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The Honorable Kimberly D. Bose
Secretary
Federal Energy Regulatory Commission
888 First Street, N.E. Room 1A
Washington, D.C. 20426

Re: *PJM Interconnection L.L.C., Docket No. ER22-____-000*
Revisions to PJM's FTR Credit Requirement and Request for 28-Day Comment
Period

Dear Secretary Bose:

PJM Interconnection, L.L.C. ("PJM"), pursuant to section 205 of the Federal Power Act ("FPA"),¹ and part 35 of the Federal Energy Regulatory Commission's ("FERC" or the "Commission") regulations,² hereby submits proposed changes to the PJM Open Access Transmission Tariff ("Tariff")³ to revise the calculation of the Financial Transmission Right ("FTR") Credit Requirement, which sets the Collateral that FTR Participants are required to provide in order to participate in PJM's FTR market ("Revised FTR Credit Requirement").

As more fully described herein, the Revised FTR Credit Requirement more accurately quantifies the potential risks to the FTR market from an FTR Participant default, which in turn better protects PJM Members from potential losses resulting from default than the current FTR

¹ 16 U.S.C. § 824d.

² 18 C.F.R. part 35.

³ The Tariff is currently located under PJM's "Intra-PJM Tariffs" eTariff title. See *PJM Interconnection, L.L.C. - Intra-PJM Tariffs*, <https://etariff.ferc.gov/TariffBrowser.aspx?tid=1731> (last visited December 21, 2021). Terms not otherwise defined herein shall have the same meaning as set forth in the Tariff, and the Amended and Restated Operating Agreement of PJM Interconnection, L.L.C. ("Operating Agreement").

Credit Requirement calculation. PJM's proposed initial margin methodology employs a widely-accepted⁴ value-at-risk ("VaR") approach using historically observed price movements to model PJM's exposure, on a per-portfolio basis, from a particular FTR Participant and its FTR market activity.⁵ PJM also proposes related and conforming changes to the FTR Credit Requirement calculation, including removing a current imprecise and ineffective adder for FTR portfolios that was intended to address greater risk due to lack of diversification.

The Revised FTR Credit Requirement is the product of a robust stakeholder process spanning over two years of stakeholder engagement at the Financial Risk Mitigation Senior Task Force ("FRMSTF"), Risk Management Committee ("RMC"), Markets and Reliability Committee ("MRC") and the Members Committee ("MC"). On October 20, 2021, the MC endorsed the proposed revisions by acclamation with two objections and one abstention.⁶

In support of this filing, PJM includes affidavits of its Vice President and Chief Risk Officer, Ms. Nigeria Bloczynski;⁷ Mr. Neal Wolkoff, a lawyer, senior executive, and consultant with deep experience in derivatives, exchanges, and financial regulation and Mr. Robert Anderson, an eminent expert in risk management;⁸ and Dr. Alexander Eydeland, PhD., a mathematics professor and expert in energy risk management.⁹

⁴ See section II.B.1.b of this transmittal.

⁵ Value at risk ("VaR") is a statistic that quantifies the extent of possible financial losses within a firm, portfolio, or position over a specific time frame.

⁶ See Members Committee, *Minutes*, PJM Interconnection, L.L.C. (Oct. 20, 2021), <https://pjm.com/-/media/committees-groups/committees/mc/2021/20211117/20211117-caa-draft-minutes-mc-20211020.ashx>.

⁷ Affidavit of Nigeria Bloczynski on Behalf of PJM Interconnection, L.L.C. (Attachment C) ("Bloczynski Aff").

⁸ Affidavit of Neal Wolkoff and Robert Anderson on Behalf of PJM Interconnection, L.L.C. (Attachment D) ("Wolkoff/Anderson Aff").

⁹ Affidavit of Dr. Alex Eydeland on Behalf of PJM Interconnection, L.L.C. (Attachment G) ("Eydeland Aff").

PJM proposes an effective date of April 1, 2022, for these Tariff changes to allow sufficient time to test and implement the Revised FTR Credit Requirement prior to the next FTR annual auction scheduled for that month. However, to provide notice and certainty to FTR Participants, PJM requests that the Commission enter an order accepting these revisions on or before February 26, 2022, which is 67 days from the date of this filing. To that end, PJM has assigned an effective date of February 27, 2022, to a non-substantive revision in the accompanying eTariff records.

Given the timing of this filing relative to the year-end holidays, PJM also requests that the Commission extend the deadline for comments on this filing to 28 days, rather than the customary 21 days.

I. BACKGROUND

A. PJM's Current Approach to Determining the FTR Credit Requirement

PJM's Tariff¹⁰ establishes a credit requirement for FTR Participants for their FTR bids into, or purchases through, FTR auctions.¹¹ Each FTR Participant's FTR Credit Requirement is currently determined on a portfolio basis and is based on five (5) factors, each of which was previously approved by the Commission: (1) a financial exposure calculation for each FTR path based on FTR Historical Value;¹² (2) the addition of an increment for portfolios considered

¹⁰ Tariff, Attachment Q, section VI.C.2; *see* PJMSettlement, Inc., *Credit Overview and Supplement to the PJM Credit Risk Management Policy*, PJM Interconnection, L.L.C., at 30-31 (June 23, 2021), <https://www.pjm.com/-/media/documents/agreements/pjm-credit-overview.ashx>.

¹¹ Market participants can bid for FTRs in (i) PJM's long-term FTR Auction, providing FTRs for periods of one to three years; (ii) PJM's FTR Annual Auction, making available FTRs for transmission capability of the entire PJM Region; and (iii) FTR Monthly Auctions, making available FTRs for any remaining transmission capability. *See* Operating Agreement, Schedule 1, sections 7.1.1(a) and 7.1A.1(i); *Financial Transmission Rights FAQs*, PJM Interconnection, L.L.C., <https://learn.pjm.com/three-priorities/buying-and-selling-energy/ftr-faqs.aspx#faq-box-text1> (last visited Dec. 21, 2021).

¹² *See* Tariff, Attachment Q, section VI.C.2; *PJM Interconnection, L.L.C.*, Letter Order Docket No. ER06-594-000 (Mar. 22, 2006) ("ER06-594 Order"). The Tariff defines FTR Historical Value as "the weighted average of historical values over three years for the FTR path using the following weightings: 50% - most recent year; 30% - second year; 20% - third year." Tariff, Part I, Definitions – E - F.

undiversified;¹³ (3) the application of a \$0.10 per megawatt hour (“MWh”) volumetric minimum charge;¹⁴ (4) the subtraction of Auction Revenue Rights (“ARR”) Credits in a FTR Participant’s account;¹⁵ and (5) subtraction of the Mark-to-Auction (“MTA”) value.¹⁶ The current Tariff also provides that long-term FTR Credit Requirement calculations will be updated annually, consistent with the updating of historic values used for the FTR Credit Requirement calculations in the annual auctions.¹⁷

B. Limitations of the Current Approach

This filing is an outgrowth of PJM’s continuing efforts, working with its stakeholders, to enhance its FTR credit and collateral rules to better reflect the market risks of FTR transactions. Much of that recent effort has been guided by, and responsive to, the findings and recommendations of an investigation by expert independent consultants, commissioned by the PJM Board of Directors, into the circumstances leading to GreenHat Energy, LLC’s (“GreenHat”) June 1, 2018 default on its sizable FTR portfolio.¹⁸ One of the GreenHat Report’s overall recommendations was to “Advance Credit/Collateral Best Practices into the Tariff” to address one of the complications identified in the report, i.e., that “[t]he PJM Credit Policy Failed to Address Critical Risks.”¹⁹ The specific recommendations considered both “Original Margin,” i.e.,

¹³ See Tariff, Attachment Q, section VI.C.6; *PJM Interconnection, L.L.C.*, 122 FERC ¶ 61,279 (2008).

¹⁴ See Tariff, Attachment Q, section VI.C.2; *PJM Interconnection, L.L.C.*, 164 FERC ¶ 61,215 (2018).

¹⁵ See Tariff, Attachment Q, section VI.C.2; ER06-594 Order.

¹⁶ See Tariff, Attachment Q, section VI.C.9; *PJM Interconnection, L.L.C.*, 167 FERC ¶ 61,002 (2019).

¹⁷ See Tariff, Attachment Q, section VI.C.8.

¹⁸ See Robert Anderson, Neal Wolkoff & Arleigh P. Helfer, III, *Report of the Independent Consultants on the Green Hat Default*, PJM Interconnection, L.L.C. (Mar. 26, 2019), <https://www.pjm.com/-/media/library/reports-notices/special-reports/2019/report-of-the-independent-consultants-on-the-greenhat-default.ashx?la=en> (“GreenHat Report”).

¹⁹ GreenHat Report at Appendix Page 1 (Recommendation A).

collateral required to address the forward value risk of the transaction at the time of execution, and “Variation Margin,” i.e., collateral changes to address periodic changes in the forward value of the open transaction.²⁰

PJM has already implemented nearly all of the GreenHat Report’s specific recommendations in this area. This filing addresses one of the remaining specific recommendations—eliminating the undiversified adder—but more broadly reflects a major step forward in advancing the overall recommendation to move the Tariff’s FTR credit policy toward credit and collateral best practices in the energy commodity and financial derivatives industry as indicated by the attached affidavits.

In addition to moving the Tariff’s FTR credit rules towards industry best practices, this filing also addresses several limitations in the current approach to determining the FTR Credit Requirement, particularly as to credit for FTR Obligations—which comprise the vast majority of FTR market activity and financial exposure.

First, the principal component of the current calculation, i.e., the potential financial exposure from each FTR path, is based on FTR Historical Value, which, as noted above,²¹ is the weighted average of historical values for the FTR path for the three most recent years, with the single most recent year afforded 50% of the weight. This confined look-back period “is a narrow historical frame of reference from which to infer possible price moves in the future, particularly considering infrequent extreme weather events.”²²

²⁰ *Id.*

²¹ *See supra* note 12.

²² Wolkoff/Anderson Aff. at 25.

Second, the simplified weighting assumption in the current approach, according 50% weight to the most recent year, in essence assumes that market scenarios in future years are substantially predicted by the single most recent year. This simplifying assumption unduly constrains the wide range of conditions and scenarios that could occur in any year, and thus could lead to both risk evaluation and margin collection errors.²³

Third, the current method updates only by adding new data without retaining older data, and thus does not consider cumulative data points reflecting the historical development of the market. Messrs. Wolkoff and Anderson support PJM's proposed replacement method in part precisely because it "uses the maximum available historical price record as the best way to predict the future [and] does not arbitrarily assign greater weight to the market effects of some events over others because such events occurred more recently."²⁴

Fourth, the current approach attempts to capture additional potential financial exposure, but those efforts are limited by their simplifying assumptions. In particular, the current FTR Credit Requirement calculation includes an adder²⁵ for portfolios that are deemed to present heightened risk from being undiversified. The GreenHat Report noted that this adder "is relevant to portfolios that are dominated by negative price (sometimes called counterflow positions)."²⁶ However, while "[c]ounterflow FTRs were important in the case of [a 2007] FTR market default," they "were not relevant to the ineffectiveness of GreenHat's portfolio collateral requirement."²⁷ In effect, the adder embodies a simplifying assumption about the existence and degree of portfolio market risk

²³ *Id.*

²⁴ *Id.* at 26.

²⁵ See Tariff, Attachment Q, section VI.C.6.

²⁶ GreenHat Report at Appendix Page 12.

²⁷ *Id.*

from the fact that a portfolio is negatively valued in the tentative auction results, but the independent consultants that prepared the GreenHat Report found the adder to be “uncorrelated to fluctuating market risk” and therefore recommended its removal.²⁸ Consistent with their opinion expressed in the GreenHat Report, Messrs. Wolkoff and Anderson in their accompanying affidavit describe the undiversified portfolio adder as “a gross oversimplification” which “[a]gain . . . could lead to risk evaluation and margin collection errors.”²⁹

As Messrs. Wolkoff and Anderson summarize, PJM’s proposal would “overcome” these “material drawbacks” in the current approach, and thereby “advance risk management practices.”³⁰

C. Stakeholder Process to Assess Reforms to the FTR Credit Requirement

PJM and its stakeholders established the FRMSTF in April 2019, in the wake of issuance of the GreenHat Report, to help investigate and develop PJM Tariff and Operating Agreement changes relevant to the FTR default risks exemplified by the GreenHat default. The FRMSTF quickly became a forum for a substantial body of productive work in this area. As most relevant to this filing, PJM commissioned work for presentation to the FRMSTF in the summer of 2019 on initial margin, and how it should best be calculated.

As explained in one of the first presentations on this topic, “Initial Margin (IM) is a good-faith deposit, posted by a trading participant as collateral to protect against the financial consequences of default.”³¹ The posted deposit is intended to represent “the potential losses that

²⁸ GreenHat Report at Appendix Page 1 (Recommendation A3). In addition, PJM and its stakeholders long have noted that the adder’s implementation, based on tentative auction results, a pre-clearing demand for additional collateral, and removal of bids if the additional collateral is not provided, has the disadvantage of delaying final clearing of auctions.

