Attachment I

Affidavit of Scott Harvey

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

New York Independent System Operator, Inc.	**)**	**Docket No. ER23-1307-000**

AFFIDAVIT OF SCOTT HARVEY
ON BEHALF OF NEW YORK INDEPENDENT SYSTEM OPERATOR, INC.

I. Qualifications

1. My name is Scott Harvey. I am testifying in my role as a consultant with FTI Consulting, Inc. My FTI Consulting business address is 200 State Street 9th Floor, Boston, MA 02109. I also work for the California Independent System Operator, Inc. ("CAISO") as a member of the CAISO Market Surveillance Committee.

2. I hold a B.A. in economics from the University of Illinois Champaign Urbana and a Ph.D. in economics from the University of California Berkeley. I was employed as an economist with the United States Federal Trade Commission from 1977 to 1987, and was subsequently employed as a consultant with Putnam, Hayes and Bartlett, Inc., from 1987 to 1998. From 1998 to 2011, I was employed as a consultant at LECG Corporation. Since 2011, I have offered consulting services through FTI Consulting, while also serving as a member of the CAISO Market Surveillance Committee. In order to satisfy the CAISO's independence requirements, I maintain an independent contractor relationship with CAISO and FTI Consulting.

3. I have testified on a variety of matters before the Federal Energy Regulatory Commission ("Commission" or "FERC"). These matters are listed on my *curriculum vitae*, which is attached as Attachment II to the NYISO's response. In addition, a variety of my board opinions, reports, working papers, and presentations have been included in FERC filings by CAISO, the Midcontinent Independent System Operator ("MISO"), the New York Independent System Operator, Inc. ("NYISO"), and PJM Interconnection, L.L.C. ("PJM").

A. Relevant NYISO Experience

4. I have a thorough understanding of the NYISO Day-Ahead Market, real-time dispatch and Virtual Transactions as a result of my ongoing work with the NYISO on market design and performance issues since the NYISO began operations in November 1999.

5. In January 2006 I co-authored a paper with David Babbel evaluating the daily multiple used for the NYISO Virtual Transaction credit requirements.[1] This paper was submitted

[1] Prior to the development and implementation of the NYISO automated Credit Management System, the NYISO, like some other independent system operators ("ISOs") and regional transmission

with the NYISO's filing in Docket No. ER05-941. I also helped the NYISO analyze the credit coverage of Virtual Supply and Virtual Demand positions associated with the 2009 changes in the Virtual Transactions credit requirements in Docket No. ER09-1010 that led to the implementation of distinct collateral requirements for Virtual Supply and Virtual Demand positions.[2] The 2009 collateral requirements continued to be based on a 97% threshold, but with the new design the requirements were calculated by location and time of day.[3] The NYISO also shifted from looking back to the same two months in the prior year to calculating the 97th percentile based on a seasonal look-back over multiple years.

6. I subsequently worked with the NYISO and its stakeholders to introduce a collateral requirement for import offers in the Day-Ahead Market that effectively functioned as Virtual Supply Transactions that was approved in Docket ER13-1199. I also worked with the NYISO to assess changes to the look-back period used to determine Virtual trading credit requirements over the 2011-2016 period.[4] This review of the look-back period and other refinements to the Virtual trading design was completed in early 2022, leading to the current filing.

B. Other Experience

7. My understanding of statistical and other issues involved in estimating day-ahead to real-time uncertainty is also informed by my work for the CAISO as a member of the Markets Surveillance Committee. In particular, it is informed by my work relating to the CAISO's estimation of net load uncertainty as part of the CAISO flexiramp product and the development of the CAISO imbalance reserve product. The estimation of net load forecast error between day-ahead and real-time or between the intra-day lookahead dispatch and real-time at the 97.5% percentile involves statistical issues very similar to those associated with estimating day-ahead to real-time price variability, with these net load forecast errors being one of the drivers of day-ahead to real-time price differences that create profits or losses on virtual trading positions.

II. Empirical Data

8. The data used in the NYISO's analysis of alternative Virtual trading collateral policies has three elements: (1) the time period used for the analysis; (2) the Bid-level data used

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organizations ("RTOs"), calculated Virtual trading collateral requirements based on a daily bidding limit in MW, a daily multiple and a percentile based per MW charge.

[2] *See* New York Independent System Operator, Inc., Proposed Tariff Revisions to the Credit Requirements for Virtual Transactions, Docket No. ER09-1010 (Apr. 17, 2009) ("2009 NYISO Filing").

[3] The 2009 changes were a major innovation as with the implementation of the automated Credit Management System, Virtual Transaction credit requirements were no longer based on a daily multiple but were calculated based on the Virtual Bids and offers submitted by a Virtual Trader on each day.

