NEW YORK INDEPENDENT SYSTEM OPERATOR
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By Electronic Filing

January 31, 2006

Honorable Magalie R. Salas
Secretary
Federal Energy Regulatory Commission
888 First Street, NE
Washington, DC 20006

Re: Compliance Report of the New York Independent System Operator, Inc. Demonstrating the Inadequacy of a One-Day Multiplier In the Formula Used To Calculate Collateral Requirements for Virtual Transactions, Docket No. ER05-941-00__

Dear Ms. Salas:

Pursuant to the Commission's July 1, 2005, order[1] and its December 28, 2005, Notice of Extension of Time in the above-captioned proceeding, the New York Independent System Operator, Inc. ("NYISO") respectfully submits this compliance filing discussing the financial risks associated with virtual transactions in the NYISO-administered markets and concluding that a one-day multiplier in the formula used to calculate collateral requirements for the virtual transactions market would be inadequate to reasonably protect market participants from the risk of bad debt losses.

The time lag between the submission of Day-Ahead bids and the settlement of those bids in the Real-Time Market (*i.e.*, the time required to settle a virtual transaction), the time required to analyze a virtual trader's potential liabilities and make any required collateral call, the time required to allow a virtual trader to meet a collateral call, and the fact that price events that may lead to virtual transaction losses often last more than one day, all support the conclusion that a one-day multiplier would be inadequate. In addition to its discussion of these factors in this filing, the NYISO is submitting an affidavit by its expert economic consultants, Dr. David Babbel of the Wharton School, University of Pennsylvania, and Dr. Scott Harvey of LECG, LLC ("LECG"), supporting the conclusion that at least a two-day collateral multiple is required.[2]

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[1] *New York Independent System Operator, Inc.*, 112 FERC ¶ 61,004 (2005) ("July 1 Order").

[2] The affidavit includes a faxed signature page from Drs. Babbel and Harvey. The NYISO will submit the original signature page to the Commission by no later than February 2, 2006.

I. Background

On May 5, 2005, the NYISO filed proposed tariff revisions in the above-captioned proceeding that would reduce the multiplier used for calculating virtual transactions credit requirements from seven days to four days. The NYISO stated that several years of experience in administering the virtual transactions market led it to conclude that the multiplier could be reduced to four days and noted that market participants unanimously approved the proposal. The NYISO also explained, in response to the protest of EPIC Merchant Energy LP, that a four-day multiplier was necessary to adequately protect against the risk of financial loss in the event that a virtual trader defaulted on its obligations. In particular, the NYISO stated that it would not be able to suspend a virtual trader until a minimum of four days worth of bids had been submitted for settlement, citing its Commission-approved tariff requirements and unavoidable timing issues associated with the calculation of virtual transaction settlements and collateral calls. In the July 1 Order, however, the Commission directed the NYISO to reduce the multiplier to two days, and to work with stakeholders to determine whether a one-day collateral multiplier would be feasible.[3] The Commission subsequently granted the NYISO an extension until January 31, 2006, to submit the results of that evaluation.

The NYISO retained Dr. Babbel and Dr. Harvey of LECG, an outside consulting firm, to undertake an analysis of the NYISO's virtual transactions credit policies. That analysis included studying what multiplier would be sufficient to reasonably protect the market against the risk of bad debt losses attributable to virtual transactions. LECG commenced work on this analysis in November 2005. In accordance with the July 1 Order, Dr. Harvey made a presentation at the NYISO's Scheduling and Pricing Working Group ("S&PWG") meeting on January 20, 2006, that detailed the results of their evaluation regarding the multiplier.[4] At that meeting, stakeholders had an opportunity to discuss this issue with Dr. Harvey and NYISO staff and to provide comments on the collateral posting requirements.

II. Analysis Demonstrating the Inadequacy of the One-Day Multiplier

Dr. Babbel and Dr. Harvey's analysis concludes, and the NYISO agrees, that less than a two-day multiplier would be insufficient to reasonably protect market participants from risk of loss. Dr. Babbel and Dr. Harvey's analysis also points to the necessity of a two-day multiplier and suggests that even the two-day multiplier required by the Commission's July 1 Order may not be sufficient to protect market participants from the risk of a virtual trader's default. Nevertheless, given the choice of a two-day or one-day multiplier, the NYISO strongly advocates the former.

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[3] July 1 Order at P 14-15; In accordance with the July 1 Order, the NYISO submitted a compliance filing that reduced the collateral posting requirement for virtual traders to two days, rather than four days. In addition, the NYISO submitted its analysis of why its use of the 97th percentile to establish credit requirements for the virtual transactions market was warranted. The Commission accepted the NYISO's compliance filing in a December 27, 2005 order. *New York Independent System Operator, Inc.*, 113 FERC ¶ 61,319 (2005). On January 25, 2006, EPIC Merchant Energy, LP filed a Request for Rehearing of the Commission's December 27, 2005 order.

[4] The NYISO held the following meetings with stakeholders to discuss the issues raised in the Commission's July 1 Order: (i) Credit Policy Task Force / S&PWG meeting on August 12, 2005; (ii) S&PWG meeting on November 29, 2005; and (iii) S&PWG meeting on January 20, 2006.

As discussed in the attached affidavit from Dr. Babbel and Dr. Harvey, their independent analysis confirmed that a two-day multiplier would be more appropriate than a one-day multiplier given several pertinent features of the NYISO virtual transactions market. Those features include: (i) the time lag between the submission of Day-Ahead bids and the calculation of Real-Time prices; (ii) the time required for the NYISO to identify losses, notify a collateral-deficient virtual trader, and collect additional collateral; and (iii) the statistical likelihood that virtual traders incurring virtual trading losses that trigger a collateral call will incur additional trading losses prior to the time the additional collateral must be posted. Taking these factors into consideration, it is clear that less than a two-day multiplier for virtual transactions would be insufficient.

With respect to the time lag between the submission of Day-Ahead bids and the settlement of those bids in the Real-Time market, Drs. Babbel and Harvey found that as a result of the timing of the closing of the Day-Ahead market, a virtual trader could potentially lock in several days of losses before both: (i) the first day's losses could be observed by the NYISO; and (ii) the virtual trader's collateral limits were adjusted accordingly. By way of example, if a virtual trader submitted a Day-Ahead virtual supply offer on Day 1 for operating Day 2, the losses attributable to the these trades could not be identified until Day 3 -- *after* the prices in the Real-Time for Day 2 would have cleared. The virtual trader in this hypothetical could therefore have taken additional positions for two days (*i.e.*, operating Days 3 and 4) before the NYISO could determine the losses based on the Day-Ahead bid for operating Day 2. Because of this time lag, the multiplier would have to be greater than one in order for the NYISO to "see" the virtual trader's losses and make the necessary adjustments.

Dr. Babbel and Dr. Harvey also analyzed what would happen after the losses were discovered and the virtual trader's collateral requirements were adjusted. Specifically, using the same basic example as above, the NYISO would not be able to notify a virtual trader of its losses in the Real-Time market for Day 2, and make any necessary collateral call, until Day 3. This means that the virtual trader in this example would be able to take additional positions on Day 3 given that the deadline for Day-Ahead bids is 5:00 a.m. on any given day. In addition, the NYISO's tariff requirements provide that the virtual trader would not be required to provide additional collateral until 4:00 p.m. on Day 4 (the next business day), thus allowing Day-Ahead bids for operating Day 5 to be submitted before the NYISO would know if the collateral call would be met. If the virtual trader failed to post collateral by 4:00 p.m. on Day 4, the NYISO's Market Participants would potentially be exposed for *four days* of losses (*i.e.*, potential losses on Days 2, 3, 4 and 5). Moreover, this example does not take into account what would happen if a weekend intervened. Since the tariff allows "until 4:00 p.m. on the next business day" to meet the collateral call, the intervention of a weekend could add two additional days of exposure.[5]

In addition, as explained in further detail in the attached affidavit, Dr. Babbel and Dr. Harvey examined the empirical correlation in the virtual transactions results over successive days and concluded that the appropriate multiplier should be at least two.

[5] Services Tariff, Attachment K, Section IV.B.(iii), Sheet 504(B); OATT Attachment W, Section IV.B.(iii), Sheet 702.

III. Conclusion

Wherefore, the New York Independent System Operator, Inc. respectfully requests that the Commission accept this compliance filing and accept the recommendation that at least a two-day multiplier should be applied rather than a one-day multiplier.

Respectfully submitted,

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CERTIFICATE OF SERVICE

I hereby certify that I have this day electronically served the foregoing document upon each person designated on the official service lists compiled by the Secretary in this proceeding in accordance with the requirements of Rule 2010 of the Rules of Practice and Procedure, 18 C.F.R. § 385.2010.

Dated at Rensselaer, New York this 31st day of January, 2005.

/s/ Andrew S. Antinori
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UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

New York Independent System Operator	)	Docket No. ER05-941-00
	)	
	)	
	)	

Joint Affidavit of
David F. Babbel and Scott Harvey
January 31, 2006

Introduction

1. We have been asked by the New York Independent System Operator ("NYISO") to comment on the appropriate multiple for use in determining the collateral requirements for virtual trading.

Background

2. Scott Harvey is a Director with LECG, LLC, an economic and management consulting company. David F. Babbel is a Professor, the Wharton School, University of Pennsylvania.

3. Dr. Babbel joined the Wharton School Faculty in 1984, where he received a joint appointment as Professor with both the Risk Management Department, and the Finance Department. He is the only person who has held a tenured appointment with both departments. He has taught in the graduate program, primarily in the areas of risk management and investments. Prior to joining Wharton, he was on the finance faculty at the University of California at Berkeley, where he taught principally in the areas of international financial management, corporate finance, and investments.

4. A former vice president and director of research in the Pension and Insurance Department at Goldman, Sachs & Co., and financial economist in the Financial Sector Development Department at the World Bank, Professor Babbel is a financial consultant for several of the largest financial institutions. He has published approximately 85 articles in the academic and professional literature on asset/liability management, insurance, fixed income investments, and risk management and has co-authored five books on financial institutions and fixed income investments.

5. Most recently, he has modeled the underlying risk in option contracts using a richer distribution, thereby enabling him to publish a valuation model whose approximation to actual traded prices is seven times closer than any of the other formulae developed on more simplistic distributional assumptions.

6. Dr. Harvey has been actively involved with the restructuring of the New York, PJM and New England power pools based on Locational Marginal Pricing ("LMP"), and with the development of the Midwest ISO's LMP based long-term congestion management system. Dr. Harvey has consulted for the NYISO on a variety of matters relating to the operation of the day-ahead and real-time markets coordinated by the NYISO.

Virtual Trading and Collateral Requirements

7. In general terms, the NYISO credit risk associated with the activities of virtual traders is that they may enter into transactions in the day-ahead market that will result in losses, which they will be unable or unwilling to cover. In the case of virtual traders submitting virtual supply offers to sell power in the day-ahead market, it is the risk that unanticipated changes in market conditions between the time the offers are submitted and real-time will require that the virtual supply positions be covered with purchases from the real-time spot market at real-time prices that are much higher than the day-ahead price at which the virtual trader sold power, resulting in losses that cannot be covered by the virtual trader. Conversely, in the case of virtual traders submitting virtual demand bids to buy power in the day-ahead market, it is the risk that unanticipated changes in market conditions will require that the trader sell power purchased in the day-ahead market at real-time prices that are lower than day-ahead prices, resulting in losses. Offsetting these potential credit risks associated with the participation of virtual traders in the day-ahead market is a variety of benefits to the overall market from the participation of virtual traders.

8. Because of the very short-term nature of the price movements with which virtual trading credit issues are concerned, the source of the price movements resulting in virtual trading losses is unlikely to be changes in the broad economy that might be correlated with other elements of a trader's financial position. Instead, price

movements generating virtual trading losses are likely to be driven by short-term events such as generator outages, electric transmission outages, interruptions or unanticipated imbalances in gas supply, and load forecast errors.

9. An important factor impacting the appropriate level of collateral requirements for virtual trading is the time lags in the NYISO market and in the NYISO process for adjusting the collateral required of virtual traders. There are time lags between the time that bids and offers are submitted in the day-ahead market and the time that prices in the real-time market for the operating day are determined; between the time that virtual trading losses are incurred and the time that the NYISO reviews trader positions and requires additional collateral, and another time lag before additional collateral must be posted. As a result, there is a potential for a virtual trader to have locked in losses for several days before revised collateral requirements would be applied and additional collateral required. The collateral requirement therefore needs not only to protect the NYISO's market participants against single-day virtual trading losses resulting in default but also against losses accruing over multiple days before the collateral requirement is adjusted.

10. The current NYISO credit policy for virtual traders is based on allowing virtual traders to choose the MW limit on their daily virtual trading positions and then requiring coverage for each MW equal to two times the highest spread between the absolute value of the day-ahead and integrated real-time energy market prices in any zone of the NYCA at the 97% percentile over the prior 90 days during the on-peak hours.[6] By this, it is meant that the collateral requirement is set so that 97% of the absolute value of virtual trading returns would be less than this threshold over that 90-day period. This collateral requirement therefore limits the size of positions that individual virtual traders can take in each day-ahead market. In addition to requiring that virtual traders post collateral, the NYISO tariffs provide for monitoring of the trading position of virtual traders and to require payment or the posting of additional collateral any time losses rise to 50% of the posted collateral. If the NYISO notifies a trader that additional collateral is required, the virtual trader has until 4:00 p.m. on the following business day (i.e., the business day following notification by the NYISO) to post the required additional collateral. If the additional collateral is not posted by 4:00 p.m., permission to engage in virtual trading may then be suspended by the NYISO.

11. One element of the appropriate collateral requirement for virtual trading in the NYISO administered markets is the determination of an appropriate multiple to account for the possibility that the collateral will need to cover more than one day's trading losses. This role of the collateral multiple in the overall NYISO collateral policy reflects a somewhat distinctive feature of collateral for virtual trading in day-ahead electricity markets. This distinctive feature is that the collateral does not cover positions arising from a single day's trades, but rather must cover potential losses on positions taken over several days. It will be shown below that under the current market, collateral call and collateral posting timelines, the NYISO two-day multiple must cover potential trading losses over periods of up to four on-peak trading days and as many as six total trading days (with some of these days being off-peak weekends). Holidays falling on Monday or Friday can occasionally result in even longer periods.

NYISO Collateral Multiple

12. The appropriate multiple for the NYISO virtual trading credit requirement (i.e., the multiple that is applied to the one-day loss threshold to determine the total collateral requirement) is a distinct component of the NYISO's virtual trading collateral policy. As observed in the introduction, there are a number of conflicting considerations that affect the appropriate virtual trading credit multiple.