²⁹ Wolkoff/Anderson Aff. at 25.

³⁰ *Id.*

³¹ *Financial Market Reform Project; Desktop Review of Methodologies for Initial Margin Calculation*, PJM Interconnection, L.L.C., at 2 (July, 2019), <https://www.pjm.com/-/media/committees-groups/task->

would be incurred by the . . . Central Counter-Party ([“]CCP[”]) . . . should the participant default, calculated to a high degree of statistical likelihood, across the participant’s entire portfolio.”³² For this purpose, the potential loss calculation “must cover the time period [known as the Market Period of Risk,] between when the position was incurred or [certain collateral was] last levied (whichever is the latter), and when it could be liquidated or taken to final settlement (whichever is the sooner) in the event of default.”³³ The July 2019 Desktop Review presentation reviewed the academic literature on models that quantify the potential exposure of Central Counter-Parties, noted guidelines from other markets on initial margin, and summarized two principal modeling approaches to the exposure calculation—historical simulation and Monte Carlo—and their advantages and disadvantages.³⁴

As part of the stakeholder process, PJM commissioned Dr. Eydeland to assess the possible initial margin models. He presented the results of his quantitative analysis of an historical simulation model to the FRMSTF in September 2019.³⁵ The analysis included back testing the model, i.e., comparing the initial margin required by the historical simulation approach against the loss a portfolio would have incurred during a Margin Period of Risk using actual FTR price data.³⁶

forces/frmstf/20190717/20190717-item-04-initial-margin-methodology-desktop-review.ashx (“Desktop Review”). This presentation, which Dr. Eydeland prepared, is included as Exhibit A to his accompanying affidavit.

³² *Id.*

³³ *Id.*

³⁴ *Id.* at 3-8.

³⁵ Alex Eydeland, *Report Results of Risk Model Quantitative Analysis, Initial Margin, Part 1: Historic Simulation Approach*, PJM Interconnection, L.L.C. (Sept. 25, 2019), <https://www.pjm.com/-/media/committees-groups/task-forces/frmstf/20190925/20190925-item-07-results-of-risk-model-quantitative-analysis-presentation.ashx>. This presentation is included as Exhibit B to Dr. Eydeland’s accompanying affidavit, and his back testing analysis is more fully discussed in section IV.E of this Transmittal and in his affidavit.

³⁶ *Id.* at 18-20.

Based on this work, Dr. Eydeland concluded that “[a]t the initial stage, [historical simulation] has proved to be a reasonable method for computing [Initial Margin.]”³⁷

After devoting its focus to other important areas, the FRMSTF returned to the topic of initial margin in March 2020. Dr. Eydeland presented “a general overview of the progress in the development of a new Initial Margin Methodology . . . based on Historical Simulations,”³⁸ including a review of the work already done at the proof-of-concept stage, i.e., “Basis analysis of FTR price dynamics for zonal paths[;] [b]ack Testing of the methodology for zonal paths[; and] [a]nalysis of a few real-life portfolios including [GreenHat].”³⁹

The ensuing meetings focused on additional education about initial margin, and its use as a risk management tool in different types of financial commodity markets—including (i) regional transmission organizations (“RTOs”) and independent system operators; (ii) commodities futures exchanges like the Chicago Mercantile Exchange; (iii) Derivatives Clearing Organizations (“DCOs”) like ICE Clear; and (iv) Nodal Exchange, i.e., a futures exchange for electricity related products with a central clearing counterparty.⁴⁰ The FRMSTF also considered additional back testing and other quantitative analyses of initial margin proposals.⁴¹

³⁷ *Id.* at 26.

³⁸ Alex Eydeland, *Initial Margin: Historical Simulation Approach*, PJM Interconnection, L.L.C., at 1 (Mar. 30, 2020), <https://www.pjm.com/-/media/committees-groups/task-forces/frmstf/2020/20200330/20200330-item-04-initial-margin-education.ashx>.

³⁹ *Id.* at 11.

⁴⁰ See, e.g., *External Clearing for the PJM FTR Market: Clearing Overview and Analysis of the Nodal Clear Proposition*, PJM Interconnection, L.L.C. (Sept. 2019), <https://www.pjm.com/-/media/committees-groups/task-forces/frmstf/20190925/20190925-item-06-external-clearing-for-pjm-ftr-market.ashx>; *FTR Clearing at Nodal Exchange*, PJM Interconnection, L.L.C. (July 21, 2020), <https://www.pjm.com/-/media/committees-groups/task-forces/frmstf/2020/20200721/20200721-informational-posting-ftr-clearing-at-nodal.ashx>; *PJM FTR Clearing, Summary of Costs and Benefits*, PJM Interconnection, L.L.C. (June 2, 2021), <https://www.pjm.com/-/media/committees-groups/task-forces/frmstf/2021/20210602/20210602-item-04d-pjm-ftr-external-clearing-regulatory-issues-presentation.ashx>.

⁴¹ See the stakeholder presentation included as Exhibit C to Dr. Eydeland’s Affidavit.

The FRMSTF's work in 2021 moved to development of specific proposals for FTR collateral enhancements. PJM presented its proposed revisions to the FTR Credit Requirement at the FRMSTF's July 16, 2021 meeting. PJM's proposed revisions replaced the current principal element of the calculation, i.e., a margin requirement for each FTR path based on FTR Historic Value, with initial margin calculated from an historical simulation ("HSIM") model, and employing, initially, a 97% confidence interval. As explained in more detail in section II.B.2 below, the confidence interval refers to the statistical certainty that a given value (i.e., the Initial Margin) will exceed the range of possible outcomes (i.e., the losses in portfolio value over the Margin Period of Risk) produced by the HSIM Model.

As the stakeholder process moved to the RMC and the MRC, the choice of confidence interval became a major topic of discussion and dispute, with a number of stakeholders advocating for 95%, while others, including PJM, advocated for 99%. As evidenced by its July 16, 2021 proposal, however, PJM was willing to use a 97% confidence interval as part of the major step forward embodied by the overall proposal. During this period, in the summer and fall of 2021, PJM also presented analyses of the impact of different confidence interval levels on aggregate levels of collected FTR collateral, and on how frequently simulated losses would exceed the collected collateral (known as the "failure rate").⁴²

This extensive collaborative effort did not produce unanimity, but it did ultimately achieve the requisite supermajority stakeholder support. As noted above, the PJM MC on October 20, 2021 endorsed the Revised FTR Credit Requirement reflected in this filing by acclamation with two objections and one abstention.

⁴² See, e.g., *Initial Margining of Financial Transmission Rights: Confidence Interval Discussion*, PJM Interconnection, L.L.C. (Sept. 10, 2021), <https://www.pjm.com/-/media/committees-groups/task-forces/frmstf/2021/20210915/20210915-item-03c-confidence-interval-discussion-presentation.ashx>.

II. THE REVISED FTR CREDIT REQUIREMENT

A. Overview

The Revised FTR Credit Requirement includes three primary changes to the current FTR Credit Requirement calculation set forth in Tariff, Attachment Q, section VI.C. First, PJM proposes to replace,⁴³ for FTR Obligations,⁴⁴ the current approach of calculating the potential payment exposure of each FTR path based on FTR Historical Value, with an initial margin calculation from an HSIM model and related confidence interval, both of which are discussed in more detail in section II.B below.⁴⁵ PJM does not propose this change for FTR Options⁴⁶ because trading activity in FTR Options is a fraction of the trading activity in FTR Obligations, and because PJM does not have the same extent of historical data for FTR Options as it has for FTR Obligations.⁴⁷

⁴³ See proposed Tariff, Attachment Q, section VI.C.2.

⁴⁴ The hourly economic value of a Financial Transmission Right Obligation is based on the Financial Transmission Right MW reservation and the difference between the Day-ahead Congestion Price at the point of delivery and the point of receipt of the Financial Transmission Right. The hourly economic value of a Financial Transmission Right Obligation is positive (a benefit to the FTR Holder) when the Day-ahead Congestion Price at the point of delivery is higher than the Day-ahead Congestion Price at the point of receipt. The hourly economic value of a Financial Transmission Right Obligation is negative (a liability to the FTR Holder) when the Day-ahead Congestion Price at the point of receipt is higher than the Day-ahead Congestion Price at the point of delivery. Operating Agreement, Schedule 1, section 5.2.2(b).

⁴⁵ See sections III.B.1 and III.B.2 below for more discussion of, respectively, the HSIM model and the confidence interval.

⁴⁶ The hourly economic value of a Financial Transmission Right Option is based on the Financial Transmission Right MW reservation and the difference between the Day-ahead Congestion Price at the point of delivery and the point of receipt of the Financial Transmission Right when that difference is positive. The hourly economic value of a Financial Transmission Right Option is positive (a benefit to the FTR Holder) when the Day-ahead Congestion Price at the point of delivery is higher than the Day-ahead Congestion Price at the point of receipt. The hourly economic value of a Financial Transmission Right Option is zero (neither a benefit nor a liability to the FTR Holder) when the Day-ahead Congestion Price at the point of receipt is higher than the Day-ahead Congestion Price at the point of delivery. Operating Agreement, Schedule 1, section 5.2.2(c).

⁴⁷ See *Bloczynski Aff.* at 11.

Second, PJM proposes to remove from Attachment Q, section VI.C.2 the undiversified adder component of the FTR Credit Requirement calculation, given expert advice that it is not correlated with market risk, and thus could result in a margin that does not sufficiently protect against the risks of default.

Third, PJM proposes to delete the component currently in Attachment Q, section VI.C.8 relating to long-term FTR Credit recalculation. This provision for capturing additional FTR values is no longer needed under the Revised FTR Credit Requirement, because prices will be updated in real time under the proposed HSIM model.

Fourth, PJM proposes to retain the \$0.10/MWh volumetric minimum charge, but apply it after any ARR Credits or MTA adjustments are applied.⁴⁸ At present, the minimum charge is applied before ARR credits or MTA adjustments—which means that the current FTR Credit Requirement can result in a zero value. This result, however, frustrates the intended purpose of the volumetric minimum charge. The volumetric minimum was originally proposed as a reasonable corrective to the risk of an FTR Holder acquiring a large volume FTR portfolio without having to provide financial security that considers the size of the FTR portfolio, given that a large portfolio in itself presents a financial risk.⁴⁹ Applying this minimum *after* application of the ARR credit and MTA components will advance this original objective by preventing FTR Holders whose FTR portfolios have a significant MWh volume of positions from having little to no credit requirements. This ensures that the \$0.10/MWh minimum floor operates as it was originally intended: as a backstop to avoid a de minimus or net zero FTR Credit Requirement.

⁴⁸ Proposed Tariff, Attachment Q, section VI.C.2.

⁴⁹ *PJM Interconnection, L.L.C.*, Request for Revisions to Attachment Q FTR Credit Requirement, Docket No. ER18-2090-000 (July 27, 2018).

Fifth, PJM proposes to make explicit an adjustment for realized gains and losses that is an inherent aspect of the current approach, so as to ensure that particular adjustment is not inadvertently eliminated as a result of adopting the initial margin approach. Net realized gains and losses from settlement of sales of FTRs in an auction are an inherent element of the FTR Historic Value calculation for the path-specific portion of the current FTR Credit Requirement. This attribute of the current approach, however, will not be inherent in the proposed HSIM model's calculation of initial margin. Accordingly, PJM is preserving this adjustment with separate, explicit Tariff language.⁵⁰ Similar to the current inherent approach, the new language provides that, at time of settlement, gains will be considered a payment and losses will be a charge to the participant, such that gains result in a decrease to, and losses result in an increase to, the FTR Credit Requirement.⁵¹

PJM also proposes:

- to provide that the FTR Credit Requirement can be decreased when the MTA value is positive, to acknowledge that an FTR Participant with FTRs that have become more highly valued than they were at the time they were transacted has thereby seen an incremental reduction in its market risk exposure;⁵²
- while PJM is not proposing any substantive change to the ARR credit provisions, those provisions, which are currently found in various sections of the FTR Credit Requirement, will now be housed in a single section;⁵³ and

⁵⁰ Proposed Tariff, Attachment Q, section VI.C.2.e.

⁵¹ *Id.*

⁵² Proposed Tariff, Attachment Q, section VI.C.2(7).

⁵³ Compare Tariff, Attachment Q, sections VI.C.2, VI.C.6, with proposed Tariff, Attachment Q, section VI.C.2.b; see *PJM Interconnection, L.L.C.*, 122 FERC ¶ 61,279, at P 4 (2008) (accepting ARR credit requirement). The Commission accepted the current ARR credit provisions to “allow[] for a correct offset between ARR credits and FTR credits.” *PJM Interconnection, L.L.C.*, Revisions to PJM Credit Policy Attachment Q, Docket No. ER08-376-000, at 6 (Dec. 21, 2007).