[4] The 2009 NYISO Filing provided for the NYISO to review the look-back period after six years of data accumulated starting April 1, 2005, so this review began in 2011.

for the analysis; and (3) the portfolio data used for the analysis. Each element is described below.

A. Time Period

9. As noted in the NYISO's November 30, 2022 (revised January 20, 2023) presentation to the Management Committee,[5] the analysis of one-year and two-year look-back periods covers the May 2007 through December 2021 period, while comparisons to five-year look-back period cover the May 2010 through December 2021 period. Two factors determine these time periods.

10. First, major changes were introduced to the NYISO Real-Time Market design in February 2005, including the introduction of reserve shortage pricing in the real-time dispatch. These changes materially impacted day-ahead to real-time price variability. There were a number of software implementation issues which required price corrections in the period from February to April so the NYISO has for many years based analyses of Virtual trading on the period since May 2005. The NYISO has used a similar start date for prior analyses of Virtual trading and the reasons for the time period have been discussed with stakeholders over the years and the rationale for the time period is understood by stakeholders.[6]

11. Second, a two-year look-back period requires two years of data to calculate the collateral requirement, hence the analysis comparing the performance of one and two year look-back periods starts in May 2007. A five-year look-back period requires five years of historical data, hence the analysis of the coverage associated with five-year look-back period begins in 2010. Comparisons of one-year and two-year look-back periods to the five-year look-back are based on this same 2010 through 2021 period so that the comparison is based on performance over the same set of market conditions and rules.

12. It is best to use as long a time period as workable given the availability of comparable data as impacted by fundamental changes in market design, to assess the performance of the Virtual Bidding collateral rules. This is because it is important to consider how the rules will perform in adjusting collateral requirements over time as market conditions, market rules, and the supply mix change.

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[5] *See* NYISO, *Virtual and External Transactions – Proposed Changes* (Jan. 20, 2023) ("NYISO Management Committee Presentation"), attached to the NYISO response as Attachment III and found at https://www.nyiso.com/documents/20142/34647738/9%20Presentation%20-%20Virtual%20and%20External%20Transactions%20-%20Proposed%20Changes_11-30-2022%20MC.pdf.

[6] Some early analysis of Virtual Transaction credit requirements started on April 1, 2005, rather than May 1, 2005. I shifted to using the May 1 start date in 2014 when the NYISO provided portfolio data starting May 1.

B. Bid-Level Data

13. The sample used to evaluate coverage of individual Virtual Bids is a Virtual Demand and Virtual Supply position each hour of each year in each zone and at each intertie location. The underlying data used for the Virtual Bid-level analysis therefore consists of all possible Virtual Bids at all biddable locations: all load zones and intertie locations. These analyses assume that a Virtual Demand or Virtual Supply Bid would be submitted in each hour over the period at each biddable location.

14. This assessment is not related to the actual Bids submitted by individual Virtual traders. Instead, the assessment is intended to assess whether the required credit support would have been adequate under the proposed or alternative rules if applied to a hypothetical position at these locations in each hour. The collateral requirement under all of the alternative rules and the actual real-time settlement for a Virtual position in each hour was calculated based on publicly-posted NYISO day-ahead and real-time zonal and intertie prices. As noted in the appendix to the Management Committee Presentation, the calculations for some intertie points is limited by the time period the interties have been in operation.[7]

C. Portfolio Data

15. The third element of the empirical assessment is the data used to assess coverage of actual Virtual trader portfolios. The NYISO provided FTI with non-public data on the cleared Virtual trades of each Virtual trader in each hour of each day at each location over the May 1, 2010, through December 31, 2021 period.[8] I have accordingly aggregated the settlements of Virtual positions by market participant over the day to determine whether each Virtual trader's portfolio was covered and to calculate the amount that was not covered. I then examined the credit coverage for each portfolio.

16. Since the implementation of the Credit Management System ("CMS") in 2009, the NYISO holds collateral on Virtual trading positions for both the current operating day ("Day 1") and the next day ("Day 2") for which Virtual Bids would have been cleared before noon on Day 1. Beginning in 2009 this collateral calculation was not based on a multiple but instead on actual offered and cleared transactions. If a Virtual trader incurs losses in excess of its collateral on Day 1, its Virtual trades for Day 2 will already have cleared in the Day-Ahead Market for that day by the time it is known that the Virtual trader lost money on Day 1. However, the NYISO will hold additional collateral on those cleared Day 2 Virtual positions and the NYISO CMS will prevent such a Virtual trader from submitting Bids for the following day ("Day 3") until it has posted sufficient collateral to cover both any uncovered losses on Day 1 and its Bids for Day 3.

17. The effect of this design is that the NYISO always has two days of Virtual trading collateral to cover the two days of potential losses that could occur before the trader

[7] *See* NYISO Management Committee Presentation, *supra* note 5.