13. The first consideration is the timing structure of NYISO day-ahead and real-time markets. Because of the timing of the day-ahead market close, 5:00 a.m. the day before the operating day, a virtual trader could potentially lock in multiple days of losses before the first day's losses would be observed by the NYISO and the trader's collateral requirements adjusted accordingly. If a virtual trader submitted virtual supply offer at 5:00 a.m. on Day 1 (Figure 1) for the day-ahead market for Day 2, the total losses attributable to the day's virtual trades could not be identified until early on Day 3, by which time the day-ahead market for operating Day 3 would already have cleared and the trader could have taken additional positions. One reason for a collateral multiple is that the market

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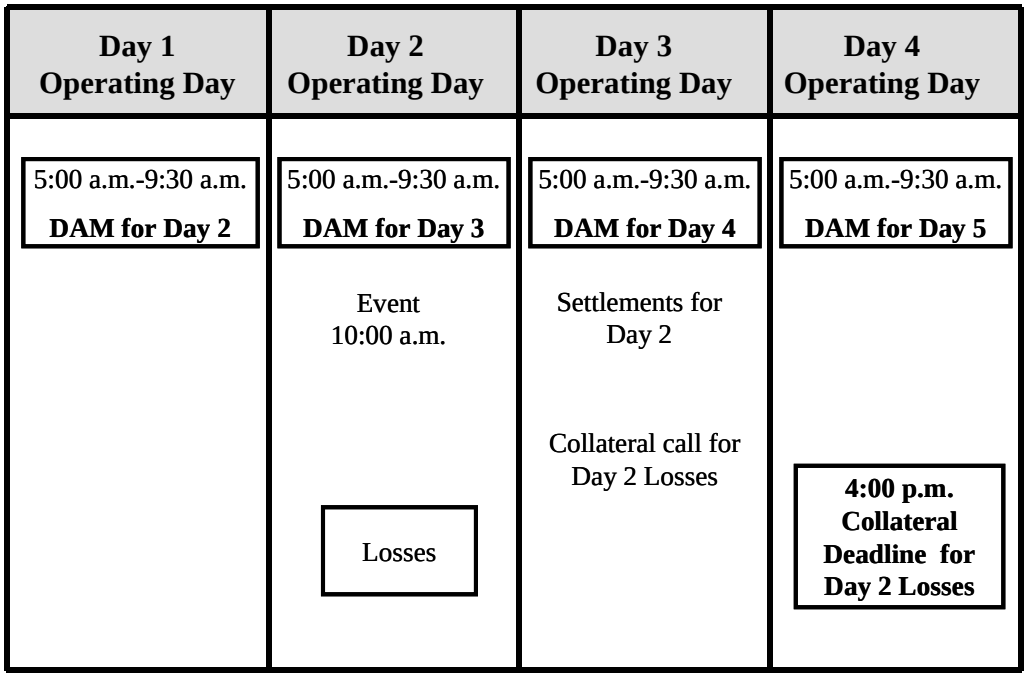
[6] The tariff states that "The amount of collateral required per MWh is equal to two times the highest differential between the Day-Ahead and Real-Time Energy market prices in the NYCA at the 97th percentile over the previous 90 days." Services Tariff Attachment K Section VI Sheet 505; OATT Attachment W Section VI. Addendum A explains that the price difference calculation is to be based on the on-peak prices in any of the zones; thus, the price difference is calculated for each zone for each hour and the largest difference in any zone for the hour is used to define the threshold. Subsequent to the completion of this analysis, the FERC ordered the NYISO to base its determination of the collateral threshold on the distribution of returns during all hours, including the less volatile off-peak hours.

timelines make it impossible for the NYISO to (1) identify virtual traders that have incurred losses; (2) recalculate collateral to identify traders that need to post additional collateral; (3) inform collateral deficient traders of the need to post additional collateral; and (4) allow the trader the time for posting additional collateral specified in the tariff before the virtual trader will submit bids to participate in one or more additional day-ahead markets. In terms of the timing described above, day-ahead market positions for Day 2 entered into at 5:00 a.m. on Day 1 will be settled at the real-time prices determined during Day 2. By 5:00 a.m. on Day 2, bids will have been submitted in the day-ahead market for Day 3 and the resulting positions will typically be known around 9:30 a.m.[7] The potential for Day 3 losses will therefore have been locked in well before the results of bids submitted on Day 1, for Day 2, are known to anyone.

Figure 1
Market Times and Collateral Calls



14. A second consideration in evaluating the NYISO's collateral multiple is the NYISO's actual mark to market policy for virtual trading. Under current NYISO policies and tariff requirements, as illustrated in Figure 1, the NYISO would not notify a virtual trader of its losses in the real-time market for Day 2 and that additional collateral was required until Day 3, by which time the virtual trader could have taken additional positions in the day-ahead market for Days 3 and 4. Moreover, the current NYISO collateral policies and tariff requirements would not require that any additional collateral be posted until 4:00 p.m. on Day 4, by which time the virtual trader could also have taken positions in the day-ahead market for Day 5.[8] If such a trader then failed to post collateral at the end of Day 4 because it was unwilling, unable, or insolvent, the NYISO would potentially be exposed to four days of trading losses that would need to be covered by the original posted collateral. These would include the losses incurred on Operating Day 2 which motivated the collateral call, any losses incurred on Operating Days 3 and 4, plus the possible losses on Day 5 which would not yet be known. In addition, since the NYISO issues a collateral call only when losses reach 50% of posted collateral, a virtual trader could in practice have collateral that is only

[7] The tariff requires that day-ahead market schedules be posted by 11:00 a.m. but they are typically posted by around 9:30 a.m.

[8] A concern that should be kept in mind is that by 4:00 p.m. on Day 4 the virtual trader would know how its trades in Day 3 had turned out and might know how some of its virtual trades for Day 4 had turned out. Its decision whether to post the required collateral or to default could therefore take into account additional losses that might have been incurred during the Day 3 and Day 4 operating days. While the collateral call is made when losses exceed 50% of collateral, the virtual trader may know that its losses exceed total collateral by the time additional collateral must be posted.

51% of the 2-day multiple on Day 1, so that if it lost the threshold amount on Day 2, it would have virtually no remaining collateral to cover possible losses on Days 3, 4 and 5.

15. While the NYISO is potentially exposed under current practices to trading losses over as many as four on-peak trading days, this does not necessarily imply that a four-day multiple would be required to protect against a given probability of uncollateralized losses. This is because the probability that a given trader would incur losses in excess of its daily collateral requirement every day over four days will be lower than the probability of incurring such a loss on a single day. If it were known that virtual trading returns were normally and independently distributed from day to day with a common variance, then the collateral required to protect against a given probability of loss in excess of collateral over four days would be only about twice the collateral required to protect against that level of loss on a single trading day.

16. There are, however, reasons to anticipate both that virtual trading returns are not independent from day to day and that they are not normally distributed. Consider first the issue of independence. Positions taken in any two successive day-ahead markets (i.e., for the Day 2 and Day 3 markets in Figure 1) are subject to being impacted by a common factor that was not known to the virtual trader, or any other market participant, at the time that those positions were taken and day-ahead prices determined. For example, the forced outage of a large generator occurring at 10:00 a.m. on Day 2 would not be reflected in the day-ahead prices for either Day 2 or Day 3 (because both day-ahead markets would already have occurred), but could have an impact on real-time prices in both markets. Therefore, there is likely to be a correlation in losses across positions taken in such successive day-ahead markets.

17. This is important because, as noted earlier, if the probability of incurring virtual trading losses on Day 2 and Day 3 were independent, and if the collateral requirement threshold were defined based on a 1% loss probability, the probability of losing the threshold amount or more on successive days would be relatively small, and the 1% probability loss over the two days would be 1.4 times the single day 1% probability loss. If these losses are not independent, however, but subject to a common influence, then the 1% probability threshold over two days would be between 1.4 and 2 times the single day threshold, depending on the degree of correlation.

18. It is noteworthy, however, that this potential for correlated losses does not extend to the third and fourth successive day-ahead market (for operating Days 4 and 5 in the example in Figure 1). That is, while the virtual trading returns on Days 2 and 3; 3 and 4; and 4 and 5; have reason to be correlated because of common factors that occurred after the closing of both day-ahead markets and prior to both real-time markets, the virtual trading returns for Days 2 and 4, and 3 and 5 should be independent. The reason for this independence relates to market timing and market efficiency. It will necessarily be the case that events which impose substantial losses on market participants during the real-time market for Day 2, will be known before positions are taken in the day-ahead market for Day 4 which will close at 5:00 a.m. on Day 3. A market surprise that occurred after the close of the day-ahead market for Days 2 and 3 and imposed losses on positions taken in those day-ahead markets (such as a generator outage that occurred during hour 11 on Day 2), would be known and factored into the day-ahead market prices for Day 4.

19. This is important from a credit standpoint, because it suggests that even if the NYISO does not adjust its collateral requirements at the end of Day 2 before the day-ahead market for Day 4 is run, the availability to the market in general of information regarding the events that imposed such losses on virtual traders during Day 2 would substantially reduce the potential for this same surprise to impose losses on Day 4 positions that would be correlated with the losses on Day 2 and Day 3. These considerations suggest that the 1% probability loss over four days should, in practice, be less than four times the 1% probability loss on a single day, but likely more than twice the single-day loss threshold.

20. Now consider the issue of normality. There are several reasons to expect that the distribution of virtual trading returns might not be normal. First, the potential profits and losses to virtual supply and virtual demand positions are likely not symmetric. A virtual demand position incurs a trading loss if the real-time price is lower than the price at which power was purchased in the day-ahead market. Since zonal prices in New York are rarely substantially negative in real-time, the potential losses for virtual demand positions are very unlikely to be greater than the day-ahead price. Conversely, however, a virtual supply position incurs a trading loss if the real-time price is higher than the price at which power was sold in the day-ahead market. Since real-time zonal prices can rise to many times the day-ahead price, it cannot be presumed that the potential losses for virtual supply positions are very unlikely to be more than the day-ahead price, they might well be several times the day-ahead price. These considerations suggest that the distribution of returns is likely not symmetric between virtual demand and supply positions (implying that the distribution of returns has more skewness than the normal distribution).

21. Second, the normal distribution implies a particular shape to the distribution of returns relative to the mean, so that a single statistic, the variance, can describe the entire shape of the distribution, including the

probability of events in the tail of the distribution. The normal distribution does not necessarily apply to the distribution of the difference between day-ahead and real-time prices, particularly given the nature of virtual supply returns. The possibility that virtual trading returns are not normally distributed suggests using measures in addition to the calculated standard deviation to measure the dispersion of returns, because the standard deviation may not fully describe the tails of the distribution of returns.

22. Given the variety of conflicting theoretical possibilities, the historical virtual trading return data provide useful information regarding the actual inter-temporal pattern of loss-producing surprises, the distribution of virtual trading returns and the appropriate multiple. The issue is basically whether there is a correlation across successive day-ahead markets of large virtual trading losses and whether any such correlation tends to end with the second or third day. We have examined this by calculating the distribution of returns across the same hour on multiple days. Several features of NYISO markets and of virtual trading returns affected our approach to this empirical assessment.

23. First, it is possible that the volatility of virtual trading returns and correlation in losses may vary by zone and time of year. The potential for large differences between day-ahead and real-time prices, which give rise to virtual trading losses could, for example, be related to the zone for which the virtual demand or supply offer applies or the time of year. Similarly, the magnitude of the potential losses may differ between virtual demand bids and virtual supply offers. The analysis of historical virtual trading returns therefore examines possible differences in the correlation in losses over days by region, by month and season, and distinguishing between losses for virtual supply offers and for virtual demand bids.

24. Second, although the NYISO has been operating and calculating day-ahead and real-time LMP prices since November 1999, there are potential limitations in utilizing some of the historical data for the proposed analysis. First, given the many software changes affecting the determination of real-time prices implemented between November1999 and the end of July 2000, it would probably not be informative to study the dispersion between day-ahead and real-time prices during this early period. Second, it is anticipated that the implementation of load pocket modeling in New York City beginning in the summer of 2002 may have materially increased the volatility of real-time prices in New York City, potentially making comparisons of day-ahead to real-time price differences in this Zone based on data from the pre-2002 summers unreliable as an indicator of prospective price dispersion. Third, implementation of SMD on February 1, 2005 led to a number of potentially significant changes in the NYISO energy markets, particularly reserve shortage pricing east of Central East, that would likely increase real-time price volatility. These changes impact the reliability of virtual trading return analysis based on data from prior years, as return data from prior periods may understate the current and prospective volatility of virtual trading returns. Fourth, because of the many real-time price corrections and software design changes impacting the February and March 2005 periods, findings regarding the dispersion of virtual trading returns during this period may not generalize to other periods.

25. While there were *ex ante* reasons to anticipate that there would be greater price volatility in Zone J in the period since June 2002, we found that this does not appear to have been the case.[9] We have therefore

[9] Return data reported separately for the September 2000-May 2002 and June 2002-January 2005 periods are set forth in Appendix A.

analyzed the pattern of historical returns separately for the SMD period (April 2005-November 2005) and pre-SMD periods (September 2000-January 2005).

26. Third, an important feature of the virtual trading returns which directly and indirectly affects the empirical analysis in a number of ways is, as noted above, the potential non-normal distribution of virtual trading returns. We have applied tests to the NYISO virtual trading returns data over a number of periods and the hypothesis that the returns are normally distributed can be rejected at more than the 99.5% confidence level. The observed returns exhibit both too much skewness and kurtosis[10] for the underlying distribution of virtual trading returns to be normal. These tests are described and reported more fully in Appendix B. Data on the means, median and shape of the tails are reported in Appendix C.

27. The non-normality of virtual trading returns is important because much statistical theory is premised on normal distributions. While the assumption of normal distributions is not essential for statistical analysis of the means of distributions, because similar asymptotic (large sample) results can be derived without requiring normal distributions, this is not the case for analysis relating to the variance of distributions. For these statistics, the assumption that the distribution or error term is normally distributed can be critical to the results, and assuming normality when the underlying distribution is not normal can result in material errors.[11]

28. Our analysis of the correlations of virtual trading returns, as shown below, therefore reports measures based on conventional standard deviation calculations for the NYISO historical virtual trading returns, and also reports a number of other measures of the shape of the distribution of returns. The data suggest that the standard deviation must be carefully interpreted in using it to infer the dispersion and correlation in virtual trading returns because the returns are not normally distributed, exhibiting both skewness and kurtosis. These are not abstract technical details. The degree of skewness in virtual trading returns is inextricably linked to the potentially different distribution of returns to virtual supply and virtual demand bids, and the degree of kurtosis is inextricably linked with the risk of loss to the NYISO and its market participants from uncollateralized virtual trading positions.

29. Given these considerations, we have taken several approaches to measuring the pattern of virtual trading returns over multiple day periods. First, we have calculated the returns to a virtual trading position taken in the same hour of two on-peak successive days, i.e., Monday and Tuesday, Tuesday and Wednesday, Wednesday and Thursday, and Thursday and Friday. This calculation did not include Friday and Saturday returns because Saturday is off-peak, nor did it combine Friday and Monday returns because the days are not successive. Second, we compared the distribution of these returns to the distribution of single on-peak day hourly returns using several measures, the ratio of the calculated standard deviation (Table 2); the ratio of the 1% loss (virtual supply loss) threshold over two days to the similar one-day threshold (Table 3); the ratio of the 3% loss (virtual supply loss) threshold over two days to the similar one-day threshold (Table 4); the ratio of the 5% loss (virtual supply loss) threshold over two days to the similar one-day threshold (Table 5); the ratio of the 95% loss (virtual demand loss) threshold over two days to the similar one-day threshold (Table 6); the ratio of the 97% loss (virtual demand loss) threshold over two days to the similar one-day threshold (Table 7); and the ratio of the 99% loss (virtual demand loss) threshold over two days to the similar one-day threshold (Table 8).