- to make a ministerial adjustment to the MTA section⁵⁴ to align with the default provisions of the Operating Agreement regarding the deadline for fulfilling a demand for additional Collateral.⁵⁵

B. Initial Margin Calculation

In general, margin is the amount of financial collateral deposited by a Market Participant with a CCP to collateralize trade exposures introduced by the participant.⁵⁶ Margins are the CCP's first line of defense in the event of the Market Participant's default, to satisfy the financial obligations of that participant.⁵⁷ The margins are designed to cover the market risk of a Market Participant's portfolio with high level of confidence.⁵⁸ As noted above, the GreenHat Report referred to two types of margin, i.e., "Original Margin," which is collateral required to address the forward value risk of the transaction at the time of execution, and "Variation Margin," which refers to collateral changes to address periodic changes in the forward value of the open transaction.⁵⁹

Initial margin, another term for Original Margin, is the amount of collateral needed to cover the replacement cost of unwinding a Market Participant's portfolio in the case of default.⁶⁰ Those replacement costs of unwinding a portfolio "are the cost incurred during the liquidation period," which is "the time period between the last variation margin posting and the complete portfolio closeout time,"⁶¹ and which also is known as the margin period of risk.⁶² The posted deposit thus

⁵⁴ Proposed Tariff, Attachment Q, section VI.C.7.

⁵⁵ See Operating Agreement, section 15.1.5.

⁵⁶ Eydeland Aff. at Exhibit A.

⁵⁷ *Id.* at 2.

⁵⁸ *Id.*

⁵⁹ See *supra* note 20 (citing GreenHat Report at at Appendix Page 1 (Recommendation A)).

⁶⁰ Eydeland Aff. Exhibit A at 2.

⁶¹ *Id.*

⁶² *Id.* at 4.

“represents the potential losses that would be incurred by a [CCP] should a participant default . . . calculated with a high degree of statistical likelihood, across a participant’s portfolio.”⁶³

As Dr. Eydeland explained to PJM stakeholders, “[t]he correct calculation and levying of [initial margin] is an essential—but not the sole—defense in protecting the market from the failure of any of its individual participants.”⁶⁴ Many approaches to calculating the risk exposure addressed by initial margin include two critical elements: (1) a model that produces a probability distribution of different potential exposure values; and (2) a choice regarding the specific level of the “high degree of statistical likelihood,” as noted by Dr. Eydeland,⁶⁵ of the potential losses that would be incurred if the participant defaults. For the first, PJM proposes an HSIM model; for the second, PJM proposes a 97% confidence interval. PJM also proposes to specify in the Tariff the method PJM will use to weigh the initial margin calculations for individual months when PJM calculates an initial margin value for a multi-month Balance of Planning Period (“BOPP”). PJM discusses each of these Tariff-specified elements of the initial margin calculation in the following three sections of this transmittal.

1. HSIM Model

a. PJM’s planned implementation of an HSIM Model

PJM proposes to memorialize in the Tariff that PJM will use an historical simulation methodology to calculate initial margin.⁶⁶ As Dr. Eydeland explains, the “HSIM approach can be categorized as a [value-at-risk (“VaR”)]-based methodology that is widely accepted in different

⁶³ *Id.* at 2-3.

⁶⁴ Eydeland Aff., Exhibit A at 2.

⁶⁵ Eydeland Aff. at 3.

⁶⁶ See proposed Tariff, Attachment Q, section VI.C.2.a.i.

markets for calculating initial margin and other capital requirements.”⁶⁷ As applied here, the HSIM model will use “[FTR] auction historical data to assess the impact of market moves on a given Market Participant’s portfolio.”⁶⁸ Specifically, the participant’s portfolio “is subjected to historically recorded FTR price movements over a specified time period called the margin period of risk,” thus generating “a distribution of the portfolio value changes,” which “is then used to calculate the maximum loss corresponding to a fixed confidence level.”⁶⁹ That maximum loss value then “determines the initial margin.”⁷⁰

PJM’s HSIM model will use FTR auction data from 2008 to the most recent auction to determine the distribution of a participant’s portfolio value over the Margin Period of Risk.⁷¹ The HSIM model will perform separate calculation adjustments for monthly, annual, and long-term FTR auctions.

For PJM’s implementation of an HSIM model, the Margin Period of Risk is the time period from the end of an FTR auction to the time PJM anticipates it would be able to liquidate a defaulted FTR transaction or position, by selling the FTRs back into the auction. Because PJM FTR auctions occur both monthly and annually, the margin period of risk is therefore two auction periods, as further explained in the *Bloczynski Aff.*⁷²

As discussed below, Dr. Eydeland (in collaboration with PJM subject matter experts) back tested the HSIM model to assess how well it would calculate initial margin. As also discussed

⁶⁷ Eydeland Aff. at 4.

⁶⁸ *Id.*

⁶⁹ *Id.*

⁷⁰ *Id.*

⁷¹ *Id.* at 8.

⁷² *Bloczynski Aff.* at 12.

below, independent outside auditors reviewed and validated PJM's version of the HSIM model for the initial margin calculation.

b. Historic simulation models are widely accepted.

Dr. Eydeland reviews the extensive academic literature on approaches to quantifying the potential exposure of central counter parties and notes that VaR-based approaches “ha[ve] been found well-suited to assessing the risk that losses on complex portfolios will exceed the specified margin level.”⁷³ Consistent with this, historical simulation models have been a mainstay for risk managers in financial markets regulated by the Commodity Futures Trading Commission (“CFTC”) for decades.⁷⁴ Their use is common for both (1) designated contract markets (“DCMs”), also known as commodity exchanges, which are market platforms on which commodity futures contracts are traded, and (2) DCOs, also known as clearinghouses, central clearing counterparties or CCPs, which are strongly capitalized financial institutions that take on counterparty credit risk between the two parties to a commodity transaction, to use HSIM modeling to analyze credit risk and calculate margin requirements in CFTC-regulated commodity markets.⁷⁵ Large commodity swap dealers, which are regulated by the CFTC, use HSIM models to analyze the credit risks the dealer faces when it enters into uncleared “over the counter” (or off-exchange) commodity

⁷³ Eydeland Aff. at 4.

⁷⁴ See Christophe Pérignon, David Smith, *The Level and Quality of Value-at-Risk Disclosure By Commercial Banks*, Journal of Banking & Finance, Volume 34, Issue 2, 362-377 (2010); Meera Sharma, *The Historical Simulation Method for Value-at-Risk: A Research Based Evaluation of the Industry Favorite*, SSRN Electronic Journal, at 3 (April 19, 2012), https://papers.ssrn.com/sol3/papers.cfm?abstract_id=2042594.

⁷⁵ The CFTC noted the utility of VaR-based methodologies in the adopting release of its rules relating to Core Principles for DCOs. See Derivatives Clearing Organization General Provisions and Core Principles, 76 Fed. Reg. 69,334, 69,419 (Nov. 8, 2011) (to be codified at 17 C.F.R. pts. 1, 21, 39, 140) (“The value-at-risk confidence interval protects DCOs, their clearing members, market participants, and the public by fixing the probability that a default will occur and the position cannot be liquidated in time.”). Several CFTC regulatory requirements also utilize VaR as a measure of risk. For example, a clearing house applying to register as a DCO must explain how it will use various risk tools, including VaR. See *Form DCO: Derivatives Clearing Organization Application for Registration*, Commodity Futures Trading Commission, at 15-18 (Exhibit D) (June 23, 2020), <https://www.cftc.gov/sites/default/files/2020-01/Form%20DCO.pdf>.

transactions and financial swaps with counterparties—to assess the credit risks the swap dealer faces from entering into transactions with counterparties. Each of these sophisticated CFTC-regulated financial commodity market organizations use risk management processes that are similar in function to PJM, and use HSIM modeling as a key component of their credit risk management tools.⁷⁶

c. Advantages of an HSIM Model

Dr. Eydeland lists the advantages of the proposed HSIM model as including “that it is a standard risk-based approach used in a majority of markets, it is easy to implement, it is a transparent process with a low probability of dispute, and there is no need to determine correlations between paths as they are included in the historical data.”⁷⁷ Elaborating on the latter point, which he characterizes as “[o]ne of the strongest arguments in favor of HSIM methodology” Dr. Eydeland explains that “correlation coefficients are frequently used in . . . alternative simulation methods as a step to determine the joint distribution of risk factors underlying the portfolio values,” but calculating those coefficients “in a stable way is challenging, and their use in the simulation methodology is questionable, as it implies that the methodology restricts itself to a narrow, and potentially inadequate, family of joint distributions of risk factors.”⁷⁸ By contrast, “[t]he HSIM approach is free from this intermediate step and uses historical data directly to determine the joint distribution of underlying risk factors (FTR prices in our case) without any assumptions or constraints on the choice of this distribution.”⁷⁹

⁷⁶ Wolfkoff/Anderson Aff. at 9.

⁷⁷ Eydeland Aff. at 6.

⁷⁸ *Id.* at 6-7.

⁷⁹ *Id.* at 7.

Accordingly, an HSIM model is particularly effective in managing risk because it “uses real data,” and “can capture unexpected ‘tail’ events and correlations that would not necessarily be predicted by a theoretical model.”⁸⁰ As used here, “tail” events refers to infrequently-occurring, but extreme and potentially catastrophic, market movements as a result of which significant market losses can occur. The proposed HSIM model therefore “allows one to model a complex joint behavior of various risk factors that impact portfolio values, making the HSIM method a very effective tool in evaluating and managing risk.”⁸¹

In sum, as Dr. Eydeland confirms, “PJM’s implementation of the HSIM model will help prevent under-collateralization in PJM markets.”⁸²

Messrs. Wolkoff and Anderson similarly support PJM’s proposed use of an HSIM model approach, because (among other benefits) it “provides explainable, verifiable results [that] can be readily supported and understood as a fair, just, consistent and reasonable basis for Initial Margin calculation” whereas “other well-known modeling methods, such as the parametric or the Monte Carlo approaches, require underlying assumptions which can be challenging to explain or to build consensus for.”⁸³ They also note the “great deal of energy industry experience with historical simulation modelling,” which has produced “a rich set of technical resources” that help “support best practices for backtesting and approaches to incremental improvements in a model’s ability over time to more accurately forecast the risks of FTR portfolios.”⁸⁴

⁸⁰ *Id.* at 8.

⁸¹ *Id.*

⁸² *Id.*

⁸³ Wolkoff/Anderson Aff. at 15-16.

⁸⁴ *Id.* at 15.

2. *Confidence Interval*

The HSIM model produces a distribution of possible changes in portfolio value (which could be an increase or a decrease from the beginning value) over the Margin Period of Risk. By itself, that distribution does not dictate how much protection an initial margin will provide against risk of loss. The other critical element of the analysis, therefore, is a choice about the degree of protection, i.e., the degree of statistical certainty that the level of the initial margin will exceed the amount of a loss in portfolio value over the relevant period. The confidence interval is the metric for expressing that desired level of statistical certainty.

Messrs. Wolkoff and Anderson include in their affidavit a graph, shown in Figure 1 below, to illustrate the role played by the confidence interval. As can be seen, the graph takes the form of a classic bell curve. The narrow purple vertical line represents no change from the FTR portfolio's starting value. Blue bars to the left show positions of reduced value; blue bars to the right show positions of increased value. The height of each bar corresponds to how frequently that value level recurs—small changes from the starting value are more common; large changes from the starting value are less common; extreme changes (up or down) are uncommon.⁸⁵ Summing the frequencies from all of the blue bars to the right of a given point shows the overall probability that the ending portfolio value will be higher than the value represented by the selected point. Stated differently, the sum of the frequencies to the right of the selected point shows the probability that the portfolio will not lose as much value as the difference between the starting portfolio value and the portfolio value at the selected point.

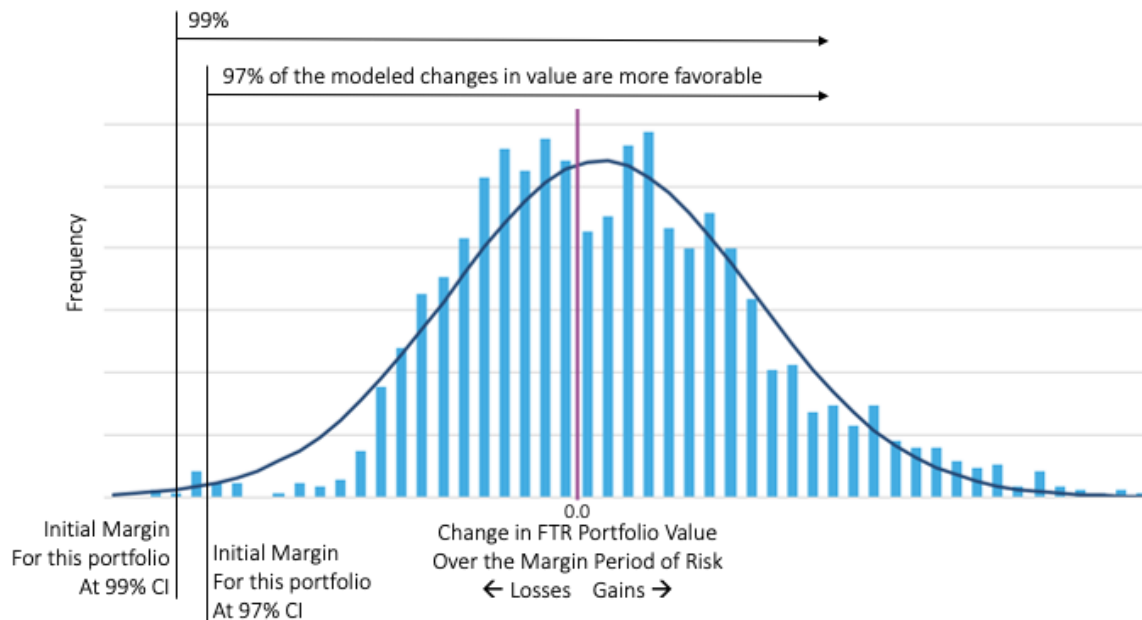
For their illustration, Messrs. Wolkoff and Anderson highlight the two points on the bell

⁸⁵ Because no data set will perfectly align with an ideal bell curve, a particular data bar may be higher or lower than an adjacent bar, as seen in the illustration provided by Figure 1. This does not change the principles discussed here.

curve where “97% of the modeled changes are more favorable” and where “99%” of the modeled changes are more favorable, as seen below.

