Introduction

A fundamental aspect of the New York ISO's two-settlement system is that generators settle short positions and load serving entries settle long positions at the Real-Time market-clearing price. With the introduction of virtual bidding in 2002, speculators submit offers to supply or bids to purchase electricity in the DAM with the sole intention of liquidating the position in the RTM. As a result, every market trading entity is able to arbitrage the Day-Ahead Market against the Real-Time Market, except for participants in the NYISO's Day-Ahead Demand Response Program (DADRP). End-users can submit offers to supply a load curtailment for a fixed price but they pay the higher of the Day-Ahead Market or the Real-Time Market (RTM) LBMP, plus a 10% adder if they fail to curtail as they were scheduled. This asymmetric non-compliance penalty was initially justified on the grounds that the DADRP was not created to give end-users a window into electricity markets for the sake of generating financial windfalls. The purpose was to provide increased competition in the DAM, reduce prices, and help to mitigate supplier market power.

A part of program revisions that are being made to improve participation, a proposal had been made to eliminate the DADRP penalty and let curtailment shortfalls be settled at the prevailing RTP LBMP. Such a provision would be consistent with the ISO's market design, as discussed above. However, some are opposed to such a change on the grounds that it would create arbitrage opportunities that would detract from the intended role of the DADRP program. To add to the discussion of this proposal, an analysis was undertaken using historical data to ascertain the extent to which the DADRP program might be used for purposes other than for which it was intended. Two different bidding rules were evaluated on a zonal basis, in each bids were submitted, the obligation was assumed to not be met, and the penalty for noncompliance was calculated under the existing DADRP rules and using the RTM price.

Methodology

NYISO price data for both the Day-Ahead market and the Real-Time market were compiled for the period of November 19, 1999 through August 31, 2002. For each day, a

moving average DAM LBMPs was calculated for each hour based on the current hour's DAM LBMP and prices in the previous 3 hours to provide a benchmark price, against which a strike price, which represents a DADRP bid for a four-hour strip, was be compared against. Several different levels of strike price were examined. If this benchmark was above the submitted strike price, then it was assumed the offer was economical over this period as average prices were above the customer's strike price. In this case, the offer was accepted and scheduled for the following day. Otherwise, it was assumed the bid was rejected. Strike prices of $50/MWh, $100/MWh, $250/MWh, and $500/MWh were used in this simulation; each offer was to curtail 1 MW of load.

Two simulations were performed. The first assumed a 1 MW bid was submitted from hour beginning 13 through hour beginning 16 (starting at 1PM and ending at 5 PM) every day. This was intended to replicate a standing bid, for both weekdays and weekends, over the traditional peak hours of the day. The constancy of this bid abstracts from reality somewhat as firm's labor and/or production schedules could require a change in the hours an end-user is willing to curtail, as would a firm's expectations of prices in the DAM. The second simulation assumed the DADRP bidder could perfectly predict the highest priced 4-hour block in the DAM and submit the bid to curtail over these same hours. Clearly, this is an unreasonable expectation, however it does represent an upper bound on the payment a participant would receive, assuming 100% compliance. Considering both simulations were intended to test the affect of the different penalty provisions on participant's net position, it may be possible that other hours in the Real-Time Market would have generated larger penalty amounts resulting in more extreme losses for participants. However, such an analysis of the Real-Time Market was not included in this simulation.

An example of the simulation algorithm is presented in Figure 1 for a $50/MWh strike price. The hourly DAM LBMPs are shown along with the average prices used as the benchmark for determining whether or not a bid is to be scheduled. In this example, the standing bid (labeled Stand Bid) of $50/MWh for hours 13 through 16 would be scheduled since the average price during this period is $81/MWh. The maximum average price for a consecutive 4-hour period occurs during hour 14 through 17. This price of

$88/MWh results in the load being scheduled during this time (column labeled Max Bid) in the highest 4-hour price simulation.

Figure 1: Scheduling Algorithm Example for $50/MWh Strike Price

	Day-Ahead Market		Scheduled	
Hour	Price	Avg-Price*	Stand Bid	Max Bid
10	42	31		
11	58	36		
12	62	54		
13	75	59	Yes	
14	63	65	Yes	Yes
15	87	72	Yes	Yes
16	100	81	Yes	Yes
17	102	88		Yes
18	60	87		
19	35	74		
20	32	57		

* 4-Hour Average price for previous 3 hours and current hour's prices

Results

Table 1 shows the results of the simulation of the standing offer for selected NYISO pricing zones. The ***Old*** column represents the current DADRP penalty formula while the ***New*** column uses the Real-Time price exclusively as the deficiency payment.

