.70 119.68 123.99 126.84 130.67 132.78 134.32 137.29 101.98 120.06 125.69 114.84 116.77 Hour 0 contains zonal prices for the last hour on 6/25/00. Imaget in the ston in t	6/26/00 7:48	25.99	23.89	24.08	14.53	18.43	110.40	90.49	90.15	91.09	91.56	91.16	14.70	103.33	26.24	30.05
6/26/00 7:55 105.52 107.82 109.12 109.92 113.94 116.61 120.03 121.91 123.33 126.03 99.39 110.28 115.59 106.15 107.44 6/26/00 8:00 105.52 107.82 109.12 109.92 113.94 116.61 120.03 121.91 123.33 126.03 99.39 110.28 115.59 106.15 107.44 6/26/00 8:00 114.24 117.03 118.70 119.68 123.99 126.84 130.67 132.78 134.32 137.29 101.98 120.06 125.69 114.84 116.77 Hour 0 contains zonal prices for the last hour on 6/25/00. Image: the stand the stand to be	6/26/00 7:53	27.24	24.88	25.06	14.41	18.69	120.99	98.79	98.37	99.41	99.89	93.26	14.59	113.14	27.55	31.78
6/26/00 8:00 105.52 107.82 109.12 109.92 113.94 116.61 120.03 121.91 123.33 126.03 99.39 110.28 115.59 106.15 107.44 6/26/00 8:00 114.24 117.03 118.70 119.68 123.99 126.84 130.67 132.78 134.32 137.29 101.98 120.06 125.69 114.84 116.77 Hour 0 contains zonal prices for the last hour on 6/25/00. Image: special contains special contains zonal prices greater than \$100 or lower than \$0. Image: special contains special contains zonal prices greater than \$100 or lower than \$0. Image: special contains zonal prices greater than \$100 or lower than \$0. Image: special contains zonal prices greater than \$100 or lower than \$0. Image: special contains zonal prices greater than \$100 or lower than \$0. Image: special contains zonal prices greater than \$100 or lower than \$0. Image: special contains zonal prices greater than \$100 or lower than \$0. Image: special contains zonal prices greater than \$100 or lower than \$0. Image: special contains zonal prices greater than \$100 or lower than \$0. Image: special contains zonal prices greater than \$100 or lower than \$0. Image: special contains zonal prices greater than \$100 or lower than \$0. Image: special contains zonal prices greater than \$100 or lower than \$0. Image: special contains zonal prices greater than \$100 or lower than \$0. Image: spe	6/26/00 7:55	105.52	107.82	109.12	109.92	113.94	116.61	120.03	121.91	123.33	126.03	99.39	110.28	115.59	106.15	107.44
6/26/00 8:00 114.24 117.03 118.70 119.68 123.99 126.84 130.67 132.78 134.32 137.29 101.98 120.06 125.69 114.84 116.77 Hour 0 contains zonal prices for the last hour on 6/25/00. Image: contains zonal prices greater than \$100 or lower than \$0. Image: contains zonal prices greater than \$100 or lower than \$0. Image: contains zonal prices greater than \$100 or lower than \$0. Image: contains zonal prices greater than \$100 or lower than \$0. Image: contains zonal prices greater than \$100 or lower than \$0. Image: contains zonal prices greater than \$100 or lower than \$0. Image: contains zonal prices greater than \$100 or lower than \$0. Image: contains zonal prices greater than \$100 or lower than \$0. Image: contains zonal prices greater than \$100 or lower than \$0. Image: contains zonal prices greater than \$100 or lower than \$0. Image: contains zonal prices greater than \$100 or lower than \$0. Image: contains zonal prices greater than \$100 or lower than \$0. Image: contains zonal prices greater than \$100 or lower than \$0. Image: contains zonal prices greater than \$100 or lower than \$0. Image: contains zonal prices greater than \$100 or lower than \$0. Image: contains zonal prices than \$50. Image: contains zonal prices greater than \$100 or lower than \$0. Image: contains zonal prices than \$50. Image: contain	6/26/00 8:00	105.52	107.82	109.12	109.92	113.94	116.61	120.03	121.91	123.33	126.03	99.39	110.28	115.59	106.15	107.44
Hour 0 contains zonal prices for the last hour on 6/25/00. Image: the state in the state	6/26/00 8:00	114.24	117.03	118.70	119.68	123.99	126.84	130.67	132.78	134.32	137.29	101.98	120.06	125.69	114.84	116.77
Hour 0 contains 20na prices for the last hour on 0/25/00. Image: Contains 20na prices for thour on 0/2			a far tha lag	theur en C	105/00											·
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Hours in Orange Indicate an absolute price change by more than \$50.	Hours in Yellow I	noicate pr	ices greater	than \$100	or lower that	an șu.										
Hours in Green Indicate prices greater than \$100 or lower than \$0 and an absolute price change by more than \$50.	Hours in Orange	Indicate a	n absolute p	price change	e by more	than \$50.										·
	Hours in Green I	ndicate pri	ces greater	than \$100 c	or lower that	an \$0 and a	an absolute	e price cha	nge by mor	e than \$50.]

There are various ad hoc checks that are performed:

- Are prices greater than \$100 or less than \$0 reasonable?
- Are price changes from SCD interval to SCD interval in excess of \$50?
- What are the binding constraints and knowing where the binding constraints are, are the zonal price patterns observed reasonable?
- Is the progression of prices consistent with the progression of loads?

We do not compare Tuesday 10th at 3 p.m. with Tuesday 3rd at 3 p.m. or Monday 9th at 3 p.m. There are so many day to day differences in internal load levels, internal generator bids, transmission outages, generator outages and scheduled imports and exports that any comparison of this nature would be of virtually no value. Investigations of price spikes are performed:

- Can the cause of the price change be identified?
 - On the hour schedule changes for external transactions;
 - On the hour schedule changes for Gilboa;
 - Operators turning off too many GTs at once;
 - On the hour changes in bid curves;
 - Transmission or generator outage;
 - Thunderstorm alerts.
- Was the price calculation erroneous?
 - Real time load data metering problems;
 - Real time interchange schedule problems;
 - Software changes;
 - Incorrect setting of upper limits in ideal dispatch;
 - Incorrect unit status.

Other conditions that require ad hoc screens for identification include:

- Incorrect upper limits in ideal dispatch when GTs are operating out of merit. (Recently implemented software change)
- Lower limits fixed during reserve pick up.
- Incorrect upper limits on off dispatch units providing 30 minute reserves.
- Incorrect calculation of reference bus price.
- Incorrect logging of out of merit units.
- Inconsistent prices in parts of the state when congestion exists and relief of the congestion is valued by slight differences in the penalty factors of two similarly located generators.
- Failure to use the right shift factors or penalty factors.

Some of these can be identified from the equilibrium condition tests, others only through ad hoc inspection. Any condition that has a dramatic effect on prices is captured either through the equilibrium conditions or through the other ad hoc screens and investigations.

SUMMARY Transmission Owners Screen Proposal

The Transmission Owner's price screen proposal describes four types of price screens in addition to those already being performed by the Market Monitor and the MMU:

- Regional price screens
- Similar day screens
- Rate of change screens
- Absolute magnitude screens

The price verification process includes elements of the rate of change screens and absolute magnitude screens but does not explicitly screen regional prices or similar days.

We believe that the equilibrium conditions and ad hoc checks being performed are superior to the similar day and regional screens proposed for the purposes of identifying erroneous prices.