Figure 1

Illustration of Confidence Interval in a Distribution of Hypothetical FTR Portfolio Outcomes



As they explain, PJM’s proposed use of a confidence interval of 97% “means that PJM expects that, in 97% of HSIM model-derived outcomes, the financial loss in value on the given portfolio of FTR positions will be less than the quantified dollar amount.”⁸⁶ That quantified dollar amount, i.e., the difference between the starting value and the value associated with the 97% confidence interval at the far left of the bell curve, establishes the initial margin. Put simply, that selected confidence interval means that “PJM expects to find that 97% of the time, any portfolio’s loss during a possible liquidation period . . . in the future will be less than that portfolio’s Initial

⁸⁶ Wolkoff/Anderson Aff. at 21.

Margin held by PJM.”⁸⁷

As noted, Figure 1 also highlights the point, even farther left on the curve, corresponding to a 99% confidence interval. As Messrs. Wolkoff and Anderson explain, the CFTC “requires that a DCO’s determination of Initial Margin requirements . . . must . . . satisfy at least a 99% Confidence Interval in all cases.”⁸⁸ That CFTC required margin also must be “calculated for a coverage period of one, two, five or ten days, depending on the type of commodity derivative product.”⁸⁹ As Messrs. Anderson and Wolkoff note, “PJM captures a much longer liquidation period . . . (auction cycles or two months) than the [CFTC’s] minimum requirement,” which “is appropriate” given that “[t]he period required to liquidate a portfolio of FTRs into relatively infrequent monthly auctions will necessarily be significantly longer than liquidation periods applicable to other . . . markets with much more frequent opportunity for pricing/repricing portfolios and unwinding transactions.”⁹⁰

They explain their understanding that PJM’s proposal to rely, at least initially, on a 97% confidence interval rather than the 99% required by the CFTC for DCOs is in part “due to the longer liquidation period . . . and the margin costs to FTR Market Participants associated with covering risk for such a lengthy time period.”⁹¹ Messrs. Wolkoff and Anderson note that decision also reflects PJM “prudently avoiding any disruption of the orderly functioning of the FTR markets that might be expected by imposing a sudden increase in margin levels.”⁹² That sort of sudden

⁸⁷ *Id.*

⁸⁸ *Id.* at 19.

⁸⁹ *Id.*

⁹⁰ *Id.*

⁹¹ *Id.* at 20.

⁹² *Id.*

increase could “shock the market system and possibly force some Market Participants to unwind FTR positions or to decide not to continue participation in the FTR auctions and FTR markets entirely.”⁹³ As they observe, “[i]t is not in the public interest to have a potentially-avoidable market disruption in the PJM FTR market.”⁹⁴

Accordingly, while Messrs. Wolkoff and Anderson also “recommend[] that PJM ultimately move to a Confidence Interval of 99% within a reasonable period of time,”⁹⁵ they stress that “[i]t is important to give the Market Participants time to adjust to the new model and the new FTR Credit Requirements for Initial Margin.”⁹⁶ This will allow participants time, if needed, “to modify their FTR portfolios, to secure additional capital or lines of credit, or to increase working capital available for posting as margin;” and will allow “such financial choices [to] be made in an orderly, planned manner.”⁹⁷

To be clear, by this filing, PJM is stating the 97% confidence interval in the Tariff, meaning PJM cannot depart from that important metric without a further filing under FPA, section 205. As Ms. Bloczynski, PJM’s Vice President and Chief Risk Officer, emphasizes, the present filing’s proposed adoption of an historical simulation VaR model with a 97% confidence interval embodies “a high confidence interval and a significant improvement to the PJM collateral practices.”⁹⁸ Any movement by PJM to a different confidence interval will entail consideration of additional data and experience gained from implementation of the present proposal, appropriate consultation with

⁹³ *Id.*

⁹⁴ *Id.*

⁹⁵ *Id.* at 27.

⁹⁶ *Id.*

⁹⁷ *Id.*

⁹⁸ Bloczynski Aff. at 15.

stakeholders, a subsequent FPA, section 205 filing, and Commission acceptance of any such filing.⁹⁹

3. *Weighting for individual months in the balance of planning period*

PJM also is including in the proposed Tariff language that the HSIM model will be “subject to a weighted aggregation method that is represented by a straight sum for long term positions and a combination of straight sum (20%) and weighted root sum of squares (80%) for balance of planning period positions.”¹⁰⁰

This weighting concerns how to aggregate the initial margin values calculated for individual months into an initial margin value for a multi-month BOPP. There are two alternative weighting calculations, depending on whether the monthly results are expected to be correlated. At one extreme, if the months in a BOPP are perfectly correlated, then the BOPP initial margin would simply be the straight sum of the initial margins calculated for each month during the BOPP. Conversely, if the months are expected to be entirely uncorrelated, then the BOPP initial margin would be the square root of the sum of the squares of the individual monthly initial margin values.¹⁰¹ PJM’s expected experience (like most real-world applications) will fall somewhere in between these two outer bounds. Accordingly, a reasonable approach is to perform both calculations, but then weight them to reflect an appropriate balance.

As Dr. Eydeland explains, PJM’s selection of an 80%/20% weight “is supported by the back-test results.”¹⁰² More specifically, “[d]ifferent weights were tested, and 80%/20% was the one that satisfied the target failure rate at the lowest collateral cost.” As explained below in section

⁹⁹ *Id.*

¹⁰⁰ Tariff, Attachment Q, section VI.C.2.a.i.

¹⁰¹ *See* Eydeland Aff. at 9.

¹⁰² *Id.*

III.E, the failure rate refers to how often in the back testing the simulated portfolio losses over the margin period of risk exceeded the specified initial margin level. Different weighting of the individual months in a BOPP will result in different portfolio value losses over the BOPP, and thus different failure rates. Since PJM proposes to use a 97% confidence interval, the expected failure rate is 3%, so a reasonable weighting of the individual months in the BOPP would result in a failure rate that approaches, but does not exceed, 3%. The 80/20 split fit that scenario here; as Dr. Eydeland summarizes, the selected weighting was “determined to achieve an optimal balance between the collateral costs to the participants and the attainment of the risk management goals.”¹⁰³

III. THE REVISED FTR CREDIT REQUIREMENT PROPOSAL IS JUST AND REASONABLE.

In addition to the explanations and showings above of the reasonableness of PJM’s proposed Revised FTR Credit Requirement, PJM’s initial margin proposal is just and reasonable based on the following additional facts and considerations.

A. *PJM’s Proposed Method to Calculate Initial Margin Advances PJM Towards Credit Management Best Practices.*

PJM’s implementation of the HSIM model to calculate the initial margin component of the FTR Credit Requirement is intended to mitigate a potential default of an FTR Participant in the PJM FTR market and helps advance PJM’s FTR Credit Requirement toward risk management best practices.¹⁰⁴ That is particularly important here, given that costs of Market Participant defaults in PJM, such as portfolio market losses not covered by posted collateral, are assessed to PJM Members.¹⁰⁵

¹⁰³ *Id.*

¹⁰⁴ Wolkoff/Anderson Aff. at 18.

¹⁰⁵ *See* Operating Agreement, section 15.2.

PJM’s proposed use of an HSIM model along with a high confidence interval to support the initial margin component of the revised FTR Credit Requirement represents, according to Messrs. Wolkoff and Anderson, “an important closure of a ‘performance gap’ which [they] observed at the time of [the GreenHat Report] in 2019.”¹⁰⁶ Adopting the proposed method, in their opinion, moves PJM into the realm of “appropriate” practice, which they define as “appropriate to achieve effectiveness balanced with the level and complexity of risks at hand for a given company.”¹⁰⁷

Further support that the Revised FTR Credit Requirement advances PJM towards best practices can be found in the regulations of financial commodity markets, and in particular in the CFTC regulations of exchanges, CCPs and commodity swap dealers.¹⁰⁸ There are many instances where the CFTC has required central counterparties for commodities markets to implement the combined use of an HSIM model and a high confidence interval. A pertinent example is the CFTC’s margin regulation of CCPs that clear commodity derivatives transactions (futures contracts and swaps)¹⁰⁹ and the CFTC’s capital and margin regulations for swap dealers and major swap Market Participants that enter into transactions in uncleared over-the-counter (off-exchange)

¹⁰⁶ Wolkoff/Anderson Aff. at 17.

¹⁰⁷ *Id.*

¹⁰⁸ PJM Settlement as the counterparty to all transactions in the PJM Market, has certain characteristics of an exchange, as it hosts market participants’ market transactions. In other respects, PJM is akin to a CCP or a commodity swap dealer, which acts as a counterparty to commodity derivatives transactions, and is, therefore much focused on the credit risk each counterparty presents. However, PJM is a not-for-profit corporation and not a CCP (a financial institution with regulatory requirements to maintain certain levels of capital and liquidity reserves to protect the market against market participant defaults) or a commodity swap dealer with both a regulatory framework within which to maintain capital and collect margin, but also an economic incentive to protect its shareholders against losses from counterparty defaults. Because PJM does not maintain regulatory capital, its risk management processes around credit risk management and margin are critical to PJM’s role in protecting the PJM market, and protecting PJM Members, from the consequences/losses that may result from a significant Market Participant default.

¹⁰⁹ See 17 C.F.R. § 39.13(g).

commodity swaps.¹¹⁰

The CFTC's regulations are important precedents because, in connection with the CFTC's implementation of the Dodd-Frank Act¹¹¹ amendments to the Commodity Exchange Act after the 2007-2008 crisis in the financial markets, the CFTC conducted an extensive review of the PJM markets and other RTO-run and ISO-run markets. Pursuant to that CFTC regulatory process, PJM, its markets and the transactions entered into in the PJM markets, were determined to be exempt from most aspects of regulation by the CFTC¹¹² in what came to be known as the "RTO Exemption Order" or the "RTO Exemption."¹¹³ In explaining its rationale for the RTO Exemption Order, the CFTC observed that, "[c]overed transactions [such as FTR's] are subject to a [Federal Energy Regulatory Commission] regulatory regime that is focused on the physical provision of reliable electric energy, and also has credit requirements that are designed to achieve risk management goals congruent with the regulatory objectives of the Commission's [CFTC] DCO and SEF Core Principles. Absent these and other similar limitations on participant- and financial-eligibility, the integrity of the markets at issue could be compromised, and members and ratepayers left unprotected from potentially significant losses resulting from purely financial, speculative activity."¹¹⁴ Initial margin based on a Market Participant's transaction portfolio and a market

¹¹⁰ Margin Requirements for Uncleared Swaps for Swap Dealers and Major Swap Participants, 86 Fed. Reg. 229 (Jan. 5, 2021) (to be codified at 17 C.F.R. part 23).

¹¹¹ The Dodd-Frank Wall Street Reform and Consumer Protection Act, Pub. L. 111-203, 124 Stat.1376 (2010) (codified in scattered sections of 12 U.S.C. and 18 U.S.C.).

¹¹² PJM and other RTO market transactions remain subject to the CFTC's anti-fraud and anti-market manipulation authority, as well as specific scienter-based prohibitions that exemplify a possible statutory basis for bringing an enforcement action, should there be a need for the CFTC to do so.

¹¹³ Final Order in Response to a Petition From Certain Independent System Operators and Regional Transmission Organizations to Exempt Specified Transactions Authorized by a Tariff or Protocol Approved by the Federal Energy Regulatory Commission of Texas from Certain Provisions of the Commodity Exchange Act Pursuant to the Authority Provided in the Act, 78 Fed. Reg. 19,880 (Apr. 2, 2013) ("RTO Exemption Order").

¹¹⁴ *Id.* at 19,911. "DCO" is a CFTC acronym for a derivatives clearing organization or CCP. A "SEF" is a CFTC acronym for a commodity swap execution facility, which is an exchange for trading commodity swaps.

model output with a high confidence interval and other features that PJM is proposing are outlined in the CFTC's Core Principles for DCO's, as discussed in section III.B below.