Table 1: DADRP Net Returns by Penalty Rule over the hours of 1 PM to 5 PM in 2002

	West		Capital		NYC		LI	
Strike Price	Old	New	Old	New	Old	New	Old	New
$50/MWh	-$4,760	-$393	-$5,980	$2,409	-$10,119	$1,592	-$10,648	$3,480
$100/MWh	-$359	$1,723	-$1,322	$2,107	-$4,466	-$451	-$5,360	$3,052
$250/MWh	$0	$0	$0	$0	$0	$0	-$871	$3,584
$500/MWh	$0	$0	$0	$0	$0	$0	$0	$0

The values reported are net returns to DADRP participants for the months of January to August of 2002. For a $50/MWh strike price, all represented zones except the West would result in positive returns under the new penalty structure. Interestingly, at a $100/MWh strike price, the customers in the West would make money while their New York City counterparts would end up loosing on the price differential. Long Island was the only zone to experience average prices over $250/MWh warranting an end-user to be scheduled, while no one in the state who bid $500/MWh would have been scheduled in 2002, under this simulation. Depending upon the zone, the net return varies substantially by strike price. This observation is true in the West and NYC, but not for Capital and Long Island. The later two zones exhibited rather consistent returns regardless of the strike price, provided a customer was scheduled. These observations of the ***New*** penalty structure are graphically represented in Graph 1, and the underlying monthly data are displayed in the Appendix Tables.

The results of the highest priced 4-hour offer simulation are shown in Table 2. In this case, all zones produce positive net returns over all strike prices when an end-user is scheduled except in NYC at a strike price of $100/MWh. It appears that as prices for electricity in the DAM rise in New York City, prices in the Real-Time market rise disproportionately more relative to the DAM LBMP. A low bid in the West, $50/MWh, would result in a customer breaking even provided that the offer could be perfectly predicted to coincide with the highest priced 4-hour block in the DAM. If this later point were not achieved, the return would drop, indicating that the area of the state with the most potential for program participants would not "benefit" from a change in the penalty structure. In this simulation, customers located in Long Island could make a substantial amount of money, as much as $7,000, if the penalty was changed and compliance with scheduled bids was not attempted.

Table 2: DADRP Net Returns by Penalty Rule for 4 Consecutive Highest Priced Hours in 2002

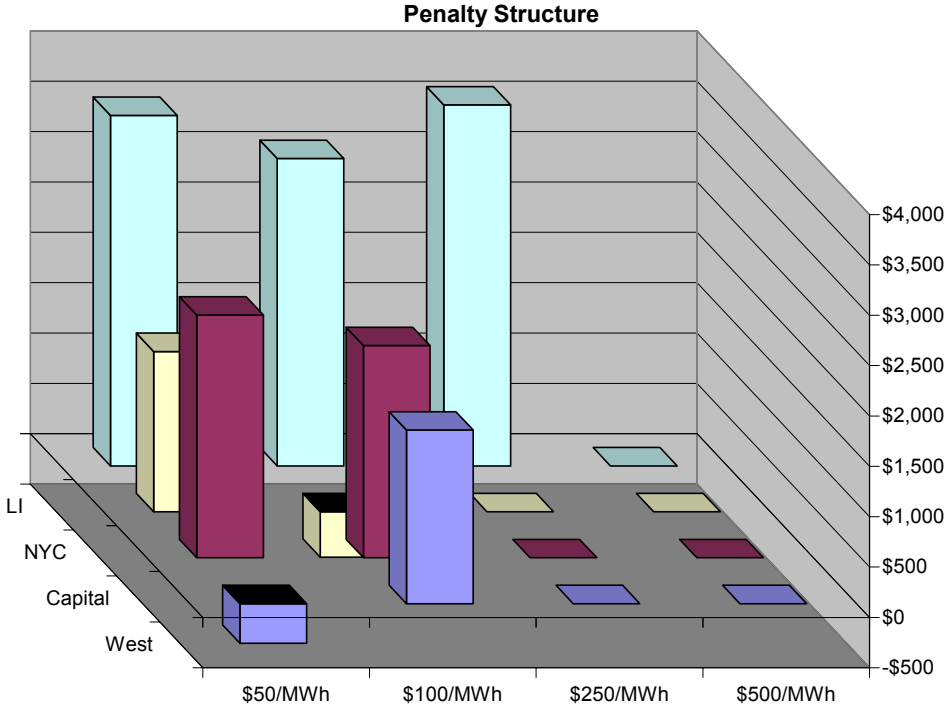
Strike	West		Capital		NYC		LI	
Price	Old	New	Old	New	Old	New	Old	New
$50/MWh	-$4,331	$78	-$6,355	$2,474	-$10,473	$2,581	-$13,189	$7,102
$100/MWh	-$359	$1,734	-$1,451	$1,985	-$4,490	-$340	-$6,477	$4,480
$250/MWh	$0	$0	$0	$0	$0	$0	-$1,005	$4,852
$500/MWh	$0	$0	$0	$0	$0	$0	-$201	$1,368