30. While a single statistic such as the standard deviation would describe the impact of correlated returns if the distribution of returns were known to be normal, we have observed above that the distribution of returns is not normal. We have therefore based our conclusions on analyses applied to several distinct regions of the distribution of returns (1, 3, 5% tails) on both sides of the distribution of returns.

31. We calculated the same measures based on the returns to a given hour on three successive on-peak days, Monday to Wednesday, Tuesday-Thursday, and Wednesday-Friday (also set forth in Tables 2 to 8). We calculated these measures separately for both the pre-SMD and SMD periods, separately for the western zones (A-E), the eastern zones (F-I), New York (Zone J) and Long Island (Zone K), and by month and season.

32. As a generalization, the calculated standard deviations for the pre-SMD period generally suggest little correlation in virtual trading returns, while the calculated standard deviations for the SMD period suggest that the standard deviations of the two- and three-day returns are too large relative to the one-day standard deviation for the day-to-day returns to be uncorrelated, particularly for the virtual trades in the eastern zones. The measures calculated for the 1% and 3% tails of the distribution of returns suggest even more strongly that the returns in the tail

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[10] That is, for a distribution with a given standard deviation, more of the returns are very close to the mean than would be the case for a normally distributed random variable, but also more of the returns are out in the extremes of the tail of the distribution than would be the case for a normally distributed random variable with the same variance.

[11] See for example, Henry Scheffe, *The Analysis of Variance*, 1959, pp.334-345; Maurice Kendall and A. Stuart, *The Advanced Theory of Statistics*, Vol. 2, 1979, pp.492-496.

of the distribution are correlated both in the pre-SMD and SMD periods and across all zones. These data suggest that for most of the periods and locations there is a correlation of returns over successive days, but it is less than perfect so the overall loss over three days tends toward about twice the loss at the given probability level on the first day. As a generalization, the data suggest that the tail of the two-day loss distribution tends to be about 1.7 to 1.8 times the value in the similar single day loss distribution and the tail of the three-day loss distribution tends to be about 2 to 2.2 times the value in the similar single-day loss distribution. While there is relatively limited data on virtual trading returns under SMD operation, the pattern of correlation in losses over multiple days appears fairly consistent over both the SMD and pre-SMD periods.

33. A further complication affecting the determination of the appropriate multiple is that the actual timing of collateral calls, collateral posting, and day-ahead markets for on-peak periods is impacted by weekends. The current NYISO practice is to analyze virtual trading returns and make collateral calls during the weekend, with collateral due at 4:00 p.m. Monday for collateral calls on Friday, Saturday and Sunday. Weekend markets are off-peak and typically have lower volatility of virtual trading returns than weekdays, so potential virtual trading losses over weekends would be much lower than during the week.

34. Figure 9 portrays the more complex pattern of collateral calls and posting times resulting from weekends. The top portion of Figure 9 shows that the day-ahead market for each operating day is run on the day prior to each operating day, seven days a week. Any call for additional collateral would be made on the day following the operating day, also seven days a week. The last row in the top portion of Figure 9 shows the days on which additional collateral would be due. For collateral calls made on Tuesday, Wednesday and Thursday, the collateral must be posted on the next calendar day, which is also the next business day. Collateral for calls made on Friday, Saturday and Sunday, however, need not be posted until 4:00 p.m. on Monday, the next business day. The bottom half of Table 9 shows, for each weekday on which a loss triggering a collateral call is assumed to occur, the additional days for which virtual trading positions could be taken, and losses potentially incurred, before additional collateral would have to be posted.

Figure 9
On-Peak Collateral Calls and Weekends

Monday	Tuesday	Wednesday	Thursday	Friday	Saturday	Sunday	Monday	Tuesday
Tuesday DAM	Wednesday DAM Monday Losses Call	Thursday DAM Tuesday Losses Call Monday Collateral Due	Friday DAM Wednesday Losses Call Tuesday Collateral Due	Saturday DAM Thursday Losses Call Wednesday Collateral Due	Sunday DAM Friday Losses Call	Monday DAM Saturday Losses Call	Tuesday DAM Sunday Losses Call Thursday-Saturday Collateral Due	Sunday Collateral Due

Losses Prior to Cutoff

Monday Tuesday Wednesday Thursday	Tuesday Wednesday Thursday Friday	Wednesday Thursday Friday Saturday	Thursday Friday Saturday Sunday Monday Tuesday	Friday Saturday Sunday Monday Tuesday				

35. Figure 9 shows that while there is a potential under current NYISO timelines for virtual traders to incur losses over four or more days before being denied access to the day-ahead market, only virtual trades on Monday and Tuesday can result in virtual trades over more than three successive on-peak days (with potential correlations between successive days) before the posting of additional collateral is required. The pattern of NYISO exposure to virtual trading losses portrayed in Figure 9 is complex and varies day-to-day but given the observed correlations, the NYISO's potential exposure to a total virtual trading losses over the period prior to virtual trader being cutoff from the day-ahead market is at least twice the Day 1 loss at a given probability level. Collateral calls

triggered by losses on Monday, Tuesday and Wednesday would have the potential for three or four days of on-peak losses to be incurred against the collateral, while collateral calls triggered by losses on Thursday could potentially lead to four days of on-peak losses plus two days of weekend losses to be covered by the collateral. Friday collateral calls would result in potential exposure to three days of on-peak losses plus two weekend days. Since the current NYISO policies do not provide for collateral calls until the virtual trader has lost 50% of its collateral, the NYISO's current collateral practices could result in a virtual trader incurring total losses to be covered by collateral that would be three or more times the loss in a given day at a given probability level.

Conclusion

36. Given the existing market timelines, existing NYISO collateral call and posting timelines, the existing 50% collateral call threshold, and the empirical correlation in virtual trading returns over successive days, the appropriate collateral multiple should be at least two.

Table 2
Standard Deviation of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

Standard deviation of Day-Ahead - Real-Time Prices on a single trading day

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	21.77		25.29		35.97		35.67	
February	22.53		27.56		28.63		29.85	
March	24.33		26.99		49.20		30.29	
April	16.31	20.65	33.74	21.59	44.63	35.34	43.43	24.46
May	15.83	25.05	31.81	22.50	39.27	17.21	42.92	24.85
June	12.69	52.93	27.77	73.84	32.39	82.52	38.45	96.50
July	43.11	31.38	52.93	117.25	54.69	148.00	58.53	162.93
August	58.38	90.79	71.00	110.01	74.60	121.09	75.55	150.42
September	23.05	31.07	25.67	35.75	36.80	53.15	33.43	61.44
October	12.76	38.14	14.27	53.45	17.52	67.78	19.08	67.43
November	16.40		22.07		25.84		25.55	
December	34.88		37.49		42.46		37.74	
Summer Avg	38.06	58.37	50.57	100.37	53.90	117.20	57.51	136.62
Winter Avg	26.39		30.11		35.69		34.42	
Rest of Year Avg	18.11	28.72	25.76	33.32	35.54	43.37	32.45	44.54
Year Avg	25.17	41.43	33.05	62.06	40.17	75.02	39.21	84.00

Standard deviation of Day-Ahead - Real-Time Prices for the same hour on 2 successive trading days

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	30.70		36.97		54.86		57.16	
February	32.62		39.51		40.40		46.40	
March	32.80		36.87		63.18		42.35	
April	24.25	29.94	53.64	34.00	70.63	59.64	64.71	37.42
May	24.33	30.61	42.60	28.82	51.08	23.98	58.09	35.73
June	18.59	64.68	42.32	91.33	50.03	109.23	61.01	153.37
July	53.26	40.10	69.19	197.66	70.35	250.44	85.09	276.21
August	93.56	140.36	108.41	175.63	111.43	196.15	124.73	253.01
September	34.18	48.61	38.31	55.11	59.03	91.08	51.43	88.62
October	20.26	53.77	26.08	79.65	32.43	108.95	34.27	97.14
November	24.78		32.21		38.08		38.89	
December	46.29		49.71		57.89		50.27	
Summer Avg	55.14	81.71	73.30	154.87	77.27	185.27	90.28	227.53
Winter Avg	36.54		42.06		51.05		51.28	
Rest of Year Avg	26.76	40.73	38.29	49.39	52.40	70.91	48.29	64.73
Year Avg	36.30	58.30	47.99	94.60	58.28	119.93	59.53	134.50

Standard deviation of Day-Ahead - Real-Time Prices for the same hour on 3 successive trading days

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	37.18		44.36		72.28		71.28	
February	39.20		48.29		50.27		59.76	
March	40.48		46.40		75.69		52.20	
April	29.05	37.55	66.20	45.02	86.76	80.68	74.48	46.19
May	31.47	35.26	53.37	34.02	64.50	28.55	73.36	42.88
June	23.12	78.39	54.59	127.11	64.73	159.88	84.41	220.36
July	62.78	47.40	84.71	259.55	83.57	328.36	106.47	355.46
August	109.18	173.45	127.31	229.97	133.69	259.73	171.25	333.29
September	39.63	62.93	44.72	70.06	78.14	119.13	64.89	112.32
October	25.73	59.00	35.21	101.95	44.84	133.40	47.32	123.78
November	31.39		36.33		45.30		44.91	
December	55.95		60.38		72.40		63.21	
Summer Avg	65.02	99.75	88.87	205.54	94.00	249.33	120.71	303.04
Winter Avg	44.11		51.01		64.98		64.75	
Rest of Year Avg	32.96	48.69	47.04	62.76	65.87	90.44	59.53	81.29
Year Avg	43.76	70.57	58.49	123.95	72.68	158.53	76.13	176.32

Table 2 (continued)
Standard Deviation of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

Ratio of standard deviations of Day-Ahead - Real-Time Prices for the same hour on 2 successive trading days / hour on a single trading day

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	1.41		1.46		1.52		1.60	
February	1.45		1.43		1.41		1.55	
March	1.35		1.37		1.28		1.40	
April	1.49	1.45	1.59	1.57	1.58	1.69	1.49	1.53
May	1.54	1.22	1.34	1.28	1.30	1.39	1.35	1.44
June	1.46	1.22	1.52	1.24	1.54	1.32	1.59	1.59
July	1.24	1.28	1.31	1.69	1.29	1.69	1.45	1.70
August	1.60	1.55	1.53	1.60	1.49	1.62	1.65	1.68
September	1.48	1.56	1.49	1.54	1.60	1.71	1.54	1.44
October	1.59	1.41	1.83	1.49	1.85	1.61	1.80	1.44
November	1.51		1.46		1.47		1.52	
December	1.33		1.33		1.36		1.33	
Summer Avg	1.45	1.40	1.45	1.54	1.43	1.58	1.57	1.67
Winter Avg	1.38		1.40		1.43		1.49	
Rest of Year Avg	1.48	1.42	1.49	1.48	1.47	1.63	1.49	1.45
Year Avg	1.44	1.41	1.45	1.52	1.45	1.60	1.52	1.60

Ratio of standard deviations of Day-Ahead - Real-Time Prices for the same hour on 3 successive trading days / hour on a single trading day

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	1.71		1.75		2.01		2.00	
February	1.74		1.75		1.76		2.00	
March	1.66		1.72		1.54		1.72	
April	1.78	1.82	1.96	2.09	1.94	2.28	1.72	1.89
May	1.99	1.41	1.68	1.51	1.64	1.66	1.71	1.73
June	1.82	1.48	1.97	1.72	2.00	1.94	2.20	2.28
July	1.46	1.51	1.60	2.21	1.53	2.22	1.82	2.18
August	1.87	1.91	1.79	2.09	1.79	2.14	2.27	2.22
September	1.72	2.03	1.74	1.96	2.12	2.24	1.94	1.83
October	2.02	1.55	2.47	1.91	2.56	1.97	2.48	1.84
November	1.91		1.65		1.75		1.76	
December	1.60		1.61		1.71		1.68	
Summer Avg	1.71	1.71	1.76	2.05	1.74	2.13	2.10	2.22
Winter Avg	1.67		1.69		1.82		1.88	
Rest of Year Avg	1.82	1.69	1.83	1.88	1.85	2.09	1.83	1.82
Year Avg	1.74	1.70	1.77	2.00	1.81	2.11	1.94	2.10

ABCDE refers to Zones A, B, C, D, and E
FGHI refers to Zones F, G, H, and I
J refers to the New York City Zone
K refers to the Long Island Zone
"presmd" refers to the period from September 2000 to January 2005
"smd" refers to the period from April 2005 to October 2005

Table 3
1st Percentile of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

1st percentile of Day-Ahead - Real-Time Prices

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	-61.01		-89.99		-153.19		-101.62	
February	-87.48		-117.87		-127.48		-119.11	
March	-54.80		-67.41		-144.01		-114.50	
April	-39.57	-66.92	-133.82	-99.24	-184.57	-142.20	-155.23	-112.98
May	-56.52	-49.85	-99.12	-52.70	-147.79	-52.51	-145.25	-124.85
June	-32.93	-189.58	-56.82	-396.42	-85.34	-457.76	-115.09	-436.04
July	-84.74	-61.59	-165.42	-566.85	-205.31	-604.40	-171.74	-761.82
August	-79.70	-412.98	-213.35	-396.08	-260.46	-441.60	-245.27	-549.05
September	-60.16	-100.38	-66.37	-104.04	-150.10	-95.33	-126.18	-232.07
October	-39.07	-195.08	-47.35	-237.02	-68.18	-275.50	-80.73	-247.20
November	-58.38		-66.99		-95.53		-75.76	
December	-68.94		-76.19		-101.82		-83.95	
Summer Avg	-65.79	-221.38	-145.20	-453.12	-183.70	-501.25	-177.37	-582.30
Winter Avg	-72.48		-94.68		-127.50		-101.56	
Rest of Year Avg	-51.42	-103.06	-80.18	-123.25	-131.70	-141.38	-116.28	-179.28
Year Avg	-60.27	-153.77	-100.06	-264.62	-143.65	-295.61	-127.87	-352.00

1st percentile of Day-Ahead - Real-Time Prices for the same hour on 2 successive trading days

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	-91.97		-121.68		-213.24		-145.04	
February	-128.21		-188.49		-172.98		-176.17	
March	-97.84		-105.02		-239.37		-129.63	
April	-64.55	-100.99	-254.90	-125.41	-340.38	-242.68	-268.53	-126.79
May	-91.35	-68.47	-172.74	-71.03	-211.54	-68.86	-233.10	-156.85
June	-37.40	-206.78	-160.12	-429.98	-190.53	-495.07	-245.52	-630.30
July	-159.54	-96.79	-334.08	-1,149.09	-349.97	-1,481.76	-310.67	-1,534.25
August	-155.95	-800.03	-409.69	-815.47	-416.55	-924.73	-481.69	-1,053.57
September	-84.73	-127.02	-114.35	-150.95	-200.44	-152.25	-188.91	-275.40
October	-63.74	-212.04	-79.53	-285.33	-100.93	-470.63	-116.50	-308.32
November	-86.82		-115.26		-166.48		-148.23	
December	-158.11		-166.66		-202.81		-157.43	
Summer Avg	-117.63	-367.87	-301.30	-798.18	-319.02	-967.19	-345.96	-1,072.71
Winter Avg	-126.10		-158.94		-196.34		-159.55	
Rest of Year Avg	-81.50	-127.13	-140.30	-158.18	-209.86	-233.61	-180.82	-216.84
Year Avg	-101.68	-230.30	-185.21	-432.47	-233.77	-548.00	-216.78	-583.64