B. The Commission's Acceptance of PJM's Proposal to More Closely Align with Credit and Collateral Best Practices Would Be Consistent with the CFTC's Express Expectation that the Commission Will Advance Robust Credit Risk Management for Central Counter Parties, and Is Consistent with the Public Interest.

The Revised FTR Credit Requirement is just and reasonable as it provides enhanced protection to the PJM market and the PJM Members by requiring that all participants in the FTR markets adequately collateralize the risks that their ongoing participation represent to the PJM markets as a whole and to PJM Members.¹¹⁵ The Commission's acceptance of the proposal also will help fulfill the CFTC's expressed expectations, in the RTO Exemption Order, that the Commission will pursue robust credit risk management practices for CCPs such as PJM in relation to PJM's administration of the FTR auctions. In that sense, the proposal is both just and reasonable and also consistent with the public interest.

When the CFTC analyzed the RTO markets in the process of approving the RTO Exemption Order, the CFTC determined that transactions entered into under RTO tariffs are consistent with the public interest, recognizing that there is consistency in regulatory objectives

¹¹⁵ When the CFTC analyzed the RTO markets in the process of approving the RTO Exemption Order, the CFTC determined that transactions entered into under RTO tariffs are consistent with the public interest, recognizing that there is consistency in regulatory objectives between the CFTC's Core Principles for its regulated exchanges and central clearing counterparties and FERC's regulation 35.47. *See* RTO Exemption Order, 78 Fed. Reg. at 19,889. In its analysis, the CFTC focused in particular on the DCO Core Principle D calling for robust credit risk management for central counterparties, and cited the RTOs ongoing obligation to update their credit risk management policies and procedures pursuant to FERC Regulation 35.47. *See id.* at 19,901. The CFTC also focused on SEF Core Principle 7 requiring risk management requirements and credit policies and SEF Core Principle 14 requiring an ongoing program of risk analysis and oversight. *See id.* at 19,901-19,902. PJM's revised FTR Credit Requirements are consistent and congruent with this CFTC recognition that risk management in the commodity markets is a continuous process. By improving its risk management modeling and consistently updating the data underlying the model, while working to further reduce the potential for market losses in excess of margin held to cover losses to the PJM members, PJM is continuing to implement industry best practices for monitoring and managing risks to the market – consistently and congruently with the CFTC “public interest” analysis in the RTO Exemption Order.

between the CFTC's Core Principles for its regulated exchanges and central clearing counterparties and FERC's regulations at 18 CFR § 35.47.¹¹⁶ The CFTC also focused on SEF Core Principle 7 mandating risk management requirements and credit policies and SEF Core Principle 14 requiring an ongoing program of risk analysis and oversight. PJM's revised FTR Credit Requirements are consistent and congruent with this CFTC recognition that risk management in the commodity markets is a continuous process.

By improving its risk management model and consistently updating the data underlying the model, as well as implementing a high confidence level to reduce the potential for significant market losses in excess of margin held if an extreme weather event or another extreme market risk scenario should occur, PJM is demonstrating its policy of continuous improvement and is implementing industry best practices for monitoring and managing risks to its market—which is consistent and congruent with the CFTC's emphasis on continuing watchfulness in the “public interest” analysis in the RTO Exemption Order.

Nothing in the CFTC's regulation of commodity exchanges, CCPs or in the RTO Exemption Order requires FERC to approve PJM's revised FTR Credit Requirements. Nevertheless, the Commission would be acting in the public interest to support and enable PJM to enact these continuing efforts to enhance its credit risk management policies and practices to protect PJM Members from the potential consequences of a significant Market Participant default in the PJM FTR markets. As one Market Participant noted during the PJM stakeholder process, all PJM Members will bear the default costs *if* and *when* an FTR market default happens. It is PJM's responsibility to protect the PJM Members by collecting and maintaining adequate initial

¹¹⁶ See RTO Exemption Order, 78 Fed. Reg. at 19,889.

margin from FTR Market Participants, and continuing to evolve its risk management policies and procedures in keeping with industry best practices.¹¹⁷

C. PJM’s Adoption of the HSIM Is Consistent with Recognized Standards for Initial Margin Models.

PJM’s decision to adopt the HSIM model was based, in part, on consideration of the same factors considered by the International Swap and Derivatives Dealers Association, Inc. (“ISDA”) in adopting its protocols for its Standards for Initial Margin Model for Non-Cleared Derivatives. These nine factors (with limited exception) were considered and adopted by PJM in the development of its HSIM model. The ISDA standards determined that initial margin models should have to following factors: (1) non-procyclical or margins are not subject to continuous change; (2) ease of replication; (3) transparency; (4) quick to calculate; (5) extensible (or conducive to addition of new risk factors); (6) predictability; (7) reasonable costs; (8) governance; and (9) margin appropriateness.¹¹⁸

No.	Criteria	PJM ‘s Adoption of Principal in HSIM Model
1	Non-procyclical	Initial margin has shown to be a relatively stable risk mitigation tool as applied to an individual FTR Market Participant over time, provided that an FTR Market Participant’s portfolio does not change substantially.
2	Ease of replication	Initial margin calculations are relatively easy to replicate by or for a particular FTR Market Participant, given the same data inputs and portfolio of positions, such that FTR Market Participants should be able to validate and anticipate the model output.

¹¹⁷ *PJM Initial Margin: Model Validation Report*, KPMG (Jan. 20, 2021) (“KPMG Validation Letter”) (on file with author).

¹¹⁸ *ISDA Standard Initial Margin Model (SIMM™) for Non-Cleared Derivatives*, International Swaps and Derivatives Association, Inc., at 3 (Dec. 2013), <https://www.isda.org/a/4AiDE/march-26-simm-for-non-cleared-paper-appendix.pdf> (discussion of the nine criteria that a standard initial margin model should satisfy).

3	Transparency	Such calculation transparency builds confidence in market risk management and enables effective dispute resolution.
4	Quick to calculate	The ability to quickly calculate initial margin, as well as to re-run and validate the calculations as needed by FTR Market Participants, enables more efficient management of the margining process.
5	Extensible	Use of the model approach will make it easier to add or revise new data points, and new default scenarios or risk factors, if necessary or as required by regulators.
6	Predictability	Enables predictability of initial margin to allow FTR Market Participants to allocate capital to specific transactions or to aggregated portfolio positions
7	Costs	Initial margin does not create unreasonable barriers of entry to qualified FTR Participants
8	Governance	Adoption of HSIM was subject to PJM Stakeholder engagement and is subject to FERC regulation.
9	Margin appropriateness	The HSIM model will be used as a tool to compute the initial margin component of the FTR Credit Requirement. The FTR Credit Requirement incorporates other elements to address risk factor offsets.

D. The HSIM Model Better Uses Relevant Available Data to Support a Better Assessment of Financial Risk.

PJM used actual FTR auction path and price data from its monthly and annual FTR auctions from 2008¹¹⁹- through 2021 in the development of its HSIM model. Although the actual number of auctions during such time period is relatively small, the inputs nevertheless represent thousands of data points. For every year, there are 12 monthly auctions that are conducted from May of the current year to April of the next year. The first auction in May covers all 12 months: June – May the second auction covers 11 months: July – May, and so on. For example, FTR contracts bid in the August 2020 auction in July included the months of Aug2020, Sep2020, Oct2020, Nov2020, Dec2020, Jan2021, Feb2021, Mar2021, Apr2021, and May2021. Participant’s FTR positions for

¹¹⁹ PJM FTR auctions commenced in 2008.

every month are treated as a standalone portfolio, each with its own initial margin calculation.¹²⁰

Messrs. Wolkoff and Anderson note that, while the time period from 2008 to the present is “relatively short,” that period “ha[s] seen a number of events that were, at the time, unexpected,” and “therefore, for a portfolio of FTR transactions, the market price impact of unexpected market stress events of the past may well be captured in the associated historical data.”¹²¹

Moreover, under the proposed HSIM model, PJM will add data points to the model following each successive FTR auction, increasing the model’s data population as subsequent auctions are held—which is a notable improvement over the current approach of using only the most recent three years at any given time. In addition, under this approach, new participants in PJM’s FTR markets will benefit from the developing history of pricing the FTR paths that are included in the HSIM model, and will not be disadvantaged by needing to establish a history at PJM.

E. Back Testing Affirmed and Improved the HSIM Model’s Accuracy.

Back testing is a standard method for validating a particular trading or risk management methodology, such as the PJM HSIM model.¹²² As explained by Dr. Eydeland, “[t]he purpose of back-testing is to validate the model and verify that in practice the model performance is consistent with its theoretically expected characteristics, i.e., that in practice the model behaves as is expected in theory.”¹²³

¹²⁰ KPMG Validation Letter at section 1.3.1.

¹²¹ Wolkoff/Anderson Aff. at 15.

¹²² Eydeland Aff. at 4.

¹²³ *Id.* at 11.

PJM back tested the HSIM model to assess its accuracy.¹²⁴ Specifically, PJM back tested the HSIM model to analyze if the initial margin collected for a given FTR Market Participant's portfolio was sufficient to cover potential losses over the Liquidation Period, should the FTR Market Participant default following an FTR auction.¹²⁵ If the initial margin was not sufficient, this outcome was counted as a failure. The back-testing results are considered satisfactory if the total failure rate is in agreement with the model confidence interval. In the performed back-testing, the failure rate did not exceed 3% which is consistent with the model confidence interval of 97%. Specifically, PJM "back-tested results for 10,724 zonal path prices" and found only 139 failures, "indicating a failure rate of .013," i.e., 1.3%.¹²⁶ The successful back testing results permitted PJM to conclude that the back testing of the model supports the model methodology.¹²⁷

As explained by Dr. Eydeland, PJM's back-testing "additionally determined that (1) there was no concentration of failures within a particular subset of participants; (2) when failures occur, no single participant stands out and failures are evenly distributed; and (3) the failures are not clustered within a small group of participants."¹²⁸

Notably, PJM's back-testing indicated a potential market failure/loss rate for the current FTR Credit Requirement of 8%.¹²⁹ By contrast, as noted above, PJM's back-testing found a failure rate of only 1.3% for the proposed HSIM model. Moreover, the proposed PJM HSIM model with a confidence

¹²⁴ *Id.*

¹²⁵ *Id.*

¹²⁶ *Id.* at 12.

¹²⁷ *Id.* at 11.

¹²⁸ *Id.* at 12.

¹²⁹ *FRMSTF Phase II – Bid and Initial Margining Update*, PJM Interconnection, L.L.C. (July 16, 2021), <https://www.pjm.com/-/media/committees-groups/task-forces/frmstf/2021/20210716/20210716-item-03-frmstf-phase-ii-bid-and-initial-margining.ashx>.

interval of 97%, is by design expected to converge at 3% failure rate over time.¹³⁰ The HSIM model is therefore a considerable improvement over the status quo in terms of protection against the risks and costs of FTR Market Participant default.

F. The HSIM Model Has Been Validated by Independent Auditors.

The PJM HSIM model was submitted to the consulting firm of KPMG for validation.¹³¹ KPMG reviewed PJM's model, its assumptions and the back-testing of the model. KPMG verified that the model operated as intended, and that the resulting output of the model was as intended. The scope of KPMG's validation also included assessing the conceptual soundness of the PJM model's methodology and assumptions, data assessment, and implementation verification. The scope also included limited testing of the model implementation, and performing sensitivity analysis and stress testing of the model.

G. Use of PJM's HSIM Model is Reasonable, and Does Not Create Unreasonable Barriers to Entry.

PJM's adoption of the revised methodology to calculating FTR Credit Requirements and, in particular, use of the HSIM model and the 97% confidence interval does not present unreasonable barriers to entry into PJM's FTR markets. Instead, the change in methodology improves PJM's risk management process, allowing entry, but preventing certain Market Participants from taking on too much market risk, for which the FTR Market Participant cannot, or chooses not to, post adequate initial margin. Therefore, the new initial margin rules increase collateral for some FTR Market Participants only when the methodology calculates that such FTR

¹³⁰ Member Committee, PJM Perspectives on Main Motion and Initial Margin, PJM Interconnection, L.L.C., at 13 (Oct. 20, 2021), <https://pjm.com/-/media/committees-groups/committees/mc/2021/20211020/20211020-item-01b-pjm-perspectives-on-main-motion-and-initial-margin.ashx>.

¹³¹ See Eydeland Aff. at 12. The version of the model KPMG tested included a 99% confidence interval, but that does not change the validation test of whether the model operated as intended.

Market Participant's positions may represent unreasonable credit risk to PJM and PJM's Members.