[8] The NYISO analysis of collateral coverage supporting the 2005 and 2009 changes did not include analysis of portfolio data. I began analyzing Virtual Bidding portfolios in 2014.

would have to cover its losses or be shut off from submitting additional Virtual Bids. The NYISO assessed portfolio coverage on a one-day basis because collateral calls for losses, and the market participant decision to meet them or default, is made on a daily basis. I have analyzed portfolio coverage on a two day basis because as described above, the NYISO always holds two days of collateral on Virtual trader positions, and the NYISO CMS will prevent the submission of Bids for a third day unless adequate collateral is posted to cover uncovered losses on Day 1 in addition to collateral on the Day 3 Bids. I therefore also tested coverage of Virtual trading positions on a rolling two-day basis. This rolling calculation includes every portfolio day in the sample period twice, once as Day 1 and once as Day 2. Results are thus divided in half to assess coverage.

18. Because the data includes the individual Virtual trades composing each Virtual trader portfolio for each day, I was able to calculate daily sub-portfolios of Virtual Demand-only and Virtual Supply-only positions and calculate coverage for those historical sub-portfolios as well as overall portfolio coverage. I was also able to identify the daily portfolios that consisted only of Virtual Supply or only Virtual Demand Bids and assess coverage of those portfolios.

19. Finally, because I have calculated daily individual portfolio losses, I also was able to identify and review the individual portfolios that would have had large losses and large uncovered losses over the ten-year period and assesses coverage of these specific portfolios under alternative rules.

III. Analysis of Virtual Trading Positions and Portfolios

20. In this section I review the NYISO's analysis of core elements of the proposed design and assess the overall reasonableness of the proposed Virtual trading credit requirements.

A. Statistical Issues and the Look-back Period

21. A core element of the NYISO collateral design is that it calculates the collateral requirement using actual outcomes over a historical period. As discussed below in Part D, the NYISO design is similar to the PJM and Southwest Power Pool, Inc. ("SPP") credit requirements. The duration of this look-back period is a key element of the NYISO design. At present, the NYISO CMS calculates Virtual trading collateral based on all market outcomes going back to April 1, 2005.

22. Virtual Supply traders sell power at the Day-Ahead Market price and buy power at the real-time price to cover their Virtual sale. They are therefore exposed to losses whenever the real-time price exceeds the Day-Ahead Market price. Virtual Demand traders buy power at the Day-Ahead Market price and sell power at the real-time price. They therefore experience losses whenever the real-time price is lower than the Day-Ahead Market price.

23. The difference between the Day-Ahead Market price and real-time price depends on a variety of factors that change between day-ahead and real-time. The potential magnitude of these changes and their impact on real-time prices varies with weather, system

conditions, and in some regions with large amounts of either utility or rooftop solar, with the sunrise and sunset times. The NYISO's current Virtual Bidding collateral design attempts to roughly control for variability from hour to hour by tracking day-ahead to real-time price variability by season, time of day, weekend/weekday, and load zone or intertie location. These controls enable the NYISO design to assign larger collateral requirements to Virtual positions that are more likely to incur large losses and to assign lower collateral requirements to Virtual positions that are less likely to incur large losses.

24. Not every ISO or RTO calculates Virtual Bidding collateral requirements that differ by time of day, but such a design is necessary and appropriate for NYISO market conditions. In the 2007-2008 period when the NYISO began evaluating changes to the Virtual Bidding collateral design it was readily apparent that day-ahead to real-time variability changed substantially over the day.

25. To provide a concrete illustration of the differences in day-ahead to real-time price variability under NYISO market conditions consider HB07-09 and HB14-17 in the summer months. Table D-2 on slide 30 of the NYISO Management Committee Presentation shows that the average coverage of Virtual Supply positions with a one-year look-back period would have been 74.48% over HB07-09 compared to 68.6% over HB 14-17.[9] What this table does not show is that the total coverage would have averaged $345,678 an hour for HB07-09 over the May 2007 through December 2021 period but averaged $1.99 million over HB14-17. Accordingly, there was lower average coverage of payments due over HB14-17 despite collateral that was almost six times higher on average. A design that calculated a single collateral requirement that would be applied to all hours under the NYISO market conditions would result either in very high uncovered payments due on Virtual Supply positions in some hours, or greatly excess collateral requirements in other hours.

26. Whatever the design that is appropriate to market conditions in other ISOs and RTOs, the differences in collateral by time of day, by season and between Virtual Demand and Virtual Supply are appropriate to NYISO market conditions. These controls are easy to apply in a look-back design that looks back over similar historical days based on season, weekend/weekday, and hour of the day to calculate day-ahead to real-time price variability. As discussed below, however, these look-back designs are limited in that they apply the same collateral requirement to a given hour on all summer weekdays, but all summer weekdays are not the same in terms of risk factors. Very hot, high load weekdays likely have more potential for large losses on Virtual Supply positions than mild rainy summer days. This lack of control for type of day creates a need to choose between a collateral requirement that will be too high on mild summer days and one that will be too low on hot summer days, with similar issues occurring during the winter.