Conclusion

Based on the bidding and scheduling rules simulated, it appears that DADRP does offer some prospect for reaping arbitrage gains if curtailment shortfalls are settled at RTM LBMP. The existing noncompliance penalty in contrast appears to eliminate any such opportunities. The gains seem to be larger at lower strike prices, $100/MWH and below, and increase across the zones going from west to east and then downstate; they are largest in LI.

Appendix

Chart 1: DADRP Participant Net Returns for Standing Bid in 2002 using New Penalty Structure



Graph 2: DADRP Particpant Net Returns for 4-Consecutive Highest Priced Hours using New Penalty Structure

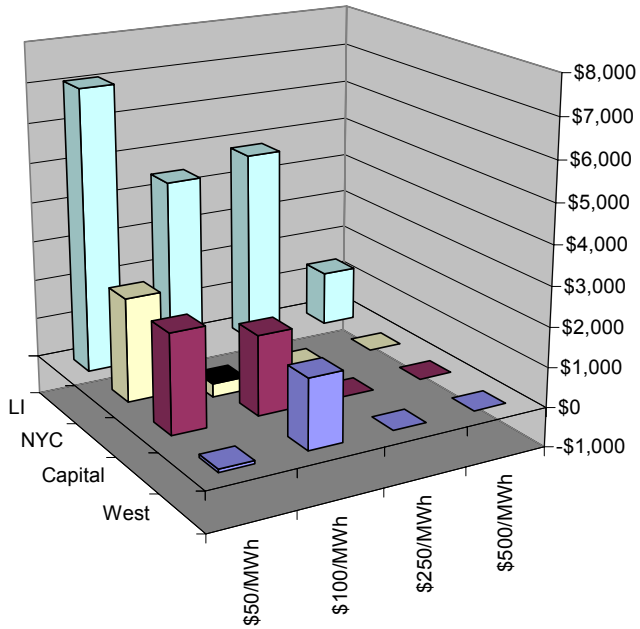


Table 1: DADRP Penalty Analysis assuming a $50/MW strike price over the hours of 1 PM to 5 PM