Under the Revised FTR Credit Requirement, all FTR Market Participants are on a level playing field based on their risk profile to the PJM Markets and their risk tolerance for posting initial margin to increase their FTR portfolio. The Revised FTR Credit Requirement enhances PJM's ability to manage risk, and thus serves PJM's goal of protecting its markets against unreasonable credit risk, protecting smaller participants and load serving PJM Members with no other means to mitigate the risk of significant market losses they may incur from another FTR Market Participant's default in the PJM FTR market.¹³²

It is PJM's obligation to be the market gatekeeper, to be the market risk manager, and to protect PJM Members and their customers and end use energy consumers from the risks that an FTR Market Participant default will result in losses in excess of the initial margin collected from FTR Market Participants. Default by an FTR Market Participant, particularly a default that results in a material loss to the market, does not just potentially result in a cost/loss to that FTR Market Participant. It potentially results in a loss to PJM Members who are not active participants in the FTR markets, and thus could be those least likely to bear the costs of such a market loss. It is those PJM Members that look to PJM to manage and mitigate their risks by collecting an appropriate amount of initial margin using the FTR Credit Requirement to support ongoing FTR market activity. This proposal is just and reasonable in advancing that objective.

¹³² This goal is clearly "congruent" with the CFTC's guidance in the RTO Exemption Order, where the CFTC's public interest determination focuses on the FERC regulatory regime having credit requirements that are designed to achieve risk management goals congruent with those of the CFTC's Core Principles, such that "[a]bsent these and other similar limitations on participant- and financial-eligibility, the integrity of the markets at issue could be compromised, and members and ratepayers left unprotected from potentially significant losses resulting from purely financial, speculative activity." RTO Exemption Order, 78 Fed. Reg. at 19,911.

IV. INITIAL MARGIN MIGRATION PHASE

A. Parallel Production Process and Implementation

For informational purposes and to facilitate FTR Market Participants' adjustments to the new rules, PJM plans to run the HSIM model for a number of months in early 2022 to calculate illustrative FTR Credit Requirements. As FTR Market Participants input bids for FTR auctions, they will be able to see their FTR Credit Requirement under both the current effective Tariff rules and the revised rules proposed in this filing.

As part of PJM's stakeholder process to implement the proposed revised FTR Credit Requirement, PJM discussed with stakeholders this type of parallel processing period for informational purposes. During this period, PJM will also conduct training and education sessions using the current FTR Credit Requirement while concurrently permitting Members to access the HSIM model for planning purposes. This approach will allow FTR Market Participants to understand and become comfortable with the new FTR Credit Requirements, and give them better visibility into their collateral requirements for the upcoming April 2022 auction, for which these Tariff revisions are intended to become effective.

V. REQUEST FOR EFFECTIVE DATE OF APRIL 1, 2022

PJM requests that the enclosed revisions become effective on April 1, 2022, which is more than sixty days after the date of this filing.

As noted above, PJM also requests that the Commission issue its order on this filing by February 26, 2022, which sixty-seven days after the date of this filing (and thus is intended to accommodate the requested seven-day extension of the comment deadline). For that purpose, PJM has assigned an effective date of February 27, 2022, to one non-substantive eTariff record that is being submitted with this filing.

VI. COMMUNICATIONS

PJM requests that all communications regarding this filing be directed to the following persons:

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VII. ADDITIONAL INFORMATION

In accordance with section 35.13(a) (1) of the Commission's regulations, 18 C.F.R. § 35.13(a) (1), PJM provides the following information:

This filing consists of the following:

1. This transmittal letter;
2. Attachment A – Revisions to the PJM Tariff (marked);
3. Attachment B – Revisions to the PJM Tariff (clean);
4. Attachment C – Affidavit of Nigeria Bloczynski;
5. Attachment D – Affidavit of Neal Wolkoff and Robert Anderson;
6. Attachment E – Resume of Neal Wolkoff;
7. Attachment F – Resume of Robert Anderson; and
8. Attachment G – Affidavit and Exhibits of Dr. Alex Eydeland

VIII. SERVICE

PJM has served a copy of this filing on all PJM Members and on all state utility regulatory commissions in the PJM Region by posting this filing electronically. In accordance with the Commission's regulations,¹³³ PJM will post a copy of this filing to the FERC filings section of its internet site, located at the following link: <https://www.pjm.com/library/filing-order.aspx> with a specific link to the newly-filed document, and will send an email on the same date as this filing to all PJM Members and all state utility regulatory commissions in the PJM Region¹³⁴ alerting them that this filing has been made by PJM today, and is available by following such link.

¹³³ See 18 C.F.R §§ 35.2(e) and 385.2010(f)(3).

¹³⁴ PJM already maintains, updates, and regularly uses email lists for all PJM Members and affected commissions.

IX. CONCLUSION

In accordance with the foregoing, PJM respectfully requests that the Commission accept the proposed revisions to the Tariff effective April 1, 2022, as discussed herein.

Respectfully submitted,

/s/ Colleen E. Hicks

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On behalf of PJM Interconnection, L.L.C.

Attachment A

Revisions to the PJM Open Access Transmission Tariff

(Marked/Redline Format)

ATTACHMENT Q

CREDIT RISK MANAGEMENT POLICY

I. INTRODUCTION

It is the policy of PJM that prior to an entity participating in any PJM Markets or in order to take Transmission Service, the entity must demonstrate its ability to meet the requirements in this Attachment Q. This Attachment Q also sets forth PJM's authority to deny, reject, or terminate a Participant's right to participate in any PJM Markets in order to protect the PJM Markets and PJM Members from unreasonable credit risk from any Participant's activities. Given the interconnectedness and overlapping of their responsibilities, PJM Interconnection, L.L.C. and PJM Settlement, Inc. are referred to both individually and collectively herein as "PJM."

PURPOSE

PJMSettlement is the counterparty to transactions in the PJM Markets. As a consequence, if a Participant defaults on its obligations under this Attachment Q, or PJM determines a Participant represents unreasonable credit risk to the PJM Markets, and the Participant does not post Collateral, additional Collateral or Restricted Collateral in response to a Collateral Call, the result is that the Participant represents unsecured credit risk to the PJM Markets. For this reason, PJM must have the authority to monitor and manage credit risk on an ongoing basis, and to act promptly to mitigate or reduce any unsecured credit risk, in order to protect the PJM Markets and PJM Members from losses.

This Attachment Q describes requirements for: (1) eligibility to be a Market Participant, (2) establishment and maintenance of credit by Market Participants, and (3) collateral requirements and forms of credit support that will be deemed as acceptable to mitigate risk to any PJM Markets.

This Attachment Q also sets forth (1) PJM's authority to monitor and manage credit risk that a Participant may represent to the PJM Markets and/or PJM membership in general, (2) the basis for establishing limits that will be imposed on a Market Participant in order to minimize risk, and (3) various obligations and requirements the violation of which will result in an Event of Default pursuant to this Attachment Q and the Agreements.

Attachment Q describes the types of data and information PJM will review in order to determine whether an Applicant or Market Participant presents an unreasonable risk to any PJM Markets and/or PJM membership in general, and the steps PJM may take in order to address that risk.

APPLICABILITY

This Attachment Q applies to all Applicants and Market Participants who take Transmission Service under this Tariff, or participate in any PJM Markets or market activities under the Agreements. Notwithstanding anything to the contrary in this Attachment Q, simply taking

transmission service or procuring Ancillary Services via market-based rates does not imply market participation for purposes of applicability of this Attachment Q.

II. RISK EVALUATION PROCESS

PJM will conduct a risk evaluation to determine eligibility to become and/or remain a Market Participant or Guarantor that: (1) assesses the entity's financial strength, risk profile, creditworthiness, and other relevant factors; (2) determines an Unsecured Credit Allowance, if appropriate; (3) determines appropriate levels of Collateral; and (4) evaluates any Credit Support, including Guaranties or Letters of Credit.

A. Initial Risk Evaluation

PJM will perform an initial risk evaluation of each Applicant and/or its Guarantor. As part of the initial risk evaluation, PJM will consider certain Minimum Participation Requirements, assign an Internal Risk Score, establish an Unsecured Credit Allowance if appropriate, and make a determination regarding required levels of Collateral, creditworthiness, credit support, Restricted Collateral and other assurances for participation in certain PJM Markets.

Each Applicant and/or its Guarantor must provide the information set forth below at the time of its initial application pursuant to this Attachment Q and on an ongoing basis in order to remain eligible to participate in any PJM Markets. The same quantitative and qualitative factors will be used to evaluate Participants whether or not they have rated debt.

1. Rating Agency Reports

PJM will review Rating Agency reports from Standard & Poor's, Moody's Investors Service, Fitch Ratings, or other Nationally Recognized Statistical Rating Organization for each Applicant and/or Guarantor. The review will focus on the Applicant's or its Guarantor's senior unsecured debt ratings. If senior unsecured debt ratings are not available, PJM may consider other ratings, including issuer ratings, corporate ratings and/or an implied rating based on an internally derived Internal Credit Score pursuant to section II.A.3 below.

2. Financial Statements and Related Information

Each Applicant and/or its Guarantor must submit, or cause to be submitted, audited financial statements, except as otherwise indicated below, prepared in accordance with United States Generally Accepted Accounting Principles ("US GAAP") or any other format acceptable to PJM for the three (3) fiscal years most recently ended, or the period of existence of the Applicant and/or its Guarantor, if shorter. Applicants and/or their Guarantors must submit, or cause to be submitted, financial statements, which may be unaudited, for each completed fiscal quarter of the current fiscal year. All audited financial statements provided by the Applicant and/or its Guarantor must be audited by an Independent Auditor.

The information should include, but not be limited to, the following:

- (a) If the Applicant and/or its Guarantor has publicly traded securities:
- (i) Annual reports on Form 10-K, together with any amendments thereto;
 - (ii) Quarterly reports on Form 10-Q, together with any amendments thereto;
 - (iii) Form 8-K reports, if any, that have been filed since the most recent Form 10-K;
 - (iv) A summary provided by the Principal responsible, or to be responsible, for PJM Market activity of: (1) the Participant's primary purpose(s) of activity or anticipated activity in the PJM Markets (investment, trading or "hedging or mitigating commercial risks," as such phrase has meaning in the CFTC's regulations regarding the end-user exception to clearing); (2) the experience of the Participant (and its Principals) in managing risks in similar markets, including other organized RTO/ISO markets or on regulated commodity exchanges; and (3) a high level overview of the Participant's intended participation in the PJM Markets.
 - (v) All audited financial statements provided by an Applicant with publicly traded securities and/or its Guarantor with publicly traded securities must be audited by an Independent Auditor that satisfies the requirements set forth in the Sarbanes-Oxley Act of 2002.
- (b) If the Applicant and/or its Guarantor does not have publicly-traded securities:
- (i) Annual Audited Financial Statements or equivalent independently audited financials, and quarterly financial statements, generally found on:
 - Balance Sheets
 - Income Statements
 - Statements of Cash Flows
 - Statements of Stockholder's or Member's Equity or Net Worth;
 - (ii) Notes to Annual Audited Financial Statements, and notes to quarterly financial statements if any, including disclosures of any material changes from the last report;
 - (iii) Disclosure equivalent to a Management's Discussion & Analysis, including an executive overview of operating results and outlook, and compliance with debt covenants and indentures, and off balance sheet arrangements, if any;
 - (iv) Auditor's Report with an unqualified opinion or written letter from auditor containing the opinion whether the annual audited financial statements comply with the US GAAP or any other format acceptable to PJM; and

- (v) A summary provided by the Principal responsible or to be responsible for PJM Market activity of: (1) the Participant's primary purpose(s) of activity or anticipated activity in the PJM Markets (investment, trading or "hedging or mitigating commercial risks," as such phrase has meaning in the CFTC's regulations regarding the end-user exception to clearing); (2) the experience of the Participant (and its Principals) in managing risks in similar markets, including other organized RTO/ISO markets or on regulated commodity exchanges; and (3) a high level overview of the Participant's intended participation in the PJM Markets.
- (c) If Applicant and/or Guarantor is newly formed, does not yet have three (3) years of audited financials, or does not routinely prepare audited financial statements, PJM may specify other information to allow it to assess the entity's creditworthiness, including but not limited to:
 - (i) Equivalent financial information traditionally found in:
 - Balance Sheets
 - Income Statements
 - Statements of Cash Flows
 - (ii) Disclosure equivalent to a Management's Discussion & Analysis, including an executive overview of operating results and outlook, and compliance with debt covenants and indentures, and off balance sheet arrangements, if any; and
 - (iii) A summary provided by the Principal responsible or to be responsible for PJM Market activity of: (1) the Participant's primary purpose(s) of activity or anticipated activity in the PJM Markets (investment, trading or "hedging or mitigating commercial risks," as such phrase has meaning in the CFTC's regulations regarding the end-user exception to clearing); (2) the experience of the Participant (and its Principals) in managing risks in similar markets, including other organized RTO/ISO markets or on regulated commodity exchanges; and (3) a high level overview of the Participant's intended participation in the PJM Markets.
- (d) During a two year transition period from June 1, 2020 to May 31, 2022, the Applicant or Guarantor may provide a combination of audited financial statements and/or equivalent financial information.