27. Difficult statistical and modeling issues underlie the choice of the look-back period used to determine collateral requirements. On the one hand, more recent data better reflects current market conditions, current market rules and the current resource mix. On the other hand, however, a short look-back period will reduce the sample size, and a large

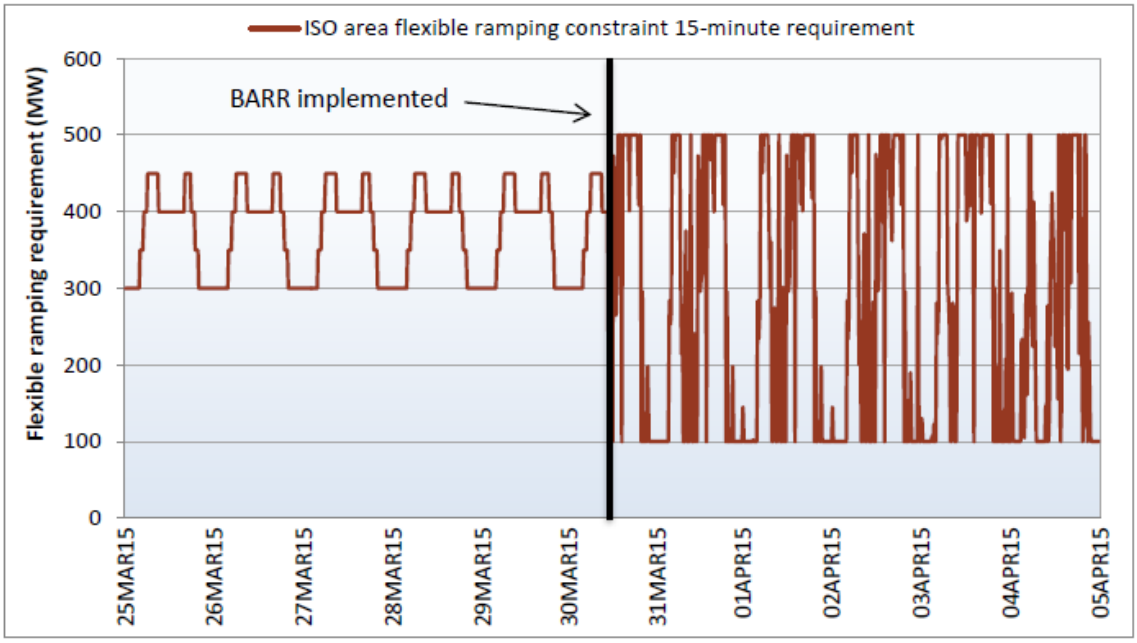
[9] NYISO Management Committee Presentation, *supra* note 5, at 30.

sample size is needed to reliability estimate the tail of a statistical distribution. For example, a summer composed of four months (comprising around seventeen weeks) would have around eighty-five weekdays and thirty-four weekend days per year. This is an extremely small number of data points to estimate the shape of the distribution for the most extreme 2-5% of outcomes. The nominal sample size can be increased by estimating the distribution for groups of hours expected to have a similar level of day-ahead to real-time price variability, which the NYISO does for that very same reason. However, the outcomes for the grouped hours are not completely independent over a given day, so the true increase in the sample size of independent outcomes is less than the nominal increase in data points.

28. The effect of a small sample size in estimating the shape of the tail of a distribution of real-time outcomes is that the estimate of the shape of the extreme tail of the distribution will not be highly accurate. That is, the estimate of the collateral required to cover losses at a specified probability level will have a large variance around the true value. This has the practical consequence that the credit requirement may be significantly higher or lower than the true values observed.

29. The adverse impact of a small sample size on the accuracy of estimates based on a 97% threshold are well illustrated by the CAISO's challenges in estimating the 97.5% threshold for net load uncertainty. Figure A-1 below, a graphic the CAISO Department of Market Monitoring prepared several years ago, illustrates the impact of small sample size on the accuracy of estimates. Figure A-1 shows the estimated capacity required to cover real-time net load uncertainty. On the left-hand side, the estimate is based on rough operator judgment that did not vary from day to day but instead over the day based on typical conditions. The right-hand side shows the estimate based on a look-back tool intended to produce more accurate interval-by-interval estimates of net load uncertainty than operator judgment by calculating the 97^{th} percentile of net load forecast error between a look-ahead period and real-time using a lookback period. The look-back period was relatively short and looked back to exactly the same time period on prior days, which means that the look-back sample consisted of a relatively small number of data points. Because of the small sample size used for the look-back period, however, the effect of individual data points entering or leaving the look-back window was to cause large day today variations in the estimated variability of net load. The variations were so large that the CAISO put a cap and floor on the requirement values to keep them within rational bounds. Nevertheless, the graphic clearly shows that the cap and floor simply resulted in many of the estimates being set by the cap and floor rather than by the data. These outcomes are a good illustration of the kind of outcomes the NYISO would have if it set Virtual Transaction credit requirements based on a short-lookback period that includes a small number of prior comparable hours.