1st percentile of Day-Ahead - Real-Time Prices for the same hour on 3 successive trading days

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	-105.37		-141.48		-260.86		-170.92	
February	-173.83		-203.38		-215.77		-221.25	
March	-106.51		-139.10		-281.09		-146.19	
April	-121.08	-105.74	-318.59	-181.61	-459.75	-484.21	-261.94	-151.62
May	-137.83	-67.57	-218.42	-70.71	-243.70	-61.03	-276.71	-163.53
June	-42.50	-179.48	-266.43	-584.26	-270.81	-668.13	-362.82	-812.15
July	-240.33	-61.95	-380.42	-1,394.13	-385.02	-1,863.88	-415.97	-1,999.29
August	-378.84	-1,050.90	-479.41	-1,218.03	-480.19	-1,755.27	-636.03	-2,067.19
September	-91.93	-138.59	-117.64	-138.32	-291.18	-160.19	-251.91	-315.77
October	-84.74	-208.28	-106.38	-410.62	-154.99	-587.26	-168.86	-470.71
November	-108.91		-161.27		-185.52		-177.01	
December	-171.32		-175.27		-219.90		-223.47	
Summer Avg	-220.56	-430.78	-375.42	-1,065.47	-378.67	-1,429.09	-471.61	-1,626.21
Winter Avg	-150.17		-173.38		-232.18		-205.21	
Rest of Year Avg	-108.50	-130.05	-176.90	-200.32	-269.37	-323.17	-213.77	-275.41
Year Avg	-146.93	-258.93	-225.65	-571.10	-287.40	-797.14	-276.09	-854.32

Table 3 (continued)
1st Percentile of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

Ratio of 1st Percentiles of Day-Ahead - Real-Time Prices for the same hour on 2 successive trading days / hour on a single trading day

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	1.51		1.35		1.39		1.43	
February	1.47		1.60		1.36		1.48	
March	1.79		1.56		1.66		1.13	
April	1.63	1.51	1.90	1.26	1.84	1.71	1.73	1.12
May	1.62	1.37	1.74	1.35	1.43	1.31	1.60	1.26
June	1.14	1.09	2.82	1.08	2.23	1.08	2.13	1.45
July	1.88	1.57	2.02	2.03	1.70	2.45	1.81	2.01
August	1.96	1.94	1.92	2.06	1.60	2.09	1.96	1.92
September	1.41	1.27	1.72	1.45	1.34	1.60	1.50	1.19
October	1.63	1.09	1.68	1.20	1.48	1.71	1.44	1.25
November	1.49		1.72		1.74		1.96	
December	2.29		2.19		1.99		1.88	
Summer Avg	1.79	1.66	2.08	1.76	1.74	1.93	1.95	1.84
Winter Avg	1.74		1.68		1.54		1.57	
Rest of Year Avg	1.59	1.23	1.75	1.28	1.59	1.65	1.56	1.21
Year Avg	1.69	1.50	1.85	1.63	1.63	1.85	1.70	1.66

Ratio of 1st Percentiles of Day-Ahead - Real-Time Prices for the same hour on 3 successive trading days / hour on a single trading day

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	1.73		1.57		1.70		1.68	
February	1.99		1.73		1.69		1.86	
March	1.94		2.06		1.95		1.28	
April	3.06	1.58	2.38	1.83	2.49	3.41	1.69	1.34
May	2.44	1.36	2.20	1.34	1.65	1.16	1.91	1.31
June	1.29	0.95	4.69	1.47	3.17	1.46	3.15	1.86
July	2.84	1.01	2.30	2.46	1.88	3.08	2.42	2.62
August	4.75	2.54	2.25	3.08	1.84	3.97	2.59	3.77
September	1.53	1.38	1.77	1.33	1.94	1.68	2.00	1.36
October	2.17	1.07	2.25	1.73	2.27	2.13	2.09	1.90
November	1.87		2.41		1.94		2.34	
December	2.49		2.30		2.16		2.66	
Summer Avg	3.35	1.95	2.59	2.35	2.06	2.85	2.66	2.79
Winter Avg	2.07		1.83		1.82		2.02	
Rest of Year Avg	2.11	1.26	2.21	1.63	2.05	2.29	1.84	1.54
Year Avg	2.44	1.68	2.26	2.16	2.00	2.70	2.16	2.43

ABCDE refers to Zones A, B, C, D, and E
FGHI refers to Zones F, G, H, and I
J refers to the New York City Zone
K refers to the Long Island Zone
"presmd" refers to the period from September 2000 to January 2005
"smd" refers to the period from April 2005 to October 2005

Table 4
3rd Percentile of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

3rd percentile of Day-Ahead - Real-Time Prices

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	-35.04		-49.22		-84.37		-58.60	
February	-25.53		-32.58		-62.47		-64.99	
March	-27.14		-33.73		-81.03		-54.35	
April	-25.94	-18.99	-53.05	-43.02	-92.72	-72.11	-72.58	-46.86
May	-31.81	-33.68	-52.77	-32.91	-54.89	-30.39	-77.37	-78.07
June	-17.62	-63.76	-34.33	-128.52	-35.17	-208.36	-73.14	-235.53
July	-30.98	-18.93	-46.82	-64.84	-60.05	-184.02	-90.85	-288.07
August	-31.66	-136.48	-80.24	-161.00	-91.41	-157.67	-114.13	-320.27
September	-27.40	-72.33	-31.28	-72.18	-42.00	-85.54	-72.40	-158.72
October	-26.49	-91.94	-29.28	-145.79	-34.29	-177.04	-48.05	-176.84
November	-31.18		-37.94		-53.43		-46.05	
December	-35.97		-40.92		-56.41		-55.23	
Summer Avg	-26.75	-73.06	-53.80	-118.12	-62.21	-183.35	-92.71	-281.29
Winter Avg	-32.18		-40.91		-67.75		-59.61	
Rest of Year Avg	-28.33	-54.24	-39.68	-73.48	-59.73	-91.27	-61.80	-115.12
Year Avg	-28.90	-62.30	-43.51	-92.61	-62.35	-130.73	-68.98	-186.34

3rd percentile of Day-Ahead - Real-Time Prices for the same hour on 2 successive trading days

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	-41.30		-63.38		-119.78		-103.72	
February	-43.20		-88.36		-103.75		-126.69	
March	-41.51		-54.14		-109.75		-97.26	
April	-37.13	-28.64	-102.88	-82.64	-158.87	-125.89	-115.90	-99.86
May	-46.75	-36.38	-77.85	-44.35	-83.78	-44.64	-138.70	-100.50
June	-23.95	-97.75	-50.27	-216.17	-65.54	-336.57	-143.70	-489.10
July	-53.20	-34.32	-104.23	-457.63	-132.41	-585.35	-181.73	-873.81
August	-44.48	-405.09	-141.98	-396.61	-163.35	-374.12	-192.04	-634.11
September	-38.24	-103.88	-48.30	-102.56	-112.08	-140.22	-134.90	-221.67
October	-41.87	-155.13	-47.89	-192.50	-57.57	-292.98	-85.72	-217.82
November	-42.13		-51.37		-83.33		-78.53	
December	-51.19		-57.56		-76.45		-92.31	
Summer Avg	-40.54	-179.05	-98.83	-356.80	-120.43	-432.01	-172.49	-665.67
Winter Avg	-45.23		-69.77		-99.99		-107.57	
Rest of Year Avg	-41.27	-81.01	-63.74	-105.51	-100.90	-150.93	-108.50	-159.96
Year Avg	-42.08	-123.03	-74.02	-213.21	-105.55	-271.40	-124.27	-376.70

3rd percentile of Day-Ahead - Real-Time Prices for the same hour on 3 successive trading days

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	-49.52		-84.14		-151.46		-121.99	
February	-62.54		-106.33		-119.61		-172.88	
March	-57.04		-67.79		-163.42		-106.73	
April	-45.78	-40.27	-158.64	-93.99	-210.07	-183.95	-145.09	-116.71
May	-61.60	-48.07	-113.28	-48.71	-185.27	-44.46	-198.93	-132.96
June	-30.37	-128.29	-76.10	-365.40	-114.46	-479.08	-218.14	-728.85
July	-84.29	-35.50	-202.14	-831.13	-200.70	-1,185.08	-276.11	-1,323.75
August	-50.36	-490.39	-207.58	-552.60	-231.92	-702.04	-306.09	-890.54
September	-49.74	-125.69	-61.27	-123.23	-160.50	-132.29	-174.95	-265.99
October	-52.84	-172.31	-58.75	-218.49	-87.67	-324.67	-103.99	-291.74
November	-53.56		-65.22		-113.08		-98.12	
December	-70.50		-76.24		-129.54		-119.05	
Summer Avg	-55.01	-218.06	-161.94	-583.04	-182.36	-788.73	-266.78	-981.05
Winter Avg	-60.85		-88.90		-133.54		-137.97	
Rest of Year Avg	-53.43	-96.59	-87.49	-121.10	-153.34	-171.34	-137.97	-201.85
Year Avg	-55.68	-148.65	-106.46	-319.08	-155.64	-435.94	-170.17	-535.79

Table 4 (continued)
3rd Percentile of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

Ratio of 3rd Percentiles of Day-Ahead - Real-Time Prices for the same hour on 2 successive trading days / hour on a single trading day

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	1.18		1.29		1.42		1.77	
February	1.69		2.71		1.66		1.95	
March	1.53		1.61		1.35		1.79	
April	1.43	1.51	1.94	1.92	1.71	1.75	1.60	2.13
May	1.47	1.08	1.48	1.35	1.53	1.47	1.79	1.29
June	1.36	1.53	1.46	1.68	1.86	1.62	1.96	2.08
July	1.72	1.81	2.23	7.06	2.20	3.18	2.00	3.03
August	1.40	2.97	1.77	2.46	1.79	2.37	1.68	1.98
September	1.40	1.44	1.54	1.42	2.67	1.64	1.86	1.40
October	1.58	1.69	1.64	1.32	1.68	1.65	1.78	1.23
November	1.35		1.35		1.56		1.71	
December	1.42		1.41		1.36		1.67	
Summer Avg	1.52	2.45	1.84	3.02	1.94	2.36	1.86	2.37
Winter Avg	1.41		1.71		1.48		1.80	
Rest of Year Avg	1.46	1.49	1.61	1.44	1.69	1.65	1.76	1.39
Year Avg	1.46	1.97	1.70	2.30	1.69	2.08	1.80	2.02

Ratio of 3rd Percentiles of Day-Ahead - Real-Time Prices for the same hour on 3 successive trading days / hour on a single trading day

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	1.41		1.71		1.80		2.08	
February	2.45		3.26		1.91		2.66	
March	2.10		2.01		2.02		1.96	
April	1.76	2.12	2.99	2.18	2.27	2.55	2.00	2.49
May	1.94	1.43	2.15	1.48	3.38	1.46	2.57	1.70
June	1.72	2.01	2.22	2.84	3.25	2.30	2.98	3.09
July	2.72	1.88	4.32	12.82	3.34	6.44	3.04	4.60
August	1.59	3.59	2.59	3.43	2.54	4.45	2.68	2.78
September	1.82	1.74	1.96	1.71	3.82	1.55	2.42	1.68
October	1.99	1.87	2.01	1.50	2.56	1.83	2.16	1.65
November	1.72		1.72		2.12		2.13	
December	1.96		1.86		2.30		2.16	
Summer Avg	2.06	2.98	3.01	4.94	2.93	4.30	2.88	3.49
Winter Avg	1.89		2.17		1.97		2.31	
Rest of Year Avg	1.89	1.78	2.21	1.65	2.57	1.88	2.23	1.75
Year Avg	1.93	2.39	2.45	3.45	2.50	3.33	2.47	2.88

ABCDE refers to Zones A, B, C, D, and E
FGHI refers to Zones F, G, H, and I
J refers to the New York City Zone
K refers to the Long Island Zone
"presmd" refers to the period from September 2000 to January 2005
"smd" refers to the period from April 2005 to October 2005

Table 5
5th Percentile of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

5th percentile of Day-Ahead - Real-Time Prices

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	-24.92		-34.55		-56.83		-48.28	
February	-17.30		-24.42		-30.50		-49.90	
March	-19.78		-24.42		-45.83		-39.26	
April	-19.48	-8.66	-31.12	-23.03	-54.34	-54.69	-49.77	-36.67
May	-24.26	-16.27	-39.11	-16.96	-41.45	-18.87	-64.22	-57.74
June	-11.96	-36.94	-23.42	-62.83	-30.22	-95.43	-57.94	-173.72
July	-22.48	-11.72	-28.68	-27.20	-38.06	-40.90	-65.78	-207.97
August	-22.14	-85.00	-39.08	-111.63	-56.11	-139.63	-78.88	-256.12
September	-20.85	-57.78	-23.08	-55.97	-27.14	-70.81	-58.21	-128.99
October	-18.88	-57.64	-21.68	-89.50	-28.22	-141.98	-36.14	-140.86
November	-21.67		-25.11		-37.44		-36.39	
December	-26.79		-30.63		-34.51		-44.88	
Summer Avg	-18.86	-44.55	-30.39	-67.22	-41.46	-91.99	-67.53	-212.60
Winter Avg	-23.00		-29.87		-40.61		-47.68	
Rest of Year Avg	-20.82	-35.09	-27.42	-46.37	-39.07	-71.59	-47.33	-91.07
Year Avg	-20.87	-39.14	-28.77	-55.30	-40.05	-80.33	-52.47	-143.15

5th percentile of Day-Ahead - Real-Time Prices for the same hour on 2 successive trading days

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	-30.49		-45.05		-95.26		-74.52	
February	-22.80		-45.94		-68.05		-101.11	
March	-28.65		-37.55		-73.44		-69.76	
April	-26.94	-13.00	-51.28	-37.59	-97.06	-95.63	-84.32	-64.15
May	-39.12	-29.68	-55.59	-28.33	-61.86	-30.31	-106.92	-80.98
June	-18.45	-70.86	-37.08	-139.65	-46.98	-216.13	-103.34	-383.22
July	-29.97	-18.40	-56.45	-239.51	-73.77	-419.21	-125.52	-675.95
August	-28.97	-209.52	-72.29	-207.01	-89.69	-224.18	-134.90	-465.68
September	-29.24	-89.77	-34.14	-84.61	-52.54	-116.09	-103.69	-180.64
October	-32.64	-89.35	-36.98	-134.76	-44.16	-174.94	-66.24	-188.49
November	-30.77		-33.76		-54.03		-59.90	
December	-40.36		-45.03		-60.14		-71.91	
Summer Avg	-25.79	-99.59	-55.27	-195.39	-70.15	-286.51	-121.25	-508.28
Winter Avg	-31.21		-45.34		-74.48		-82.51	
Rest of Year Avg	-31.22	-55.45	-41.55	-71.32	-63.85	-104.24	-81.80	-128.57
Year Avg	-29.86	-74.36	-45.93	-124.49	-68.08	-182.36	-91.84	-291.30

5th percentile of Day-Ahead - Real-Time Prices for the same hour on 3 successive trading days