If any of the above information in this section II.A.2 is available on the internet, the Applicant and/or its Guarantor may provide a letter stating where such statements can be located and retrieved by PJM. If an Applicant and/or its Guarantor files Form 10-K, Form 10-Q, or Form 8-K with the SEC, then the Applicant and/or its Guarantor will be deemed to have satisfied the requirement by indicating to PJM where the information in this section II.A.2 can be located on the internet.

If the Applicant and/or its Guarantor fails, for any reason, to provide the information required above in this section II.A.2, PJM has the right to (1) request Collateral and/or Restricted Collateral to cover the amount of risk reasonably associated with the Applicant and/or its Guarantor's expected activity in any PJM Markets, and/or (2) restrict the Applicant from participating in certain PJM Markets, including but not limited to restricting the positions the Applicant (once it becomes a Market Participant) takes in the market.

For certain Applicants and/or their Guarantors, some of the above submittals may not be applicable and alternate requirements for compliant submittals may be specified by PJM. In the credit evaluation of Municipalities and Cooperatives, PJM may also request additional information as part of the initial and ongoing review process and will consider other qualitative factors in determining financial strength and creditworthiness.

3. Credit Rating and Internal Credit Score

PJM will use credit risk scoring methodologies as a tool in determining an Unsecured Credit Allowance for each Applicant and/or its Guarantor. As its source for calculating the Unsecured Credit Allowance, PJM will rely on the ratings from a Rating Agency, if any, on the Applicant's or Guarantor's senior unsecured debt or their issuer ratings or corporate ratings if senior unsecured debt ratings are not available. If there is a split rating between the Rating Agencies, the lower of the ratings shall apply. If no external credit rating is available PJM will utilize its Internal Credit Score in order to calculate the Unsecured Credit Allowance.

The model used to develop the Internal Credit Score will be quantitative, based on financial data found in the income statement, balance sheet, and cash flow statement, and it will be qualitative based on relevant factors that may be internal or external to a particular Applicant and/or its Guarantor.

PJM will employ a framework, as outlined in Tables 1-5 below, based on metrics internal to the Applicant and/or its Guarantor, including capital and leverage, cash flow coverage of fixed obligations, liquidity, profitability, and other qualitative factors. The particular metrics and scoring rules differ according to the Applicant's or Guarantor's line of business and the PJM Markets in which it anticipates participating, in order to account for varying sources and degrees of risk to the PJM Markets and PJM members.

The formulation of each metric will be consistently applied to all Applicants and Guarantors across industries with slight variations based on identifiable differences in entity type, anticipated market activity, and risks to the PJM Markets and PJM members. In instances where the external credit rating is used to calculate the unsecured credit allowance, PJM may also use the Internal Credit Score as an input into determining the overall risk profile of an Applicant and/or its Guarantor.

Table 1. Quantitative Metrics by Line of Business: Leverage and Capital Structure	Investor-Owned Utilities	Municipal Utilities	Co-Operative Utilities	Power Transmission	Merchant Power	Project Developers	Exploration & Production	Financial Institutions	Commodity Trading	Private Equity
Debt / Total Capitalization (%)										
FFO / Debt (%)										
Debt / EBITDA (x)										
Debt / Property, Plant & Equipment (%)										
Retained Earnings / Total Assets (%)										
Debt / Avg Daily Production or Kwh (\$)										
Tangible Net Worth (\$)										
Core Capital / Total Assets (%)										
Risk-Based Capital / RWA (%)										
Tier 1 Capital / RWA (%)										
Equity / Investments (%)										
Debt / Investments (%)										

primary metric secondary metric

FFO = Funds From Operations RWA = Risk-Weighted Assets

Table 2. Quantitative Metrics by Line of Business: Fixed Charge Coverage and Funding	Investor-Owned Utilities	Municipal Utilities	Co-Operative Utilities	Power Transmission	Merchant Power	Project Developers	Exploration & Production	Financial Institutions	Commodity Trading	Private Equity
EBIT / Interest Expense (x)										
EBITDA / Interest Expense (x)										
EBITDA / [Interest Exp + CPLTD] (x)										
[FFO + Interest Exp] / Interest Exp (x)										
Loans / Total Deposits (%)										
NPL / Gross Loans (%)										
NPL / [Net Worth + LLR] (%)										
Market Funding / Tangible Bank Assets (%)										

primary metric secondary metric

CPLTD = Current Portion of Long-Term Debt EBIT = Earnings Before Interest and Taxes EBITDA = Earnings Before Interest, Taxes, Depreciation and Amortization LLR = Loan Loss Reserves NPL = Non-Performing Loans

Table 3. Quantitative Metrics by Line of Business: Liquidity	Investor-Owned Utilities	Municipal Utilities	Co-Operative Utilities	Power Transmission	Merchant Power	Project Developers	Exploration & Production	Financial Institutions	Commodity Trading	Private Equity
CFFO / Total Debt (x)										
Current Assets / Current Liabilities (x)										
Liquid Assets / Tangible Bank Assets (%)										
Sources / Uses of Funds (x)										
Weighted Avg Maturity of Debt (yrs)										
Floating Rate Debt / Total Debt (%)										
primary metric	secondary metric									

CFFO = Cash Flow From Operations

Table 4. Quantitative Metrics by Line of Business: Profitability	Investor-Owned Utilities	Municipal Utilities	Co-Operative Utilities	Power Transmission	Merchant Power	Project Developers	Exploration & Production	Financial Institutions	Commodity Trading	Private Equity
Return on Assets (%)										
Return on Equity (%)										
Profit Volatility (%)										
Return on Revenue (%)										
Net Income / Tangible Assets (%)										
Net Profit (\$)										
Net Income / Dividends (x)										
primary metric	secondary metric									

Table 5. Qualitative Factors: Industry Level	Sample Reference Metrics	Investor-Owned Utilities	Municipal Utilities	Co-Operative Utilities	Power Transmission	Merchant Power	Project Developers	Exploration & Production	Financial Institutions	Commodity Trading	Private Equity
Need for PJM Markets to Achieve Business Goals	Rating Agency criteria or other industry analysis	High	High	High	High	Med	Low	Med	Low	Low	N/A
Ability to Grow/Enter Markets other than PJM	Rating Agency criteria or other industry analysis	Very Low	Very Low	Very Low	Very Low	High	High	Med	Med	High	N/A

Other Participants' Ability to Serve Customers	Rating Agency criteria or other industry analysis	Low	Low	Low	Low	Low	Med	Low	Low	High	N/A
Regulation of Participant's Business	RRA regulatory climate scores, S&P BICRA	PUCS	Govt	N/A	FERC PUCs	N/A	N/A	N/A	N/A	N/A	N/A
Primary Purpose of PJM Activity	Investment ("Inv.")/ Trading ("Trade")/ Hedging or Mitigating Commercial Risk of Operations ("CRH")	CRH	CRH	CRH	CRH/ Trade	CRH/ Trade	CRH/ Trade	CRH/ Trade	Inv./ Trade	Inv./ Trade	Inv./ Trade

RRA = Regulatory Research Associates, a division of S&P Global, Inc.

BICRA = Bank Industry Country Risk Assessment

The scores developed will range from 1-6, with the following mappings:

- 1 = Very Low Risk (S&P/Fitch: AAA to AA-; Moody's: Aaa to Aa3)
- 2 = Low Risk (S&P/Fitch: A+ to BBB+; Moody's: A1 to Baa1)
- 3 = Low to Medium Risk (S&P/Fitch: BBB; Moody's: Baa2)
- 4 = Medium Risk (S&P/Fitch: BBB-; Moody's: Baa3)
- 5 = Medium to High Risk (S&P/Fitch: BB+ to BB; Moody's Ba1 to Ba2)
- 6 = High Risk (S&P/Fitch: BB- and below; Moody's: Ba3 and below)

4. Trade References

If deemed necessary by PJM, whether because the Applicant is newly or recently formed or for any other reason, each Applicant and/or its Guarantor shall provide at least one (1) bank reference and three (3) Trade References to provide PJM with evidence of Applicant's understanding of the markets in which the Applicant is seeking to participate and the Applicant's experience and ability to manage risk. PJM may contact the bank references and Trade References provided by the Applicant to verify their business experience with the Applicant.

5. Litigation and Contingencies

Unless prohibited by law, each Applicant and Guarantor is also required to disclose and provide information as to the occurrence of, within the five (5) years prior to the submission of the information to PJM (i) any litigation, arbitration, investigation (formal inquiry initiated by a governmental or regulatory entity), or proceeding, pending or, to the knowledge of the involving, Applicant or its Guarantor or any of their Principals that would likely have a material adverse impact on its financial condition and/or would likely materially affect the risk of non-payment by the Applicant or Guarantor, or (ii) any finding of material defalcation, market

manipulation or fraud by or involving the Applicant, Guarantor, or any of their Principals, predecessors, subsidiaries, or Credit Affiliates that participate in any United States power markets based upon a final adjudication of regulatory and/or legal proceedings, (iii) any bankruptcy declarations or petitions by or against an Applicant and/or Guarantor, or (iv) any violation by any of the foregoing of any federal or state regulations or laws regarding energy commodities, U.S. Commodity Futures Trading Commission (“CFTC”) or FERC requirements, the rules of any exchange monitored by the National Futures Association, any self-regulatory organization or any other governing, regulatory, or standards body responsible for regulating activity in North American markets for electricity, natural gas or electricity-related commodity products. Each Applicant and Guarantor shall take reasonable measures to obtain permission to disclose information related to a non-public investigation. These disclosures shall be made by Applicant and Guarantor upon application, and within ten (10) Business Days of any material change with respect to any of the above matters.

6. History of Defaults in Energy Projects

Each Applicant and Guarantor shall disclose their current default status and default history for any energy related generation or transmission project (e.g. generation, solar, development), and within any wholesale or retail energy market, including but not limited to within PJM, any Independent System Operator or Regional Transmission Organization, and exchange that has not been cured within the past five (5) years. Defaults of a non-recourse project financed entity may not be included in the default history.

7. Other Disclosures and Additional Information

Each Applicant and Guarantor is required to disclose any Credit Affiliates that are currently Members of PJM, applying for membership with PJM, Transmission Customers, Participants, applying to become Market Participants, or that participate directly or indirectly in any PJM Markets or any other North American markets for electricity, natural gas or electricity-related commodity products. Each Applicant and Guarantor shall also provide a copy of its limited liability company agreement or equivalent agreement, certification of formation, articles of incorporation or other similar organization document, offering memo or equivalent, the names of its five (5) most senior Principals, and information pertaining to any non-compliance with debt covenants and indentures.

Applicants shall provide PJM the credit application referenced in section III.A and any other information or documentation reasonably required for PJM to perform the initial risk evaluation of Applicant’s or Guarantor’s creditworthiness and ability to comply with the requirements contained in the Agreements related to settlements, billing, credit requirements, and other financial matters.

B. Supplemental Risk Evaluation Process

As described in section VI below, PJM will conduct a supplemental risk evaluation process for Applicants, Participants, and Guarantors applying to conduct virtual and export transactions or participate in any PJM Markets.

C. Unsecured Credit Allowance

A Market Participant may request that PJM consider it for an Unsecured Credit Allowance pursuant to the provisions herein. Notwithstanding the foregoing, an FTR Participant shall not be considered for an Unsecured Credit Allowance for participation in the FTR markets.

1. Unsecured Credit Allowance Evaluation

PJM will perform a credit evaluation on each Participant that has requested an Unsecured Credit Allowance, both initially and at least annually thereafter. PJM shall determine the amount of Unsecured Credit Allowance, if any, that can be provided to the Market Participant in accordance with the creditworthiness and other requirements set forth in this Attachment Q. In completing the credit evaluation, PJM will consider:

(a) Rating Agency Reports

PJM will review Rating Agency reports as for each Market Participant on the same basis as described in section II.A.1 above and section II.E.1 below.

(b) Financial Statements and Related Information

All financial statements and related information considered for an Unsecured Credit Allowance must satisfy all of the same requirements described in section II.A.2 above and section II.E.2 below.

2. Material Adverse Changes

Each Market Participant is responsible for informing PJM, in writing, of any Material Adverse Change in its financial condition (or the financial condition of its Guarantor) since the date of the Market Participant or Guarantor's most recent annual financial statements provided to PJM, pursuant to the requirements reflected in section II.A.2 above and section II.E.3 below.

In the event that PJM determines that a Material Adverse Change in the financial condition of a Market Participant warrants a requirement to provide Collateral, additional Collateral or Restricted Collateral, PJM shall comply with the process and requirements described in section II.A above and section II.E below.

3. Other Disclosures

Each Market Participant desiring an Unsecured Credit Allowance is required to make the disclosures and upon the same requirements reflected in section II.A.7 above and section II.E.7 below.