Figure A-1: CAISO Flexiramp Requirements 2015[10]



30. The cap and floor values in the graphic are not the only spurious results of an inadequate sample size. Potentially all of the estimates are spurious, and the values at the cap and floor and the wild variations make the impact of inadequate sample size on the accuracy of the estimates particularly visible. The potential for erroneous estimates of day-ahead to real-time price variability as a consequence of small sample size is an important concern in developing methods for setting collateral requirements based on historical outcomes.

31. When the original Virtual Bidding collateral requirements were developed in 2008, there was a very limited dataset covering the period since the implementation of changes in the real-time shortage pricing design in 2005. As noted above, one way for the NYISO to compensate for the limited historical data then-available was to group data points for months into seasons, group hourly data points into groups of hours, and group data for some of the zones that were expected to have similar day-ahead to real-time price variability.

32. This grouping approach is not a perfect solution to increasing the sample size from a statistical standpoint because (1) the variability of real-time prices may not be the same across the grouped hours and (2) the outcomes may not be independent across the grouped hours and zones.

[10] *See* CAISO Department of Market Monitoring, *Q2 2015 Report on Market Issues and Performance* at 44, figure 2.4 (Aug. 17, 2015), http://www.caiso.com/documents/2015_second quarterreport-marketissues_performance-august2015.pdf.

33. However, even if the distribution of real-time price variability is not exactly the same across the grouped zones, hours and months, if the distribution is reasonably similar across the groupings, estimates based on a large number of grouped data points can provide a much more accurate estimate of variability than estimates based on a small number of data points for exactly the same hour, month and zone. And while observed real-time price variability between adjacent hours is not completely independent, it provides additional variability data. Hence, decisions made on the look-back period must take account of their impact on sample size.

34. It is important to understand that the historical portfolio level analysis the NYISO has carried out of Virtual Bid collateral coverage necessarily implicitly assumes that the portfolios, and hence the level of risky Virtual Bidding, would not change as collateral requirements do. One risk associated with sporadically understated or overstated collateral requirements resulting from a small sample size, however, is that thinly-capitalized, collateral-constrained Virtual traders may respond to anomalously low collateral requirements by taking larger Virtual positions than they otherwise would, increasing the magnitude of potential uncovered losses relative to those otherwise observed applying collateral requirements to the historical data.

35. The NYISO also analyzed the month-to-month variations in collateral requirements based on a one-year, two-year and five-year look-back periods. This analysis confirmed that the one-year look-back period occasionally resulted in month-to-month swings in collateral coverage from anomalously low to anomalously high or from reasonable to anomalously low or high. This was particularly the case in the winter and summer periods when collateral requirements based on a short look-back period would fall to low levels after a mild winter or summer and subsequently rise dramatically following a summer month with extreme heat events or a winter month with extreme cold events. This analysis contributed to the NYISO's assessment that a pure one-year look back period was too short and too prone to setting collateral requirements that did not reflect intended coverage levels to be relied upon by the NYISO.

36. A five-year look-back period, on the other hand, would have around 420 weekday data points and 170 weekend data points over a four-month summer season, with additional data points provided by grouping hours. This increased sample size provides more accurate estimates of the shape of the tail of the distribution of Virtual Bidding outcomes. As noted above, the downside of a five-year look-back period is that there can be more frequent and larger changes in market conditions, market rules, and resource mix over such a period, with the result that the analysis may not accurately estimate the current distribution of Virtual Bidding outcomes. A five-year look-back period adapts to changes in market design, market conditions and resource mix over time, but adapts more slowly than a one-year or two-year look-back period.

37. As the NYISO looks forward to the 2023-2030 period, material changes in resource mix, supply and demand balance, and market conditions from year-to-year appear likely as the New York resource mix evolves. These expectations support a look-back period that places greater weight on current outcomes than was appropriate in the past.

38. The NYISO design will address these conflicting considerations by using a weighted look-back period design that puts two-thirds weight on the requirement estimated using a five-year look-back period and places one-third weight on the requirement estimated using a one-year look-back period. This design puts much more weight on recent outcomes than a pure five-year look-back period, but also places weight on past outcomes going back five-years. The NYISO carried out extensive comparisons of the performance of the various look-back period and reviewed them with stakeholders. I concluded that the proposed "Alternative 3" (2/3 five-year, 1/3 one-year) weighting should provide a good design for accommodating changes in day-ahead to real-time price variability associated with impending changes in the NYISO resource mix while greatly reducing the potential for anomalously low collateral requirements associated with a pure one-year or two-year look-back period.