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	-28.57		-55.11		-122.40		-93.84	
February	-29.17		-69.87		-92.70		-136.94	
March	-32.61		-49.64		-105.60		-86.54	
April	-33.16	-21.18	-81.91	-50.55	-126.98	-141.74	-107.34	-95.91
May	-49.74	-31.50	-76.74	-29.15	-83.18	-32.86	-155.97	-107.58
June	-21.13	-90.52	-49.25	-215.65	-70.82	-294.34	-166.85	-539.83
July	-39.53	-16.45	-95.43	-405.34	-115.62	-590.96	-196.64	-904.97
August	-37.24	-373.04	-139.36	-407.80	-152.81	-455.31	-193.08	-668.91
September	-34.70	-118.79	-44.26	-107.05	-87.23	-119.66	-137.55	-240.96
October	-40.46	-85.74	-49.44	-173.67	-65.13	-282.69	-88.60	-232.28
November	-39.99		-45.48		-73.21		-78.80	
December	-47.01		-58.92		-79.11		-98.59	
Summer Avg	-32.63	-160.00	-94.68	-342.93	-113.08	-446.87	-185.52	-704.57
Winter Avg	-34.91		-61.30		-98.07		-109.79	
Rest of Year Avg	-38.44	-64.30	-57.91	-90.11	-90.22	-144.24	-109.13	-169.18
Year Avg	-36.11	-105.32	-67.95	-198.46	-97.90	-273.94	-128.40	-398.63

Table 5 (continued)
5th Percentile of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

Ratio of 5th Percentiles of Day-Ahead - Real-Time Prices for the same hour on 2 successive trading days / hour on a single trading day

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	1.22		1.30		1.68		1.54	
February	1.32		1.88		2.23		2.03	
March	1.45		1.54		1.60		1.78	
April	1.38	1.50	1.65	1.63	1.79	1.75	1.69	1.75
May	1.61	1.82	1.42	1.67	1.49	1.61	1.66	1.40
June	1.54	1.92	1.58	2.22	1.55	2.26	1.78	2.21
July	1.33	1.57	1.97	8.81	1.94	10.25	1.91	3.25
August	1.31	2.46	1.85	1.85	1.60	1.61	1.71	1.82
September	1.40	1.55	1.48	1.51	1.94	1.64	1.78	1.40
October	1.73	1.55	1.71	1.51	1.56	1.23	1.83	1.34
November	1.42		1.34		1.44		1.65	
December	1.51		1.47		1.74		1.60	
Summer Avg	1.37	2.24	1.82	2.91	1.69	3.11	1.80	2.39
Winter Avg	1.36		1.52		1.83		1.73	
Rest of Year Avg	1.50	1.58	1.52	1.54	1.63	1.46	1.73	1.41
Year Avg	1.43	1.90	1.60	2.25	1.70	2.27	1.75	2.03

Ratio of 5th Percentiles of Day-Ahead - Real-Time Prices for the same hour on 3 successive trading days / hour on a single trading day

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	1.15		1.60		2.15		1.94	
February	1.69		2.86		3.04		2.74	
March	1.65		2.03		2.30		2.20	
April	1.70	2.44	2.63	2.19	2.34	2.59	2.16	2.62
May	2.05	1.94	1.96	1.72	2.01	1.74	2.43	1.86
June	1.77	2.45	2.10	3.43	2.34	3.08	2.88	3.11
July	1.76	1.40	3.33	14.90	3.04	14.45	2.99	4.35
August	1.68	4.39	3.57	3.65	2.72	3.26	2.45	2.61
September	1.66	2.06	1.92	1.91	3.21	1.69	2.36	1.87
October	2.14	1.49	2.28	1.94	2.31	1.99	2.45	1.65
November	1.85		1.81		1.96		2.17	
December	1.75		1.92		2.29		2.20	
Summer Avg	1.73	3.59	3.12	5.10	2.73	4.86	2.75	3.31
Winter Avg	1.52		2.05		2.41		2.30	
Rest of Year Avg	1.85	1.83	2.11	1.94	2.31	2.01	2.31	1.86
Year Avg	1.73	2.69	2.36	3.59	2.44	3.41	2.45	2.78

ABCDE refers to Zones A, B, C, D, and E
FGHI refers to Zones F, G, H, and I
J refers to the New York City Zone
K refers to the Long Island Zone
"presmd" refers to the period from September 2000 to January 2005
"smd" refers to the period from April 2005 to October 2005

Table 6
95th Percentile of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

95th percentile of Day-Ahead - Real-Time Prices

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	34.48		35.29		36.62		50.16	
February	27.45		26.78		25.02		29.78	
March	25.10		27.75		25.50		30.74	
April	18.72	23.73	23.41	25.46	27.32	34.57	24.74	26.81
May	19.08	21.81	23.01	26.13	27.03	26.88	29.41	10.40
June	24.30	30.29	29.64	44.85	36.84	44.62	38.95	71.24
July	20.83	30.98	30.12	40.49	31.85	40.83	32.41	33.74
August	54.95	31.76	55.51	63.12	48.32	64.19	46.82	87.53
September	18.73	40.64	21.12	55.11	22.11	107.15	18.51	63.97
October	18.66	37.36	19.40	53.08	22.40	66.59	17.94	65.85
November	18.83		20.60		19.21		21.92	
December	28.00		29.11		25.21		24.33	
Summer Avg	33.36	31.01	38.42	49.49	39.00	49.88	39.39	64.17
Winter Avg	29.98		30.39		28.95		34.76	
Rest of Year Avg	19.85	30.89	22.55	39.95	23.93	58.80	23.88	41.76
Year Avg	25.76	30.94	28.48	44.03	28.95	54.98	30.48	51.36

95th percentile of Day-Ahead - Real-Time Prices for the same hour on 2 successive trading days

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	55.55		56.39		70.34		89.25	
February	49.18		47.92		42.14		45.36	
March	46.62		52.37		40.18		53.31	
April	29.02	37.45	37.10	42.69	45.49	56.29	44.25	49.59
May	30.58	35.45	38.44	43.91	46.98	40.65	40.68	18.11
June	38.63	57.78	50.38	86.54	65.60	83.65	58.52	111.02
July	37.15	56.08	55.90	66.92	51.41	64.36	58.28	46.46
August	95.91	55.15	93.47	103.85	83.84	90.30	86.59	159.00
September	30.71	72.44	34.06	92.85	38.66	200.61	37.70	109.29
October	31.17	65.92	33.38	98.95	38.88	121.81	33.64	115.10
November	31.65		35.54		34.74		35.92	
December	50.79		52.33		45.46		37.51	
Summer Avg	57.23	56.33	66.58	85.77	66.95	79.44	67.80	105.49
Winter Avg	51.84		52.21		52.65		57.37	
Rest of Year Avg	33.29	52.81	38.48	69.60	40.82	104.84	40.91	73.02
Year Avg	43.91	54.32	48.94	76.53	50.31	93.95	51.75	86.94

95th percentile of Day-Ahead - Real-Time Prices for the same hour on 3 successive trading days

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	75.19		72.73		93.43		122.75	
February	69.00		64.79		56.15		54.47	
March	61.99		71.27		54.09		69.14	
April	37.65	55.27	51.85	61.05	58.85	74.04	55.19	69.91
May	39.19	47.94	49.48	61.38	60.53	56.59	50.68	25.07
June	52.28	80.06	67.06	123.44	94.68	110.28	77.77	131.88
July	62.63	88.65	81.91	87.37	70.63	80.59	68.08	58.98
August	110.69	64.46	110.45	118.87	115.37	115.26	101.04	173.20
September	39.63	97.38	43.58	120.30	47.70	272.80	47.81	166.19
October	40.90	82.21	44.06	136.35	51.59	160.63	43.73	156.10
November	42.17		46.62		44.49		49.68	
December	65.02		68.54		61.15		45.87	
Summer Avg	75.20	77.72	86.47	109.89	93.56	102.04	82.30	121.35
Winter Avg	69.74		68.69		70.24		74.36	
Rest of Year Avg	43.59	70.70	51.14	94.77	52.88	141.01	52.70	104.32
Year Avg	58.03	73.71	64.36	101.25	67.39	124.31	65.52	111.62

Table 6 (continued)
95th Percentile of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

Ratio of 95th Percentiles of Day-Ahead - Real-Time Prices for the same hour on 2 successive trading days / hour on a single trading day

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	1.61		1.60		1.92		1.78	
February	1.79		1.79		1.68		1.52	
March	1.86		1.89		1.58		1.73	
April	1.55	1.58	1.58	1.68	1.67	1.63	1.79	1.85
May	1.60	1.63	1.67	1.68	1.74	1.51	1.38	1.74
June	1.59	1.91	1.70	1.93	1.78	1.87	1.50	1.56
July	1.78	1.81	1.86	1.65	1.61	1.58	1.80	1.38
August	1.75	1.74	1.68	1.65	1.74	1.41	1.85	1.82
September	1.64	1.78	1.61	1.68	1.75	1.87	2.04	1.71
October	1.67	1.76	1.72	1.86	1.74	1.83	1.87	1.75
November	1.68		1.73		1.81		1.64	
December	1.81		1.80		1.80		1.54	
Summer Avg	1.72	1.82	1.73	1.73	1.72	1.59	1.72	1.64
Winter Avg	1.73		1.72		1.82		1.65	
Rest of Year Avg	1.68	1.71	1.71	1.74	1.71	1.78	1.71	1.75
Year Avg	1.70	1.76	1.72	1.74	1.74	1.71	1.70	1.69

Ratio of 95th Percentiles of Day-Ahead - Real-Time Prices for the same hour on 3 successive trading days / hour on a single trading day

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	2.18		2.06		2.55		2.45	
February	2.51		2.42		2.24		1.83	
March	2.47		2.57		2.12		2.25	
April	2.01	2.33	2.21	2.40	2.15	2.14	2.23	2.61
May	2.05	2.20	2.15	2.35	2.24	2.11	1.72	2.41
June	2.15	2.64	2.26	2.75	2.57	2.47	2.00	1.85
July	3.01	2.86	2.72	2.16	2.22	1.97	2.10	1.75
August	2.01	2.03	1.99	1.88	2.39	1.80	2.16	1.98
September	2.12	2.40	2.06	2.18	2.16	2.55	2.58	2.60
October	2.19	2.20	2.27	2.57	2.30	2.41	2.44	2.37
November	2.24		2.26		2.32		2.27	
December	2.32		2.35		2.43		1.89	
Summer Avg	2.25	2.51	2.25	2.22	2.40	2.05	2.09	1.89
Winter Avg	2.33		2.26		2.43		2.14	
Rest of Year Avg	2.20	2.29	2.27	2.37	2.21	2.40	2.21	2.50
Year Avg	2.25	2.38	2.26	2.30	2.33	2.26	2.15	2.17

ABCDE refers to Zones A, B, C, D, and E
FGHI refers to Zones F, G, H, and I
J refers to the New York City Zone
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"presmd" refers to the period from September 2000 to January 2005
"smd" refers to the period from April 2005 to October 2005

Table 7
97th Percentile of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

97th percentile of Day-Ahead - Real-Time Prices

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	39.18		40.57		49.18		62.12	
February	34.12		34.50		29.85		37.86	
March	31.88		36.47		34.83		36.16	
April	22.85	27.86	27.47	28.42	34.35	39.77	29.54	31.05
May	21.55	24.81	25.11	29.54	30.88	28.29	36.99	12.44
June	28.19	40.03	35.66	52.68	43.29	48.01	45.60	84.28
July	27.97	34.33	38.52	47.19	39.03	45.55	44.80	51.13
August	75.05	39.70	75.31	83.36	67.82	74.89	69.83	106.56
September	22.81	43.60	24.06	63.38	28.28	119.99	28.05	72.77
October	21.64	43.00	22.56	60.44	25.90	74.59	22.48	72.16
November	21.96		23.64		22.32		25.86	
December	33.71		34.89		28.78		30.90	
Summer Avg	43.74	38.02	49.83	61.08	50.05	56.15	53.41	80.66
Winter Avg	35.67		36.65		35.94		43.63	
Rest of Year Avg	23.78	34.82	26.55	45.45	29.43	65.66	29.85	47.11
Year Avg	31.74	36.19	34.90	52.14	36.21	61.58	39.18	61.48

97th percentile of Day-Ahead - Real-Time Prices for the same hour on 2 successive trading days

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	64.58		66.65		92.41		114.80	
February	66.47		65.14		51.58		61.36	
March	60.29		67.86		49.87		62.83	
April	34.27	43.46	45.92	46.66	56.22	62.29	53.14	53.07
May	34.34	41.73	42.38	48.93	52.84	46.47	49.50	19.78
June	43.70	62.70	61.12	95.23	77.75	88.59	71.73	136.31
July	51.87	66.27	73.24	78.64	63.20	78.62	75.32	57.22
August	128.28	61.64	130.36	124.72	122.16	115.62	132.65	187.91
September	36.64	75.73	39.72	103.02	44.99	207.36	48.60	130.33
October	35.27	76.38	38.75	105.92	46.15	126.55	40.20	119.57
November	36.63		41.40		40.65		47.35	
December	58.72		61.29		51.04		43.05	
Summer Avg	74.62	63.54	88.24	99.53	87.70	94.28	93.23	127.15
Winter Avg	63.26		64.36		65.01		73.07	
Rest of Year Avg	39.57	59.33	46.01	76.13	48.45	110.67	50.27	80.69
Year Avg	54.25	61.13	61.15	86.16	62.40	103.64	66.71	100.60

97th percentile of Day-Ahead - Real-Time Prices for the same hour on 3 successive trading days

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	84.29		85.46		126.90		156.04	
February	91.18		87.09		72.46		74.52	
March	80.35		90.36		72.55		83.33	
April	45.67	75.90	60.66	65.31	67.97	88.21	64.22	72.26
May	42.35	59.07	57.26	73.80	68.00	61.45	62.07	28.09
June	56.85	87.41	81.28	136.62	115.87	117.21	89.76	166.19
July	78.84	100.26	106.12	117.62	81.46	91.52	92.50	66.17
August	139.53	79.04	145.02	138.04	147.02	138.50	171.50	193.82
September	46.67	104.22	49.36	132.96	56.58	276.52	57.16	182.54
October	46.51	88.68	51.80	151.80	60.88	164.71	49.36	166.64
November	48.91		54.05		53.31		61.39	
December	77.49		81.38		70.46		58.98	
Summer Avg	91.74	88.90	110.81	130.76	114.78	115.74	117.92	142.06
Winter Avg	84.32		84.64		89.94		96.51	
Rest of Year Avg	51.74	81.97	60.58	105.97	63.22	147.72	62.92	112.38
Year Avg	69.89	84.94	79.15	116.59	82.79	134.02	85.07	125.10

Table 7 (continued)
97th Percentile of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

Ratio of 97th Percentiles of Day-Ahead - Real-Time Prices for the same hour on 2 successive trading days / hour on a single trading day