		West		Capital		NYC		LI	
Year	Month	Old	New	Old	New	Old	New	Old	New
1999	11					-94	226		
1999	12					-100	1	-60	145
2000	1			-339	-19	-533	641	-1,287	-707
2000	2			-247	-160	-266	630	-981	140
2000	3							-109	560
2000	4							-21	128
2000	5	-114	726	-3,597	-862	-5,919	-3,605	-7,140	-4,612
2000	6	-375	1,938	-1,509	7,283	-9,896	-1,307	-2,986	3,416
2000	7	-169	575	-1,021	2,688	-2,230	1,639	-2,441	466
2000	8	-624	1,118	-2,201	2,738	-11,217	-5,224	-6,674	-2,472
2000	9	-656	310	-1,461	535	-4,618	-2,553	-5,729	-3,610
2000	10	-544	496	-889	920	-1,613	-196	-1,396	296
2000	11	-149	52	-1,047	213	-2,064	-1,018	-1,674	-586
2000	12	-365	746	-1,228	476	-3,510	-833	-1,523	280
2001	1	-132	207	-789	887	-1,134	588	-1,667	1,421
2001	2			-208	109	-1,176	-158	-637	-113
2001	3	-22	20	-410	355	-1,764	5	-1,026	277
2001	4	-44	102	-290	313	-1,108	878	-1,343	-58
2001	5	-339	209	-4,563	-3,317	-4,133	-2,173	-5,093	-3,502
2001	6	-334	371	-536	353	-2,812	187	-4,677	-2,328
2001	7	-586	-264	-2,161	-1,250	-3,763	-1,336	-3,682	-1,338
2001	8	-1,578	3,480	-2,374	3,821	-6,616	-543	-7,630	-2,033
2001	9					-637	-361	-641	333
2001	10							-140	96
2001	11					-21	89		
2002	3					-21	72	-24	105
2002	4	-20	97	-181	659	-1,967	-1,429	-1,351	-207
2002	5			-731	493	-424	929	-783	125
2002	6	-206	210	-435	592	-1,081	1,238	-1,139	862
2002	7	-3,820	-2,339	-3,515	-1,168	-4,791	-1,429	-5,102	-788
2002	8	-714	1,640	-1,117	1,832	-1,835	2,211	-2,249	3,383
Total		**-10,790**	**9,695**	**-30,849**	**17,493**	**-75,342**	**-12,834**	**-69,204**	**-10,320**
All Hours Total		**-16,304**	**13,828**	**-41,999**	**18,025**	**-79,562**	**-5,753**	**-87,830**	**-3,265**

Table 2: DADRP Penalty Analysis assuming a $100/MW strike price over the hours of 1 PM to 5 PM

		West		Capital		NYC		LI	
Year	Month	Old	New	Old	New	Old	New	Old	New
2000	1					-99	475		
2000	2					-51	263	-86	290
2000	5	-43	225	-143	572	-121	431	-177	894
2000	6	-224	1,188	-616	4,483	-1,550	3,189	-1,551	2,785
2000	7			-168	1,033	-306	538	-62	187
2000	8	-41	285	-567	2,355	-1,888	1,401	-2,374	-189
2000	9							-640	107
2000	10							-44	107
2000	12					-49	270		
2001	1			-86	429			-400	1,079
2001	3					-40	227		
2001	4					-124	176		
2001	5					-440	-270	-437	-276
2001	6					-617	540	-650	646
2001	7					-82	387	-1,292	-315
2001	8	-1,275	2,867	-1,670	3,446	-2,096	2,357	-3,022	911
2001	9							-234	98
2002	4							-139	556
2002	6							-228	151
2002	7	-99	357	-714	606	-3,617	-1,789	-4,035	-1,188
2002	8	-260	1,367	-607	1,502	-848	1,338	-957	3,533
Total		**-1,943**	**6,289**	**-4,572**	**14,425**	**-11,927**	**9,533**	**-16,328**	**9,376**
All Hours Total		**-2,127**	**7,426**	**-4,787**	**16,884**	**-13,195**	**12,198**	**-24,141**	**16,600**

Table 3: DADRP Penalty Analysis assuming a $250/MW strike price over the hours of 1 PM to 5 PM

		West		Capital		NYC		LI	
Year	Month	Old	New	Old	New	Old	New	Old	New
2000	6			-383	3,327	-403	3,242	-326	2,477
2000	8			-425	1,497	-222	1,574	-180	1,167
2001	8	-797	1,924	-923	2,995	-1,412	1,854	-955	1,228
2002	4							-139	556
2002	7							-322	661
2002	8							-410	2,367
Total		**-797**	**1,924**	**-1,731**	**7,818**	**-2,038**	**6,670**	**-2,332**	**8,455**
All Hours Total		**-797**	**1,924**	**-1,523**	**9,159**	**-2,038**	**6,625**	**-2,729**	**11,419**

Table 4: DADRP Penalty Analysis assuming a $500/MW strike price over the hours of 1 PM to 5 PM

		West		Capital		NYC		LI	
Year	Month	Old	New	Old	New	Old	New	Old	New
2000	6			-383	3,327	-403	3,242	-326	2,477
2000	8			-425	1,497	-222	1,574		
2001	8	-797	1,924	-813	2,114	-921	2,079	-955	1,228
Total		**-797**	**1,924**	**-1,620**	**6,937**	**-1,547**	**6,895**	**-1,281**	**3,705**
All Hours Total		**-797**	**1,924**	**-1,003**	**8,267**	**-1,547**	**6,850**	**-1,482**	**5,027**