B. Virtual Demand and Supply

39. An important element of the improved NYISO Virtual Bidding collateral design is to apply a collateral requirement based on a 98th percentile threshold to Virtual Supply. One of the important improvements in the NYISO collateral design implemented in 2009 was to calculate distinct collateral requirements for Virtual Demand and Virtual Supply.

40. The underlying reason that a 97% threshold applied to Virtual Demand Bids results in very different coverage of payments due than a 97% threshold applied to Virtual Supply Bids is that the amount of uncovered payments due depends not just on the proportion of cleared Virtual Bids whose payments due are covered by the collateral requirement, but also on the size of the losses on the uncovered Virtual positions. Again, Virtual Supply Bids incur losses when real-time prices exceed Day-Ahead Market prices, while Virtual Demand positions incur losses when real-time prices are lower than Day-Ahead Market prices. This distribution is not symmetric between Virtual Demand and Virtual Supply positions because real-time prices can rise to very high levels when there are reserve shortages but rarely fall below zero. Hence, there is a much larger potential for extreme losses on Virtual Supply positions than on Virtual Demand positions.

41. While part of the difference in potential losses between Virtual Demand and Virtual Supply positions is reflected in the 97th percentile and accounted for in the current collateral design (which typically has a much larger coverage requirement for Virtual Supply than Virtual Demand at the same location and time of day), this difference in collateral requirement is not enough to account for the differences in the distribution of losses in the tail of the distribution of Virtual Demand and Virtual Supply settlement outcomes. The 97th percentile threshold does not account for the practical outcome that the losses on Virtual Supply positions not covered by the 97th percentile threshold can be much larger than the losses on the Virtual Demand positions not covered by the 97th percentile threshold.

42. The need to apply a higher percentile threshold to Virtual Supply Bids in order to achieve more adequate cover of losses on Virtual Supply positions is shown in appendix slides

35-43 of the NYISO Management Committee presentation.[11] Tables 1 and 4 show that a collateral requirement based on the 97th percentile threshold consistently results in much lower coverage of payments due at the Virtual Bid level on Virtual Supply positions than on Virtual Demand positions.[12] For example, the current design overall covers 91.2% of the payments due on Virtual Demand positions but only 75% coverage of Virtual Supply positions. This constitutes a significant difference in average coverage.

43. Additional analysis that was not presented to the Management Committee found that if market participant portfolios were decomposed into Virtual Supply and Virtual Demand portfolios, the overall one day average coverage of Virtual Demand portfolios was 96.89%, while that of Virtual Supply sub portfolios was 91.37%. The poor coverage of Virtual Supply positions is particularly important since over the 2010-2021 period 26.22% of all daily Virtual trading portfolios consisted only of Virtual Supply Bids. These coverage differences are not due to short term anomalies, as they have now persisted for many years and need to be addressed with changes to the collateral design.[13]

44. The proposed calculation of Virtual Supply collateral requirements based on a 98th percentile threshold will not eliminate the difference in coverage of either individual Virtual Supply and Virtual Demand positions or of Virtual Supply and Virtual Demand portfolios. I also analyzed the coverage provided by Virtual Supply collateral requirement based on a 99th percentile threshold. I did not recommend such a design to NYISO Market Participants because the increase in collateral evaluated over all hours and zones over the period May 2007 through December 2021 was more than 100 times the reduction in uncovered payments due. I judged the increase in collateral requirements to be too large relative to the increase in coverage and thus did not consider this option further.[14]

45. One alternative would be to apply a collateral requirement based on a 99th percentile standard to Virtual Supply positions in some hours. One consideration in avoiding such an approach was that would require a more complex design for Market Participants and the NYISO to administer. A 99th percentile threshold could be considered for selective application to individual hours with particularly poor coverage in the future if this is observed to be a concern as the NYISO transmission system and resource mix evolves over time.

46. However, a second consideration is that the extreme outcomes are associated with a small number of outcomes in those hours and seasons and are likely associated with conditions

[11] *See* NYISO Management Committee Presentation, *supra* note 5, at 35-43.

[12] *Id.* at 35, 40

[13] The NYISO identified a continuing difference in coverage in a review of elements of the Virtual Bidding design in the 2014-2016, but the implementation of changes was delayed by the project prioritization process.