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	1.65		1.64		1.88		1.85	
February	1.95		1.89		1.73		1.62	
March	1.89		1.86		1.43		1.74	
April	1.50	1.56	1.67	1.64	1.64	1.57	1.80	1.71
May	1.59	1.68	1.69	1.66	1.71	1.64	1.34	1.59
June	1.55	1.57	1.71	1.81	1.80	1.85	1.57	1.62
July	1.85	1.93	1.90	1.67	1.62	1.73	1.68	1.12
August	1.71	1.55	1.73	1.50	1.80	1.54	1.90	1.76
September	1.61	1.74	1.65	1.63	1.59	1.73	1.73	1.79
October	1.63	1.78	1.72	1.75	1.78	1.70	1.79	1.66
November	1.67		1.75		1.82		1.83	
December	1.74		1.76		1.77		1.39	
Summer Avg	1.71	1.67	1.77	1.63	1.75	1.68	1.75	1.58
Winter Avg	1.77		1.76		1.81		1.67	
Rest of Year Avg	1.66	1.70	1.73	1.68	1.65	1.69	1.68	1.71
Year Avg	1.71	1.69	1.75	1.65	1.72	1.68	1.70	1.64

Ratio of 97th Percentiles of Day-Ahead - Real-Time Prices for the same hour on 3 successive trading days / hour on a single trading day

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	2.15		2.11		2.58		2.51	
February	2.67		2.52		2.43		1.97	
March	2.52		2.48		2.08		2.30	
April	2.00	2.72	2.21	2.30	1.98	2.22	2.17	2.33
May	1.97	2.38	2.28	2.50	2.20	2.17	1.68	2.26
June	2.02	2.18	2.28	2.59	2.68	2.44	1.97	1.97
July	2.82	2.92	2.75	2.49	2.09	2.01	2.06	1.29
August	1.86	1.99	1.93	1.66	2.17	1.85	2.46	1.82
September	2.05	2.39	2.05	2.10	2.00	2.30	2.04	2.51
October	2.15	2.06	2.30	2.51	2.35	2.21	2.20	2.31
November	2.23		2.29		2.39		2.37	
December	2.30		2.33		2.45		1.91	
Summer Avg	2.10	2.34	2.22	2.14	2.29	2.06	2.21	1.76
Winter Avg	2.36		2.31		2.50		2.21	
Rest of Year Avg	2.18	2.35	2.28	2.33	2.15	2.25	2.11	2.39
Year Avg	2.20	2.35	2.27	2.24	2.29	2.18	2.17	2.03

ABCDE refers to Zones A, B, C, D, and E
FGHI refers to Zones F, G, H, and I
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K refers to the Long Island Zone
"presmd" refers to the period from September 2000 to January 2005
"smd" refers to the period from April 2005 to October 2005

Table 8
99th Percentile of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

99th percentile Day-Ahead - Real-Time Prices

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	54.18		55.38		83.17		91.03	
February	45.01		46.63		38.86		51.47	
March	46.32		49.48		52.34		44.36	
April	33.24	45.57	37.35	35.29	46.81	53.05	50.00	41.67
May	25.64	30.39	33.57	35.52	42.04	32.79	45.26	15.74
June	38.95	49.14	53.00	69.66	69.94	60.64	60.59	92.78
July	43.80	46.67	59.25	65.65	60.56	63.01	95.16	70.56
August	118.23	60.95	111.06	110.26	102.77	87.64	144.40	202.86
September	33.41	49.03	34.08	84.11	35.23	146.43	54.46	84.35
October	26.57	54.71	28.15	67.78	31.20	86.74	40.92	81.85
November	26.61		28.06		28.05		34.81	
December	41.68		44.36		38.92		43.06	
Summer Avg	66.99	52.25	74.44	81.86	77.76	70.43	100.05	122.07
Winter Avg	46.96		48.79		53.65		61.85	
Rest of Year Avg	31.96	44.93	35.12	55.68	39.28	79.75	44.97	55.90
Year Avg	44.47	48.07	48.36	66.90	52.49	75.76	62.96	84.26

99th percentile of Day-Ahead - Real-Time Prices for the same hour on 2 successive trading days

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	85.52		88.68		154.48		152.73	
February	83.95		88.05		69.29		77.98	
March	83.88		90.19		71.50		79.18	
April	52.00	145.96	61.66	66.25	66.38	89.17	68.50	92.72
May	39.81	52.36	50.19	61.19	60.83	52.55	66.07	32.24
June	56.95	76.63	84.50	122.90	107.09	98.27	95.42	182.84
July	79.51	81.62	113.79	123.21	108.39	90.34	193.63	62.10
August	352.45	96.83	196.92	148.87	187.14	146.68	459.90	285.09
September	52.09	81.51	51.75	124.60	62.95	250.39	79.04	161.33
October	44.87	88.27	49.74	119.25	52.64	134.61	53.99	130.07
November	46.01		51.59		52.98		63.29	
December	78.45		78.45		67.32		57.36	
Summer Avg	162.97	85.03	131.74	131.66	134.21	111.76	249.65	176.68
Winter Avg	82.64		85.06		97.03		96.02	
Rest of Year Avg	53.11	92.03	59.19	92.82	61.21	131.68	68.34	104.09
Year Avg	87.96	89.03	83.79	109.47	88.42	123.14	120.59	135.20

99th percentile of Day-Ahead - Real-Time Prices for the same hour on 3 successive trading days

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	117.40		111.85		212.30		228.35	
February	114.41		116.97		92.89		104.94	
March	112.79		123.63		102.77		112.79	
April	60.89	207.36	76.71	167.34	91.91	141.50	96.14	183.01
May	47.40	74.38	70.70	85.16	78.26	65.54	78.18	39.96
June	68.36	293.12	115.22	162.23	130.44	141.14	129.33	190.99
July	148.90	228.51	156.95	156.12	109.42	121.15	183.23	89.22
August	401.58	93.73	236.02	169.20	205.19	159.84	665.33	302.82
September	58.04	110.99	59.98	172.47	71.44	304.24	70.96	223.31
October	58.37	119.71	64.21	168.67	68.48	172.16	60.39	179.49
November	58.42		68.33		78.04		82.40	
December	101.71		113.31		93.22		78.66	
Summer Avg	206.28	205.12	169.40	162.52	148.35	140.71	325.96	194.34
Winter Avg	111.17		114.04		132.80		137.32	
Rest of Year Avg	65.98	128.11	77.26	148.41	81.82	170.86	83.48	156.44
Year Avg	112.36	161.11	109.49	154.46	111.20	157.94	157.56	172.69

Table 8 (continued)
99th Percentile of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

Ratio of 99th Percentiles of Day-Ahead - Real-Time Prices for the same hour on 2 successive trading days / hour on a single trading day

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	1.58		1.60		1.86		1.68	
February	1.87		1.89		1.78		1.52	
March	1.81		1.82		1.37		1.78	
April	1.56	3.20	1.65	1.88	1.42	1.68	1.37	2.23
May	1.55	1.72	1.50	1.72	1.45	1.60	1.46	2.05
June	1.46	1.56	1.59	1.76	1.53	1.62	1.57	1.97
July	1.82	1.75	1.92	1.88	1.79	1.43	2.03	0.88
August	2.98	1.59	1.77	1.35	1.82	1.67	3.18	1.41
September	1.56	1.66	1.52	1.48	1.79	1.71	1.45	1.91
October	1.69	1.61	1.77	1.76	1.69	1.55	1.32	1.59
November	1.73		1.84		1.89		1.82	
December	1.88		1.77		1.73		1.33	
Summer Avg	2.43	1.63	1.77	1.61	1.73	1.59	2.50	1.45
Winter Avg	1.76		1.74		1.81		1.55	
Rest of Year Avg	1.66	2.05	1.69	1.67	1.56	1.65	1.52	1.86
Year Avg	1.98	1.85	1.73	1.64	1.68	1.63	1.92	1.60

Ratio of 99th Percentiles of Day-Ahead - Real-Time Prices for the same hour on 3 successive trading days / hour on a single trading day

Month	ABCDEpresmd	ABCDEsmd	FGHIpresmd	FGHIsmd	Jpresmd	Jsmd	Kpresmd	Ksmd
January	2.17		2.02		2.55		2.51	
February	2.54		2.51		2.39		2.04	
March	2.44		2.50		1.96		2.54	
April	1.83	4.55	2.05	4.74	1.96	2.67	1.92	4.39
May	1.85	2.45	2.11	2.40	1.86	2.00	1.73	2.54
June	1.76	5.96	2.17	2.33	1.87	2.33	2.13	2.06
July	3.40	4.90	2.65	2.38	1.81	1.92	1.93	1.26
August	3.40	1.54	2.13	1.53	2.00	1.82	4.61	1.49
September	1.74	2.26	1.76	2.05	2.03	2.08	1.30	2.65
October	2.20	2.19	2.28	2.49	2.19	1.98	1.48	2.19
November	2.20		2.44		2.78		2.37	
December	2.44		2.55		2.40		1.83	
Summer Avg	3.08	3.93	2.28	1.99	1.91	2.00	3.26	1.59
Winter Avg	2.37		2.34		2.48		2.22	
Rest of Year Avg	2.06	2.85	2.20	2.67	2.08	2.14	1.86	2.80
Year Avg	2.53	3.35	2.26	2.31	2.12	2.08	2.50	2.05

ABCDE refers to Zones A, B, C, D, and E
FGHI refers to Zones F, G, H, and I
J refers to the New York City Zone
K refers to the Long Island Zone
"presmd" refers to the period from September 2000 to January 2005
"smd" refers to the period from April 2005 to October 2005

I am the witness identified in the foregoing affidavit. I have read the affidavit and am familiar with its contents. The facts set forth therein are true to the best of my knowledge, information, and belief.

Scott M Harvey
SCOTT HARVEY

SUBSCRIBED AND SWORN to before me this 31st day of January, 2006.

Notary Public

My Commission expires:

PING H. WONG
Notary Public
Commonwealth of Massachusetts
My Commission Expires
AUGUST 6, 2010

COMMONWEALTH OF MASSACHUSETTS

County of Middlesex

Before me, the undersigned notary public, personally appeared Scott Harvey **, and acknowledged to me that he/she signed the forgoing document voluntarily for its stated purposes. I identified** Scott Harvey **to be the person whose name is signed on the forgoing document by means of the following satisfactory evidence of identity (check one):**

— **identification based on my personal knowledge of his/her identity, or**

✓ **current government-issued identification bearing his/her photographic image and signature, or**

Appendix A
Virtual Trading Returns Before and After the Introduction of Load Pocket Modeling

Table A-1
Zone J Mean and Median of Day-Ahead LBMP – Real-Time LBMP
On-Peak Early, Load Pocket, and Pre-SMD Periods

	Early Period		Load Pocket Period		Pre-SMD Period	
Month	Mean	Median	Mean	Median	Mean	Median
January	5.79	6.93	-4.43	2.66	-0.26	5.25
February	1.18	4.25	-0.54	3.89	0.32	4.12
March	-3.85	5.03	-3.83	0.68	-3.84	3.74
April	-3.57	6.68	-1.79	2.92	-2.67	4.96
May	4.18	7.82	-3.62	3.31	0.42	6.14
June	9.14	11.84	4.05	6.09	5.32	7.32
July	-2.77	9.56	-0.89	3.79	-1.35	4.95
August	-7.22	5.78	3.33	4.67	0.57	5.04
September	-1.75	6.24	-1.30	2.09	-1.48	3.97
October	-1.14	2.88	2.14	4.37	0.82	3.74
November	-0.21	3.73	-0.72	4.99	-0.51	4.52
December	-0.05	4.21	-1.27	3.25	-0.81	3.79
Summer Avg	-0.28	9.06	2.16	4.85	1.51	5.77
Winter Avg	2.31	5.13	-2.08	3.27	-0.25	4.39
Rest of Year Avg	-1.06	5.39	-1.52	3.06	-1.21	4.51
Year Avg	-0.02	6.24	-0.74	3.56	-0.29	4.80

Zone J refers to the New York City Zone
"Early Period" refers to the period from September 2000 to May 2002
"Load Pocket Period" refers to the period from June 2002 to January 2005
"Pre-SMD Period" refers to the period from September 2000 to January 2005

Table A-2
Zone J Standard Deviation of Day-Ahead LBMP – Real-Time LBMP
On-Peak Early, Load Pocket, and Pre-SMD Periods

Month	Early Period	Load Pocket Period	Pre-SMD Period
January	18.11	43.78	35.97
February	26.98	30.18	28.63
March	59.68	36.18	49.20
April	57.47	26.69	44.63
May	44.38	32.47	39.27
June	52.17	22.08	32.39
July	62.68	51.88	54.69
August	138.42	27.18	74.60
September	44.88	30.67	36.80
October	18.30	16.85	17.52
November	27.56	24.59	25.84
December	54.99	32.63	42.46
Summer Avg	84.42	33.71	53.90
Winter Avg	33.36	35.53	35.69
Rest of Year Avg	42.05	27.91	35.54
Year Avg	50.47	31.26	40.17

Zone J refers to the New York City Zone
"Early Period" refers to the period from September 2000 to May 2002
"Load Pocket Period" refers to the period from June 2002 to January 2005
"Pre-SMD Period" refers to the period from September 2000 to January 2005

Table A-3
Zone J 1st, 99th Percentile of Day-Ahead LBMP – Real-Time LBMP
On-Peak Early, Load Pocket, and Pre-SMD Periods

	Early Period		Load Pocket Period		Pre-SMD Period	
Month	**1st**	**99th**	**1st**	**99th**	**1st**	**99th**
January	-52.68	43.57	-198.94	89.73	-153.19	83.17
February	-96.95	29.06	-137.79	45.30	-127.48	38.86
March	-157.95	37.63	-128.81	59.88	-144.01	52.34
April	-237.08	60.22	-132.66	35.08	-184.57	46.81
May	-72.70	45.78	-183.84	28.44	-147.79	42.04
June	-331.22	90.00	-60.91	48.88	-85.34	69.94
July	-334.89	77.62	-98.92	53.13	-205.31	60.56
August	-499.52	435.49	-77.16	67.82	-260.46	102.77
September	-164.68	37.14	-74.37	34.67	-150.10	35.23
October	-80.61	25.96	-58.07	33.43	-68.18	31.20
November	-75.10	25.06	-98.29	29.01	-95.53	28.05
December	-189.75	47.41	-77.72	32.42	-101.82	38.92
Summer Avg	-388.54	201.04	-79.00	56.61	-183.70	77.76
Winter Avg	-113.13	40.01	-138.15	55.82	-127.50	53.65
Rest of Year Avg	-131.35	38.63	-112.67	36.75	-131.70	39.28
Year Avg	-191.09	79.58	-110.62	46.48	-143.65	52.49

Zone J refers to the New York City Zone
"Early Period" refers to the period from September 2000 to May 2002
"Load Pocket Period" refers to the period from June 2002 to January 2005
"Pre-SMD Period" refers to the period from September 2000 to January 2005

Table A-4
Zone J 3rd, 97th Percentile of Day-Ahead LBMP – Real-Time LBMP
On-Peak Early, Load Pocket, and Pre-SMD Periods

	Early Period		Load Pocket Period		Pre-SMD Period	
Month	**3rd**	**97th**	**3rd**	**97th**	**3rd**	**97th**
January	-33.06	34.99	-97.33	65.87	-84.37	49.18
February	-29.54	22.95	-79.97	35.42	-62.47	29.85
March	-78.08	24.12	-92.23	45.94	-81.03	34.83
April	-117.77	40.07	-47.96	23.70	-92.72	34.35
May	-47.57	37.03	-67.51	23.66	-54.89	30.88
June	-39.18	68.94	-34.78	36.59	-35.17	43.29
July	-186.61	48.65	-48.45	35.36	-60.05	39.03
August	-310.55	108.39	-50.24	47.93	-91.41	67.82
September	-80.94	29.48	-31.07	27.19	-42.00	28.28
October	-35.85	16.19	-32.33	27.47	-34.29	25.90
November	-39.36	20.62	-61.56	23.25	-53.43	22.32
December	-50.03	32.81	-56.86	26.31	-56.41	28.78
Summer Avg	-178.78	75.33	-44.49	39.96	-62.21	50.05
Winter Avg	-37.54	30.25	-78.05	42.53	-67.75	35.94
Rest of Year Avg	-66.60	27.92	-55.44	28.53	-59.73	29.43
Year Avg	-87.38	40.35	-58.36	34.89	-62.35	36.21

Zone J refers to the New York City Zone
"Early Period" refers to the period from September 2000 to May 2002
"Load Pocket Period" refers to the period from June 2002 to January 2005
"Pre-SMD Period" refers to the period from September 2000 to January 2005

Table A-5
Zone J 5th, 95th Percentile of Day-Ahead LBMP – Real-Time LBMP
On-Peak Early, Load Pocket, and Pre-SMD Periods

	Early Period		Load Pocket Period		Pre-SMD Period	
Month	**5th**	**95th**	**5th**	**95th**	**5th**	**95th**
January	-21.36	28.96	-81.43	47.98	-56.83	36.62
February	-22.76	19.48	-55.39	30.10	-30.50	25.02
March	-35.69	18.21	-54.82	32.93	-45.83	25.50
April	-77.73	33.37	-34.66	19.35	-54.34	27.32
May	-34.35	30.79	-50.80	20.97	-41.45	27.03
June	-22.09	48.07	-30.91	33.05	-30.22	36.84
July	-78.15	35.44	-34.24	31.19	-38.06	31.85
August	-209.00	94.21	-34.68	41.19	-56.11	48.32
September	-42.00	22.47	-24.27	21.74	-27.14	22.11
October	-29.70	14.08	-25.61	25.09	-28.22	22.40
November	-25.35	17.12	-44.87	20.62	-37.44	19.21
December	-31.75	28.98	-38.01	23.87	-34.51	25.21
Summer Avg	-103.08	59.24	-33.28	35.14	-41.46	39.00
Winter Avg	-25.29	25.81	-58.28	33.98	-40.61	28.95
Rest of Year Avg	-40.80	22.67	-39.17	23.45	-39.07	23.93
Year Avg	-52.49	32.60	-42.47	29.01	-40.05	28.95

Zone J refers to the New York City Zone
"Early Period" refers to the period from September 2000 to May 2002
"Load Pocket Period" refers to the period from June 2002 to January 2005
"Pre-SMD Period" refers to the period from September 2000 to January 2005

Table A-6
Zone J Standard Deviation of Different Peak Hours of Day-Ahead - Real-Time Prices
On-Peak Early, Load Pocket, and Pre-SMD Periods

	Early Period				Load Pocket Period				Pre-SMD Period			
Month	**HB 7-10**	**HB 11-14**	**HB 15-18**	**HB 19-22**	**HB 7-10**	**HB 11-14**	**HB 15-18**	**HB 19-22**	**HB 7-10**	**HB 11-14**	**HB 15-18**	**HB 19-22**
January	21.90	10.57	23.68	9.89	43.28	52.55	40.15	37.48	36.22	41.52	34.92	29.83
February	13.77	21.35	45.60	13.44	41.62	28.43	25.56	19.96	31.28	25.13	36.97	17.13
March	110.29	25.59	33.22	10.60	46.60	32.07	40.99	19.16	84.38	29.01	37.33	15.93
April	44.42	56.65	36.98	81.58	38.09	29.60	17.41	14.38	41.28	45.07	28.76	58.20
May	81.55	23.48	18.94	15.32	23.29	41.82	41.31	13.27	60.79	34.38	32.22	14.79
June	16.72	27.95	96.91	13.58	17.68	24.79	25.85	18.51	17.44	26.36	53.33	18.27
July	25.08	85.69	80.41	36.90	17.10	51.75	86.60	16.64	19.34	61.72	85.01	23.28
August	75.01	144.46	172.17	143.96	17.34	31.70	30.33	25.77	41.76	78.55	91.46	76.92
September	70.05	40.46	31.97	21.41	12.64	35.73	46.50	12.68	44.79	37.58	41.46	16.84
October	18.00	22.56	18.45	12.51	15.30	16.46	21.07	13.00	16.43	19.43	20.25	12.79
November	15.24	11.80	50.54	7.14	22.57	21.69	35.33	12.69	19.86	18.26	42.21	10.90
December	52.14	20.66	90.66	26.13	19.17	15.28	53.89	26.72	35.37	17.49	69.99	26.90
Summer Avg	38.93	86.03	116.50	64.81	17.37	36.08	47.59	20.30	26.18	55.54	76.60	39.49
Winter Avg	29.27	17.53	53.31	16.49	34.69	32.09	39.87	28.05	34.29	28.04	47.29	24.62
Rest of Year Avg	56.59	30.09	31.68	24.76	26.41	29.56	33.77	14.20	44.59	30.62	33.70	21.58
Year Avg	45.35	40.94	58.29	32.71	26.22	31.82	38.75	19.19	37.41	36.21	47.83	26.82

Zone J refers to the New York City Zone
"Early Period" refers to the period from September 2000 to May 2002
"Load Pocket Period" refers to the period from June 2002 to January 2005
"Pre-SMD Period" refers to the period from September 2000 to January 2005

Appendix B
Tests of Normality

The skewness and kurtosis test for normality carried out on the NYISO virtual trading returns data is based on the paper by D'Agostino, R. B., A. Balanger and R. B. D'Agostino, Jr. (1990)[12].

The test uses the sample skewness g_1 and the sample size *n* to calculate a variable Z_1 that is distributed approximately standard normal under the hypothesis that the data are normally distributed. The variable Z_1 is calculated as follows:

$$Y = g_1 \left\{ \frac{(n+1)(n+3)}{6(n-2)} \right\}^{1/2}$$

$$\beta_2 = \frac{3(n^2 + 27n - 70)(n+1)(n+3)}{(n-2)(n+5)(n+7)(n+9)}$$

$$W^2 = -1 + \left(2\left(\beta_2 - 1\right)\right)^{1/2}$$

$$\alpha = \left(2 \Big/ \left(W^2 - 1\right)\right)^{1/2}$$

$$Z_1 = \frac{1}{\sqrt{\ln W}} \ln\left(Y/\alpha + \left(\left(Y/\alpha\right)^2 + 1 \right)^{1/2} \right)$$

The sample skewness g_1 is calculated as:

$$g_1 = \frac{\sum_{i=1}^{n} \left(R_i - \bar{R}\right)^3}{n s^3},$$

where *s* is standard deviation of the virtual returns R_i:

$$s^2 = \frac{\sum_{i=1}^{n} \left(R_i - \bar{R}\right)^2}{n-1}$$

A variable with a symmetric distribution has a skewness of zero.

[12] *D'Agostino, R. B., A. Balanger and R. B. D'Agostino, Jr. 1990. "A suggestion for using powerful and informative test of normality."* The American Statistician *44(4): 316 – 321.*

The statistic Z_1 was calculated and the skewness tests performed for price differences during the on-peak for all zones in the sample from September 2000 to date excluding February and March 2005. The test was also performed separately for SMD period from April 2005 to date and the pre-SMD period until January 2005 as well as for SMD non-summer period and pre-SMD non-summer period. The values of Z_1 and the results of the test are reported in Table B-1.

The skewness test indicates the probability that the sample has been drawn from a distribution that has no skewness. The values in the column Z1 of Table B-1 indicate that it is extremely unlikely (less than 0.5%) that these data were drawn from a symmetric distribution. This is the case for both the SMD and pre-SMD periods and is the case even if the summer months are excluded.

The sample kurtosis b_2 and the sample size *n* can also be used to calculate a variable Z_2 that is approximately standard normal under the hypothesis that the data is normally distributed. The variable Z_2 is calculated as follows:

$$E(b_2) = \frac{3(n-1)}{n+1}$$

$$\text{var}(b_2) = \frac{24n(n-2)(n-3)}{(n+1)^2(n+3)(n+5)}$$

$$X = \left(b_2 - E(b_2)\right) \Big/ \sqrt{\text{var}(b_2)}$$

$$\sqrt{\beta_1} = \frac{6(n^2-5n+2)}{(n+7)(n+9)}\left(\frac{6(n+3)(n+5)}{n(n-2)(n-3)}\right)^{1/2}$$

$$A = 6 + \frac{8}{\sqrt{\beta_1}}\left(\frac{2}{\sqrt{\beta_1}} + \left(1+\frac{4}{\beta_1}\right)^{1/2}\right)$$

$$Z_2 = \frac{1}{\sqrt{2/(9A)}}\left(\left(1-\frac{2}{9A}\right) - \left(\frac{1-2/A}{1+X\sqrt{2/(A-4)}}\right)^{1/3}\right)$$

The sample kurtosis was calculated as:

$$b_2 = \frac{\sum_{i=1}^{n}\left(R_i - \bar{R}\right)^4}{ns^4}$$

The kurtosis of a normal distribution is equal to 3. The sample kurtosis, values of Z_2, and results of the kurtosis tests for peak hour price differences in the whole sample, pre-SMD period, SMD period, pre-SMD non-summer period, and SMD non-summer period are shown in Table B-1.

The kurtosis test indicates the probability that the sample has been drawn from a distribution that has the same kurtosis as a normal distribution. The values in the column Z2 of the Table B-1 indicate that the distribution of the day-ahead market to real-time price difference is very unlikely (well below 0.5%) to be as peaky as the normal distribution. This is the case for both the SMD period and the pre-SMD period and is the case even if the summer months are excluded. Figure B-2 shows that the distribution of the day-ahead market to real-time price difference is in fact more peaked and has thicker tails than the normal distribution with the same mean and variance.

A third combined test for normality uses the statistic $K^2 = Z_1^2 + Z_2^2$ which has a χ^2 - distribution with two degrees of freedom under the hypothesis that the data are normally distributed. For a variable to be found normally distributed at the 5% significance level, the value K^2 needs to be less than the critical value of a chi-squared distribution with two degrees of freedom – 5.99. Values K^2 for peak hour price differences are reported in the Table B-1. The values of K^2 indicate once again that there is a very small likelihood (less than 0.5%) that the sample was drawn from a normal distribution based on the skewness and kurtosis tests combined. As before, this is the case for both the SMD and pre-SMD periods and is the case even if the summer months are excluded.

Table B-1
Descriptive Statistics of the Differences between Day Ahead and Real-Time Prices and Normality Test

	Observations	Mean	Standard Deviation	Skewness	Kurtosis	Z1	Normal Pr(Skewness)	Z2	Normal Pr(kurtosis)	K
All period	224,400	1.26	39.26	-10.80	330.94	-517.48	<.005	325.38	<.005	373,6
Pre-SMD	198,176	1.48	33.73	-7.58	264.90	-434.04	<.005	301.35	<.005	279,2
SMD	26,224	-0.37	67.74	-10.86	195.51	-177.30	<.005	107.36	<.005	42,9
Pre-SMD non-summer	152,768	1.07	26.92	-11.76	291.57	-438.04	<.005	266.31	<.005	262,8
SMD non-summer	14,784	4.08	35.91	-2.08	26.07	-67.48	<.005	63.19	<.005	8,5

Appendix C

Table C-1 reports the mean and median of the difference between the day-ahead price and the real-time price for Zone J for the SMD and pre-SMD periods. It is noteworthy that while the median price difference in Zone J has consistently been positive (day-ahead price greater than real-time price) the mean has frequently been negative. This difference suggests that the returns are not normally distributed, consistent with the finding above. This asymmetry indicates that virtual supply offers have had a positive return on more than half of the hours during the SMD period, but that large losses during a minority of the hours caused virtual supply offers to be unprofitable overall on an expected value basis in the SMD period.[13]

Table C-1
Zone J Mean and Median of Day-Ahead – Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

	Pre-SMD Period		SMD Period		Entire Period	
Month	Mean	Median	Mean	Median	Mean	Median
January	-0.26	5.25			-0.26	5.25
February	0.32	4.12			0.32	4.12
March	-3.84	3.74			-3.84	3.74
April	-2.67	4.96	3.30	9.17	-1.51	5.65
May	0.42	6.14	5.72	6.77	1.47	6.26
June	5.32	7.32	-7.62	6.76	2.64	7.29
July	-1.35	4.95	-11.46	12.66	-3.26	6.25
August	0.57	5.04	-19.67	3.60	-3.62	4.76
September	-1.48	3.97	8.93	4.13	0.31	3.97
October	0.82	3.74	2.39	17.14	1.07	4.18
November	-0.51	4.52			-0.51	4.52
December	-0.81	3.79			-0.81	3.79
Summer Avg	1.51	5.77	-12.92	7.67	-1.42	6.10
Winter Avg	-0.25	4.39			-0.25	4.39
Rest of Year Avg	-1.21	4.51	5.08	9.30	-0.50	4.72
Year Avg	-0.29	4.80	-2.63	8.60	-0.67	4.98

Zone J refers to the New York City Zone
"Pre-SMD Period" refers to the period from September 2000 to January 2005
"SMD Period" refers to the period from April 2005 to October 2005

[13] It should be kept in mind that these calculations are based on all hours. Virtual trading based on virtual supply offers could still have been profitable if the offers were concentrated in the hours in which virtual supply would have been profitable.

Table C-2 reports similar returns data for Zone K (Long Island) for the SMD period, the pre-SMD period and the combined period. Once again, it is seen that the median price difference is consistently positive, i.e., the day-ahead price is higher than the real-time price most of the time, but the mean return is generally negative. This pattern again suggests an asymmetric distribution of virtual trading returns.

Table C-2
Zone K Mean and Median of Day-Ahead – Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

	Pre-SMD Period		SMD Period		Entire Period	
Month	Mean	Median	Mean	Median	Mean	Median
January	4.15	4.06			4.15	4.06
February	-3.43	2.51			-3.43	2.51
March	-0.86	3.47			-0.86	3.47
April	-4.30	2.89	3.70	8.00	-2.74	3.85
May	-8.34	1.28	-6.15	2.75	-7.90	1.72
June	-2.49	3.57	-14.84	8.97	-5.05	4.42
July	-7.42	1.77	-36.10	4.21	-12.83	2.13
August	-6.32	0.56	-30.79	3.56	-11.39	0.92
September	-6.32	1.95	-12.47	1.63	-7.38	1.91
October	-0.94	2.91	0.80	20.08	-0.66	3.49
November	-1.04	2.97			-1.04	2.97
December	-4.17	1.79			-4.17	1.79
Summer Avg	-5.41	1.97	-27.24	5.58	-9.76	2.49
Winter Avg	-1.15	2.79			-1.15	2.79
Rest of Year Avg	-3.63	2.58	-3.53	8.12	-3.43	2.90
Year Avg	-3.46	2.48	-13.69	7.03	-4.44	2.77

Zone K refers to the Long Island Zone
"Pre-SMD Period" refers to the period from September 2000 to January 2005
"SMD Period" refers to the period from April 2005 to October 2005

Table C-3 reports similar returns data for Zones A, B, C, D and E (all west of Central East). It is again seen that the median return (Day-Ahead Price – Real-Time Price) is consistently positive. For this region the mean price difference was also generally positive for the Pre-SMD period, but less than the median, while there is a mix of positive and negative mean price differences across the months in the SMD period.