[14] The evaluation of a 99th percentile threshold was based on one-year and two-year look-back periods. Having determined that a 99th percentile threshold would require excessive collateral, I did not further analyze this option under all of the various look-back alternatives.

specific to those days. Adequately addressing these coverage needs without undue increases in collateral requirements over all days may be better achieved with a much more complex model of day-ahead to real-time net load uncertainty and price variations that the NYISO may develop over time to manage net load uncertainty in real-time operations.

C. Intertie Offers

47. The NYISO market design does not provide for Virtual Bids or offers at the interties. All day-ahead transactions at the interties are intended to be physical transactions that would flow in real-time if market conditions were appropriate. On the other hand, the NYISO market design envisions that imports and exports scheduled in the Day-Ahead Market would not flow if market conditions change between day-ahead and real-time such that the imports or exports would be uneconomic at real-time prices. Intertie traders can submit offers in real-time either through Coordinated Transaction Scheduling ("CTS") or offer price-based scheduling. These offers would be economically evaluated by the NYISO scheduling software and intertie transactions scheduled to flow or not based on that evaluation. The market participant can also zero out the day-ahead transaction quantity in the NYISO market systems so that the import or export transaction will not be economically evaluated and will not flow. The same effect could generally be achieved by submitting very high offer prices for imports or very low Bid prices for exports.

48. Following automation of the CMS in 2009, the NYISO proposed to pull intertie transactions out of the general energy and ancillary services component of the operating credit requirement and calculate the collateral requirement on a transaction specific basis. Hence, external buyers would be required to post collateral to cover their price capped export Bids in the Day-Ahead Market. Most Market Participants that schedule imports in the Day-Ahead Market deliver those imports in real-time and therefore are paid for the imports and have no payments due to the NYISO. There is no deviation settlement, unless prices have changed to make the imports scheduled day-ahead uneconomic.[15] Similarly, with the 2013 changes most exports scheduled in the Day-Ahead Market have a collateral requirement to pay for the exported power that exceeds the Virtual Demand collateral requirement.

49. While the NYISO design does not explicitly provide for Virtual Bidding on the ties the NYISO observed in the 2007-2009 period that some intertie traders were clearing import transactions in the Day-Ahead Market that rarely if ever flowed in real-time. These offers had the effect of being Virtual Supply offers that were not subject to any collateral requirement. The Virtual trading rules covering imports and exports were developed by the NYISO to prevent Virtual traders from circumventing the Virtual trading collateral requirements by submitting import offers in the Day-Ahead Market for transactions that would not flow in real-time. The rules also cover a gap in collateral coverage for very

[15] When this happens the NYISO will typically owe money to the import supplier, rather than the import supplier owing payments to the NYISO.

low-priced export transactions that could incur losses in excess of the collateral required to cover the purchase price.

50. The collateral rules filed in Docket No. ER13-1199 and approved by the Commission[16] are intended to ensure that a collateral requirement is applied to Market Participants that use intertie transactions in the Day-Ahead Market to carry out Virtual trading. The intertie Virtual Supply collateral rules only apply to a small set of Market Participants that fail a threshold that distinguishes physical import suppliers from Market Participants that are in practice intertie Virtual traders. The intertie Virtual Demand collateral requirements only apply to a small number of low-priced exports scheduled in the Day-Ahead Market.

51. Although the NYISO Services Tariff does not provide for Virtual Bidding at the interties, the collateral rules applied in Docket No. ER13-1199 apply the Virtual Supply collateral requirements to the import offers of intertie traders that fail the test that distinguishes physical import suppliers from Virtual traders. Those rules also apply a collateral requirement based on the Virtual Demand collateral requirement to very low-priced exports. The current proposed changes in Virtual Bidding collateral would apply to intertie transactions covered by the Docket No. ER13-1199 rules. Hence, although intertie Bidding at the ties is not an element of the NYISO market design, the NYISO carried out an analysis of what the coverage of payments due would have been under alternative Virtual Demand and Virtual Supply collateral policies of a Virtual Supply or Virtual Demand Bid submitted at each intertie in each hour of May 2007 through December 2021 period.

52. The NYISO's focus on evaluating the coverage provided by its intertie collateral rules over the interties and hours of the day (reported in Tables M1 and M2 in the Appendix to the NYISO Management Committee Presentation[17]) was to confirm that there are no loopholes that might enable under collateralized Virtual Supply offers at the interties. It is my understanding that the NYISO did not analyze historical portfolios of Virtual Bids at the interties because there are very few covered transactions and only a small number of Market Participants that are in practice subject to these rules at any point in time.

D. Reasonableness of the Overall Coverage Standard and Design

53. A few distinctions should be kept in mind when assessing the adequacy and reasonableness of the collateral coverage provided by the proposed NYISO design. First, while a collateral requirement set based on a 97th percentile coverage level at the level of individual Virtual Bids will generally average out to provide coverage of 97% of *total Virtual Transactions*, this coverage threshold will not cover 97% of the *payments due* on those Virtual Transactions. There are several reasons for this. One consideration is that around half of Virtual Transactions will normally be profitable, so there are only losses to

[16] *See N.Y. Indep. Sys. Operator, Inc.*, 143 FERC ¶ 61,229 (2013).