Table C-3
Zone A-E Mean and Median of Day-Ahead – Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

	Pre-SMD Period		SMD Period		Entire Period	
Month	Mean	Median	Mean	Median	Mean	Median
January	5.06	4.82			5.06	4.82
February	3.33	4.04			3.33	4.04
March	2.72	3.91			2.72	3.91
April	1.69	3.24	5.68	5.44	2.46	3.62
May	0.58	2.51	3.69	2.98	1.20	2.61
June	5.84	6.46	0.72	5.88	4.77	6.37
July	-0.44	2.89	7.32	6.51	1.02	3.59
August	8.26	4.55	-11.42	3.57	4.18	4.40
September	0.70	2.64	2.00	7.25	0.92	2.94
October	1.33	2.15	4.97	13.45	1.90	2.96
November	0.62	2.17			0.62	2.17
December	1.28	2.68			1.28	2.68
Summer Avg	4.55	4.63	-1.13	5.32	3.33	4.78
Winter Avg	3.22	3.85			3.22	3.85
Rest of Year Avg	1.27	2.77	4.09	7.28	1.64	3.03
Year Avg	2.58	3.50	1.85	6.44	2.46	3.67

Zone A-E refers to Zones A, B, C, D, and E
"Pre-SMD Period" refers to the period from September 2000 to January 2005
"SMD Period" refers to the period from April 2005 to October 2005

Finally, Table C-4 reports these data combined over Zones F, G, H and I (all east of Central East). The median price difference is again consistently positive for these zones across the two periods. For these zones the mean price difference is also generally positive, but less so than the median.

Table C-4
Zone F-I Mean and Median of Day-Ahead – Real-Time Prices
All On-Peak Hours Pre-SMD and SMD Periods

	Pre-SMD Period		SMD Period		Entire Period	
Month	Mean	Median	Mean	Median	Mean	Median
January	3.11	5.20			3.11	5.20
February	2.16	4.62			2.16	4.62
March	2.69	4.72			2.69	4.72
April	-0.08	4.73	5.58	7.85	1.02	5.13
May	-0.29	4.68	5.54	5.56	0.86	4.84
June	5.02	7.23	-1.35	8.63	3.70	7.52
July	0.13	5.38	-5.51	8.05	-0.94	5.88
August	4.22	5.07	-7.69	7.45	1.75	5.38
September	1.15	3.86	7.06	10.95	2.17	4.29
October	1.33	2.82	4.67	18.70	1.86	3.60
November	1.13	3.78			1.13	3.78
December	1.34	3.51			1.34	3.51
Summer Avg	3.12	5.89	-4.85	8.04	1.51	6.26
Winter Avg	2.20	4.44			2.20	4.44
Rest of Year Avg	0.99	4.10	5.72	10.76	1.62	4.39
Year Avg	1.83	4.63	1.19	9.60	1.74	4.87

Zone F-I refers to Zones F, G, H, and I
"Pre-SMD Period" refers to the period from September 2000 to January 2005
"SMD Period" refers to the period from April 2005 to October 2005

Table C-5 presents a different way of looking at the return data for virtual trading which reflects some of the non-normality in the return data. Table C-5 shows the value of the observations in the 1st and 99th percentile of the returns distribution for each of the four regions in the SMD period. It can be seen that the 1st percentile return is much more negative than the 99th percentile return is positive across all four regions, and that the 1st percentile is much more negative in Zones J and K than in the western zones. For example, during August of the SMD period in Zone J, 1% of the observed virtual trading returns during on-peak hours entailed losses for a virtual supply offer (day-ahead market price minus the integrated hourly real-time price less than zero) in excess of $441.60/MWh, while 1% of the observed virtual trading returns during these same hours entailed losses for a virtual demand offer (day-ahead market price minus the integrated hourly real-time price greater than zero) in excess of only $87.64/MWh

Table C-5
All Zones 1st, 99th Percentile of Day-Ahead – Real-Time Prices
All On-Peak Hours SMD Period

	ABCDE		FGHI		J		K	
Month	**1st**	**99th**	**1st**	**99th**	**1st**	**99th**	**1st**	**99th**
January								
February								
March								
April	-66.92	45.57	-99.24	35.29	-142.20	53.05	-112.98	41.67
May	-49.85	30.39	-52.70	35.52	-52.51	32.79	-124.85	15.74
June	-189.58	49.14	-396.42	69.66	-457.76	60.64	-436.04	92.78
July	-61.59	46.67	-566.85	65.65	-604.40	63.01	-761.82	70.56
August	-412.98	60.95	-396.08	110.26	-441.60	87.64	-549.05	202.86
September	-100.38	49.03	-104.04	84.11	-95.33	146.43	-232.07	84.35
October	-195.08	54.71	-237.02	67.78	-275.50	86.74	-247.20	81.85
November								
December								
Summer Avg	-221.38	52.25	-453.12	81.86	-501.25	70.43	-582.30	122.07
Rest of Year Avg	-103.06	44.93	-123.25	55.68	-141.38	79.75	-179.28	55.90
Year Avg	-153.77	48.07	-264.62	66.90	-295.61	75.76	-352.00	84.26

Zone A-E refers to Zones A, B, C, D, and E
Zone F-I refers to Zones F, G, H, and I
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"SMD Period" refers to the period from April 2005 to October 2005

Table C-6 presents similar data for the pre-SMD period. The same asymmetry between the 1st and 99th percentile appears to be present in the Eastern Zone here as well and there is less dispersion in virtual supply returns in the western zones than in the eastern zones.

Table C-6
All Zones 1st, 99th Percentile of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD Period

	ABCDE		FGHI		J		K	
Month	**1st**	**99th**	**1st**	**99th**	**1st**	**99th**	**1st**	**99th**
January	-61.01	54.18	-89.99	55.38	-153.19	83.17	-101.62	91.03
February	-87.48	45.01	-117.87	46.63	-127.48	38.86	-119.11	51.47
March	-54.80	46.32	-67.41	49.48	-144.01	52.34	-114.50	44.36
April	-39.57	33.24	-133.82	37.35	-184.57	46.81	-155.23	50.00
May	-56.52	25.64	-99.12	33.57	-147.79	42.04	-145.25	45.26
June	-32.93	38.95	-56.82	53.00	-85.34	69.94	-115.09	60.59
July	-84.74	43.80	-165.42	59.25	-205.31	60.56	-171.74	95.16
August	-79.70	118.23	-213.35	111.06	-260.46	102.77	-245.27	144.40
September	-60.16	33.41	-66.37	34.08	-150.10	35.23	-126.18	54.46
October	-39.07	26.57	-47.35	28.15	-68.18	31.20	-80.73	40.92
November	-58.38	26.61	-66.99	28.06	-95.53	28.05	-75.76	34.81
December	-68.94	41.68	-76.19	44.36	-101.82	38.92	-83.95	43.06
Summer Avg	-65.79	66.99	-145.20	74.44	-183.70	77.76	-177.37	100.05
Winter Avg	-72.48	46.96	-94.68	48.79	-127.50	53.65	-101.56	61.85
Rest of Year Avg	-51.42	31.96	-80.18	35.12	-131.70	39.28	-116.28	44.97
Year Avg	-60.27	44.47	-100.06	48.36	-143.65	52.49	-127.87	62.96

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"Pre-SMD Period" refers to the period from September 2000 to January 2005

Similar data have been compiled for the 3rd and 97th percentile of the virtual trading returns for the SMD and pre-SMD periods. Table C-7 portrays these data for the SMD period. It is again seen that the distribution of returns is non-symmetric around zero, with much larger virtual supply losses at the 3% threshold than gains at the 97% level. For example, during the summer months of the SMD period in Zones F, G, H and I, 3% of the observed virtual trading returns during on-peak hours entailed losses for a virtual supply offer (day-ahead market price minus the integrated hourly real-time price less than zero) in excess of $118.12/MWh, while 3% of the observed virtual trading returns during these same hours entailed losses for a virtual demand offer (day-ahead market price minus the integrated hourly real-time price greater than zero) in excess of $61.08/MWh.

Table C-7
All Zones 3rd, 97th Percentile of Day-Ahead – Real-Time Prices
All On-Peak Hours SMD Period

	ABCDE		FGHI		J		K	
Month	3rd	97th	3rd	97th	3rd	97th	3rd	97th
January								
February								
March								
April	-18.99	27.86	-43.02	28.42	-72.11	39.77	-46.86	31.05
May	-33.68	24.81	-32.91	29.54	-30.39	28.29	-78.07	12.44
June	-63.76	40.03	-128.52	52.68	-208.36	48.01	-235.53	84.28
July	-18.93	34.33	-64.84	47.19	-184.02	45.55	-288.07	51.13
August	-136.48	39.70	-161.00	83.36	-157.67	74.89	-320.27	106.56
September	-72.33	43.60	-72.18	63.38	-85.54	119.99	-158.72	72.77
October	-91.94	43.00	-145.79	60.44	-177.04	74.59	-176.84	72.16
November								
December								
Summer Avg	-73.06	38.02	-118.12	61.08	-183.35	56.15	-281.29	80.66
Rest of Year Avg	-54.24	34.82	-73.48	45.45	-91.27	65.66	-115.12	47.11
Year Avg	-62.30	36.19	-92.61	52.14	-130.73	61.58	-186.34	61.48

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"SMD Period" refers to the period from April 2005 to October 2005

Table C-8 portrays similar data for the pre-SMD period. For this period, there is much less asymmetry in the returns to virtual supply and demand.

Table C-8
All Zones 3rd, 97th Percentile of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD Period

	ABCDE		FGHI		J		K	
Month	**3rd**	**97th**	**3rd**	**97th**	**3rd**	**97th**	**3rd**	**97th**
January	-35.04	39.18	-49.22	40.57	-84.37	49.18	-58.60	62.12
February	-25.53	34.12	-32.58	34.50	-62.47	29.85	-64.99	37.86
March	-27.14	31.88	-33.73	36.47	-81.03	34.83	-54.35	36.16
April	-25.94	22.85	-53.05	27.47	-92.72	34.35	-72.58	29.54
May	-31.81	21.55	-52.77	25.11	-54.89	30.88	-77.37	36.99
June	-17.62	28.19	-34.33	35.66	-35.17	43.29	-73.14	45.60
July	-30.98	27.97	-46.82	38.52	-60.05	39.03	-90.85	44.80
August	-31.66	75.05	-80.24	75.31	-91.41	67.82	-114.13	69.83
September	-27.40	22.81	-31.28	24.06	-42.00	28.28	-72.40	28.05
October	-26.49	21.64	-29.28	22.56	-34.29	25.90	-48.05	22.48
November	-31.18	21.96	-37.94	23.64	-53.43	22.32	-46.05	25.86
December	-35.97	33.71	-40.92	34.89	-56.41	28.78	-55.23	30.90
Summer Avg	-26.75	43.74	-53.80	49.83	-62.21	50.05	-92.71	53.41
Winter Avg	-32.18	35.67	-40.91	36.65	-67.75	35.94	-59.61	43.63
Rest of Year Avg	-28.33	23.78	-39.68	26.55	-59.73	29.43	-61.80	29.85
Year Avg	-28.90	31.74	-43.51	34.90	-62.35	36.21	-68.98	39.18

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Similar data have been compiled for the 5th and 95th percentiles of virtual trading returns. Table C-9 reports these data for the SMD period. It can be seen the level of asymmetry between the 95th and 5th percentiles is not very large except for Zone K and, to a lesser extent, Zone J in the summer.

Table C-9
All Zones 5th, 95th Percentile of Day-Ahead – Real-Time Prices
All On-Peak Hours SMD Period

	ABCDE		FGHI		J		K	
Month	**5th**	**95th**	**5th**	**95th**	**5th**	**95th**	**5th**	**95th**
January								
February								
March								
April	-8.66	23.73	-23.03	25.46	-54.69	34.57	-36.67	26.81
May	-16.27	21.81	-16.96	26.13	-18.87	26.88	-57.74	10.40
June	-36.94	30.29	-62.83	44.85	-95.43	44.62	-173.72	71.24
July	-11.72	30.98	-27.20	40.49	-40.90	40.83	-207.97	33.74
August	-85.00	31.76	-111.63	63.12	-139.63	64.19	-256.12	87.53
September	-57.78	40.64	-55.97	55.11	-70.81	107.15	-128.99	63.97
October	-57.64	37.36	-89.50	53.08	-141.98	66.59	-140.86	65.85
November								
December								
Summer Avg	-44.55	31.01	-67.22	49.49	-91.99	49.88	-212.60	64.17
Rest of Year Avg	-35.09	30.89	-46.37	39.95	-71.59	58.80	-91.07	41.76
Year Avg	-39.14	30.94	-55.30	44.03	-80.33	54.98	-143.15	51.36

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For the pre-SMD period, Table C-10 shows little, if any, asymmetry between virtual supply and demand returns at the 5th and 95th percentiles, suggesting that at least for the pre-SMD period, the difference in riskiness is further out in the tails of the distribution.

Table C-10
All Zones 5th, 95th Percentile of Day-Ahead - Real-Time Prices
All On-Peak Hours Pre-SMD Period

	ABCDE		FGHI		J		K	
Month	5th	95th	5th	95th	5th	95th	5th	95th
January	-24.92	34.48	-34.55	35.29	-56.83	36.62	-48.28	50.16
February	-17.30	27.45	-24.42	26.78	-30.50	25.02	-49.90	29.78
March	-19.78	25.10	-24.42	27.75	-45.83	25.50	-39.26	30.74
April	-19.48	18.72	-31.12	23.41	-54.34	27.32	-49.77	24.74
May	-24.26	19.08	-39.11	23.01	-41.45	27.03	-64.22	29.41
June	-11.96	24.30	-23.42	29.64	-30.22	36.84	-57.94	38.95
July	-22.48	20.83	-28.68	30.12	-38.06	31.85	-65.78	32.41
August	-22.14	54.95	-39.08	55.51	-56.11	48.32	-78.88	46.82
September	-20.85	18.73	-23.08	21.12	-27.14	22.11	-58.21	18.51
October	-18.88	18.66	-21.68	19.40	-28.22	22.40	-36.14	17.94
November	-21.67	18.83	-25.11	20.60	-37.44	19.21	-36.39	21.92
December	-26.79	28.00	-30.63	29.11	-34.51	25.21	-44.88	24.33
Summer Avg	-18.86	33.36	-30.39	38.42	-41.46	39.00	-67.53	39.39
Winter Avg	-23.00	29.98	-29.87	30.39	-40.61	28.95	-47.68	34.76
Rest of Year Avg	-20.82	19.85	-27.42	22.55	-39.07	23.93	-47.33	23.88
Year Avg	-20.87	25.76	-28.77	28.48	-40.05	28.95	-52.47	30.48

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200601315067 Received FERC OSEC 01/31/2006 04:48:00 PM Docket# ER05-941-004

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