[17] NYISO Management Committee Presentation, *supra* note 5, at 52.

cover on half of the Virtual Transactions. Accordingly, one might expect a 97% threshold calculated over profitable and unprofitable positions to cover about 94% of losses. Second, the 3% of Bids with the largest losses will necessarily have larger average losses than the average for the universe of all positions with losses. Third, if the shape of the distribution of losses has a long, thin tail, some of the uncovered Virtual transactions may have much larger losses than the average for Virtual transactions with losses that are covered.

54. Due to the second and third factors, the larger the dispersion of outcomes in a particular hour of the day and location, the further below 94% the average coverage will fall. For these reasons, there also can be a large difference between covering 99% of all portfolios and 99% of all losses.

55. Over all hours, zones, and years 2010 through 2021, Alternative 3 with a 98% threshold for Virtual Supply raises average coverage from just under 75% to just under 80% and reduces overall uncovered payments due by 19% over the eleven-year period. The 98th percentile improves coverage more in the winter and summer than in the shoulder months and brings the coverage level within about 1% rather than covering being lower in the summer and winter months than in the shoulder months by 3% or more under the current design. There would be a significant increase in collateral on Virtual Supply positions, but it is intrinsic to the design that the increase will be greater on Virtual Supply in hours of the day and times of the year when the dispersion in outcomes is greatest and the potential for uncovered losses greatest.

56. The assessment of the adequacy of a collateral design should consider the coverage at the Virtual Bid level, the coverage of portfolios and the overall coverage of payments due at the portfolio level. The materials presented to the Management Committee showed that the proposed design would have covered 99.49% of all Virtual portfolios on a one-day basis and would have covered 96.77% of all payments due on a one-day portfolio basis.[18] The coverage of Virtual Supply sub portfolio payments due would have been slightly over 94%, compared to 91.37% under the current design. The proposed design therefore results in a nearly 33% reduction in the uncovered payments due on Virtual Supply portfolios relative to the current design.

57. On a two-day basis, the proposed collateral design would cover 99.6% of all portfolios and almost 98% of the payments due on a portfolio basis and reduce uncovered payments due on a two-day basis by roughly 30% relative to the current design. On a two-day basis the proposed collateral design raises coverage of Virtual Supply portfolio payments due from 94.16% under the current design to 96.24% and would have reduced uncovered payments due from $35.96 million to $23.16 million over the May 2010 through December 2021 period, a more than 35% reduction.

[18] *See* NYISO Management Committee Presentation, *supra* note 5, at 50 tbl. 4N.

58. The proposed changes would increase collateral requirements overall on Virtual Supply positions and historical Virtual Supply sub-portfolios while reducing them on Virtual Demand positions and historical Virtual Demand sub-portfolios. In addition to increasing the coverage of historical Virtual Supply sub-portfolios, the proposed design increases coverage of Virtual Supply positions in hours of the day and times of the year in which the coverage provided by the current design was very low. The NYISO did not present coverage data down to the individual hour of the day and time of year to the Management Committee, but this data was reviewed and it is concerning that there are a number of individual hours of the day in the winter and summer under the current design for which average coverage of payments due on Virtual Supply positions was less than 70%, and even less than 60% over the more than ten-year period studied. This is an average over the eleven zones; there would have been even lower coverage at times in certain zones.

59. At an individual portfolio level under the current rule, there would have been $13.13 million of uncovered payments due on portfolios with uncovered payments due in excess of $1 million on a one-day basis over the 2010 through 2021 period. Under the proposed rule, the uncovered payments due on portfolios with payments due in excess of $1 million, would drop to $10.22 million. The similar figure for uncovered payments due on portfolios with uncovered payments due in excess of $0.50 million on a one-day basis would drop from $20.89 million under the current design to $14.00 million under the Alternative 3 design.[19]

60. This concludes my affidavit.

[19] The NYISO did not redo this portfolio level analysis following final adjustments to the hourly groupings that will likely provide some additional improvement in coverage.

UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION

New York Independent System Operator, Inc.	**)**	**Docket No. ER23-1307-000**

VERIFICATION

I, **Scott Harvey**, state, under penalty of perjury, that I am the Scott Harvey referred to in the foregoing document entitled "Affidavit of Scott Harvey on behalf of New York Independent System Operator, Inc.," that I have read the same and am familiar with the contents thereof, and that the facts set forth therein are true and correct to the best of my knowledge, information, and belief.

Executed on June 5, 2023.

/s/ Scott Harvey
Scott Harvey