D. Determination of Unreasonable Credit Risk

Unreasonable credit risk shall be determined by the likelihood that an Applicant will default on a financial obligation arising from its participation in any PJM Markets. Indicators of potentially

unreasonable credit risk include, but are not limited to, a history of market manipulation based upon a final adjudication of regulatory and/or legal proceedings, a history of financial defaults, a history of bankruptcy or insolvency within the past five (5) years, or a combination of current market and financial risk factors such as low capitalization, a reasonably likely future material financial liability, a low Internal Credit Score (derived pursuant to section II.A.3 above) and/or a low externally derived credit score. PJM's determination will be based on, but not limited to, information and material provided to PJM during its initial risk evaluation process, information and material provided to PJM in the Officer's Certification, and/or information gleaned by PJM from public and non-public sources.

If PJM determines that an Applicant poses an unreasonable credit risk to the PJM Markets, PJM may require Collateral, additional Collateral, or Restricted Collateral commensurate with the Applicant's risk of financial default, reject an application, and/or limit or deny Applicant's participation in the PJM Markets, to the extent and for the time period it determines is necessary to mitigate the unreasonable credit risk to the PJM Markets. PJM will reject an application if it determines that Collateral, additional Collateral, or Restricted Collateral cannot address the risk.

PJM will communicate its concerns regarding whether the Applicant presents an unreasonable credit risk, if any, in writing to the Applicant and attempt to better understand the circumstances surrounding that Applicant's financial and credit position before making its determination. In the event PJM determines that an Applicant presents an unreasonable credit risk that warrants a requirement to provide Collateral of any type, or some action to mitigate risk, PJM shall provide the Applicant with a written explanation of why such determination was made.

E. Ongoing Risk Evaluation

In addition to the initial risk evaluation set forth in sections II.A through II.D above and the annual certification requirements set forth in section III.A below, each Market Participant and/or its Guarantor has an ongoing obligation to provide PJM with the information required in section IV.A described in more detail below. PJM may also review public information regarding a Market Participant and/or its Guarantor as part of its ongoing risk evaluation. If appropriate, PJM will revise the Market Participant's Unsecured Credit Allowance and/or change its determination of creditworthiness, credit support, Restricted Collateral, required Collateral or other assurances pursuant to PJM's ongoing risk evaluation process.

Each Market Participant and/or its Guarantor must provide the information set forth below on an ongoing basis in order to remain eligible to participate in any PJM Markets. The same quantitative and qualitative factors will be used to evaluate Market Participants whether or not they have rated debt.

1. Rating Agency Reports

PJM will review Rating Agency reports for each Market Participant and/or Guarantor on the same basis as described in section II.A.1 above.

2. Financial Statements and Related Information

On an ongoing basis, Market Participants and/or their Guarantors shall provide the information they are required to provide as described in section II.A.2 above, pursuant to the schedule reflected below, with one exception. With regard to the summary that is required to be provided by the Principal responsible for PJM Market activity, with respect to experience of the Participant or its Principals in managing risks in similar markets, the Principal only needs to provide that information for a new Principal that was not serving in the position when the prior summary was provided. PJM will review financial statements and related information for each Market Participant and/or Guarantor on the same basis as described in section II.A.2 above.

Each Market Participant and/or its Guarantor must submit, or cause to be submitted, annual audited financial statements, except as otherwise indicated below, prepared in accordance with US GAAP or any other format acceptable to PJM for the fiscal year most recently ended within ten (10) calendar days of the financial statements becoming available and no later than one hundred twenty (120) calendar days after its fiscal year end. Market Participants and/or their Guarantors must submit, or cause to be submitted, financial statements, which may be unaudited, for each completed fiscal quarter of the current fiscal year, promptly upon their issuance, but no later than sixty (60) calendar days after the end of each fiscal quarter. All audited financial statements provided by the Market Participant and/or its Guarantor must be audited by an Independent Auditor.

Notwithstanding the foregoing, PJM may upon request, grant a Market Participant or Guarantor an extension of time, if the financials are not available within the time frame stated above.

3. Material Adverse Changes

Each Market Participant and each Guarantor is responsible for informing PJM, in writing, of any Material Adverse Change in its or its Guarantor's financial condition within five (5) Business Days of any Principal becoming aware of the occurrence of a Material Adverse Change since the date of the Market Participant or Guarantor's most recent annual financial statements provided to PJM. However, PJM may also independently establish from available information that a Participant and/or its Guarantor has experienced a Material Adverse Change in its financial condition without regard to whether such Market Participant or Guarantor has informed PJM of the same.

For the purposes of this Attachment Q, a Material Adverse Change in financial condition may include, but is not be limited to, any of the following:

- (a) a bankruptcy filing;
- (b) insolvency;
- (c) a significant decrease in market capitalization;
- (d) restatement of prior financial statements unless required due to regulatory changes;
- (e) the resignation or removal of a Principal unless there is a new Principal appointed or expected to be appointed, a transition plan in place pending the appointment of a new Principal, or a planned restructuring of such roles;

- (f) the filing of a lawsuit or initiation of an arbitration, investigation, or other proceeding that would likely have a material adverse effect on any current or future financial results or financial condition or increase the likelihood of non-payment;
- (g) a material financial default in any other organized energy, ancillary service, financial transmission rights and/or capacity markets including but not limited to those of another Regional Transmission Organization or Independent System Operator, or on any commodity exchange, futures exchange or clearing house, that has not been cured or remedied after any required notice has been given and any cure period has elapsed;
- (h) a revocation of a license or other authority by any Federal or State regulatory agency; where such license or authority is necessary or important to the Participant's continued business, for example, FERC market-based rate authority, or State license to serve retail load;
- (i) a significant change in credit default swap spreads, market capitalization, or other market-based risk measurement criteria, such as a recent increase in Moody's KMV Expected Default Frequency (EDFtm) that is materially greater than the increase in its peers' EDFtm rates, or a collateral default swap (CDS) premium normally associated with an entity rated lower than investment grade;
- (j) a confirmed, undisputed material financial default in a bilateral arrangement with another Participant or counterparty that has not been cured or remedied after any required notice has been given and any cure period has elapsed;
- (k) the sale by a Participant of all or substantially all of its bilateral position(s) in the PJM Markets;
- (l) any adverse changes in financial condition which, individually, or in the aggregate, are material; and,
- (m) any adverse changes, events or occurrences which, individually or in the aggregate, could affect the ability of the entity to pay its debts as they become due or could reasonably be expected to have a material adverse effect on any current or future financial results or financial condition.

Upon identification of a Material Adverse Change, PJM shall evaluate the financial strength and risk profile of the Market Participant and/or its Guarantor at that time and may do so on a more frequent basis going forward. If the result of such evaluation identifies unreasonable credit risk to any PJM Market as further described in section II.E.8 below, PJM will take steps to mitigate the financial exposure to the PJM Markets. These steps include, but are not limited to requiring the Market Participant and/or each Guarantor to provide Collateral, additional Collateral or additional Restricted Collateral that is commensurate with the amount of risk in which the Market Participant wants to engage, and/or limiting the Market Participant's ability to participate in any PJM Market to the extent, and for the time-period necessary to mitigate the unreasonable credit risk. In the event PJM determines that a Material Adverse Change in the financial condition or risk profile of a Market Participant and/or Guarantor, warrants a requirement to provide Collateral of any type, or some action to mitigate risk, PJM shall provide the Market Participant and/or Guarantor, a written explanation of why such determination was made. Conversely, in the event PJM determines there has been an improvement in the financial condition or risk profile of a Market Participant and/or Guarantor such that the amount of

Collateral needed for that Market Participant and/or Guarantor can be reduced, PJM shall provide a written explanation why such determination was made, including the amount of the Collateral reduction and indicating when and how the reduction will be made.

4. Litigation and Contingencies

Each Market Participant and/or Guarantor is required to disclose and provide information regarding litigation and contingencies as outlined in section II.A.5 above.

5. History of Defaults in Energy Projects

Each Market Participant and/or Guarantor is required to disclose current default status and default history as outlined in section II.A.6 above.

6. Internal Credit Score

As part of its ongoing risk evaluation, PJM will use credit risk scoring methodologies as a tool in determining an Internal Credit Score for each Market Participant and/or Guarantor, utilizing the same model and framework outlined in section II.A.3 above.

7. Other Disclosures and Additional Information

Each Market Participant and/or Guarantor is required to make other disclosures and provide additional information outlined in section II.A.7 above.

PJM will monitor each Market Participant's use of services and associated financial obligations on a regular basis to determine their total potential financial exposure and for credit monitoring purposes, and may require the Market Participant and/or Guarantor to provide additional information, pursuant to the terms and provisions described herein.

Market Participants shall provide PJM, upon request, any information or documentation reasonably required for PJM to monitor and evaluate a Market Participant's creditworthiness and compliance with the Agreements related to settlements, billing, credit requirements, and other financial matters.

8. Unreasonable Credit Risk

If PJM has reasonable grounds to believe that a Market Participant and/or its Guarantor poses an unreasonable credit risk to any PJM Markets, PJM may immediately notify the Market Participant of such unreasonable credit risk and (1) issue a Collateral Call to demand Collateral, additional Collateral, or Restricted Collateral or other assurances commensurate with the Market Participant's and/or its Guarantor's risk of financial default or other risk posed by the Market Participant's or Guarantor's financial condition or risk profile to the PJM Markets and PJM members, or (2) limit or suspend the Market Participant's participation in any PJM Markets, to the extent and for such time period PJM determines is necessary to mitigate the unreasonable credit risk to any PJM Markets. PJM will only limit or suspend a Market Participant's market

participation if Collateral, additional Collateral or Restricted Collateral cannot address the unreasonable credit risk.

PJM's determination will be based on, but not limited to, information and material provided to PJM during its ongoing risk evaluation process or in the Officer's Certification, and/or information gleaned by PJM from public and non-public sources. PJM will communicate its concerns, if any, in writing to the Market Participant and attempt to better understand the circumstances surrounding the Market Participant's financial and credit position before making its determination. At PJM's request or upon its own initiative, the Market Participant or its Guarantor may provide supplemental information to PJM that would allow PJM to consider reducing the additional Collateral requested or reducing the severity of limitations or other restrictions designed to mitigate the Market Participant's credit risk. Such information shall include, but not be limited to: (i) the Market Participant's estimated exposure, (ii) explanations for any recent change in the Market Participant's market activity, (iii) any relevant new load or unit outage information; or (iv) any default or supply contract expiration, termination or suspension.

The Market Participant shall have five (5) Business Days to respond to PJM's request for supplemental information. If the requested information is provided in full to PJM's satisfaction during said period, the additional Collateral requirement shall reflect the Market Participant's anticipated exposure based on the information provided. Notwithstanding the foregoing, any additional Collateral requested by PJM in a Collateral Call must be provided by the Market Participant within the applicable cure period.

In the event PJM determines that an Market Participant and/or its Guarantor presents an unreasonable credit risk, as described above, that warrants a requirement to provide Collateral of any type, or some action to mitigate risk, PJM shall provide the Market Participant with a written explanation of why such final determination was made.

PJM has the right at any time to modify any Unsecured Credit Allowance and/or require additional Collateral as may be deemed reasonably necessary to support current or anticipated market activity as set forth in Tariff, Attachment Q, sections II.A.2 and II.C.1.b. Failure to remit the required amount of additional Collateral within the applicable cure period shall constitute an Event of Default.

F. Collateral and Credit Restrictions

PJM may establish certain restrictions on available credit by requiring that some amounts of credit, i.e. Restricted Collateral, may not be available to satisfy credit requirements. Such designations shall be construed to be applicable to the calculation of credit requirements only, and shall not restrict PJM's ability to apply such designated credit to any obligation(s) in case of a default. Any such Restricted Collateral will be held by PJM, as applicable. Such Restricted Collateral will not be returned to the Participant until PJM has determined that the risk for which such Restricted Collateral is being held has subsided or been resolved.

PJM may post on PJM's web site, and may reference on OASIS, a supplementary document which contains additional business practices (such as algorithms for credit scoring) that are not included in this Attachment Q. Changes to the supplementary document will be subject to stakeholder review and comment prior to implementation. PJM may specify a required compliance date, not less than fifteen (15) calendar days from notification, by which time all Participants and their Guarantors must comply with provisions that have been revised in the supplementary document.

PJM will regularly post each Participant's and/or its Guarantor's credit requirements and credit provisions on the PJM web site in a secure, password-protected location. Each Participant and/or its Guarantor is responsible for monitoring such information, and maintaining sufficient credit to satisfy the credit requirements described herein. Failure to maintain credit sufficient to satisfy the credit requirements of the Attachment Q shall constitute a Credit Breach, and the Participant will be subject to the remedies established herein and in any of the Agreements.

G. Unsecured Credit Allowance Calculation

The external rating from a Rating Agency will be used as the source for calculating the Unsecured Credit Allowance, unless no external credit rating is available in which case PJM will utilize its Internal Credit Score for such purposes. If there is a split rating between the Rating Agencies, the lower of the ratings shall apply.

Where two or more entities, including Participants, are considered Credit Affiliates, Unsecured Credit Allowances will be established for each individual Participant, subject to an aggregate maximum amount for all Credit Affiliates as provided for in Attachment Q, section II.G.3.

In its credit evaluation of Municipalities and Cooperatives, PJM may request additional information as part of the ongoing risk evaluation process and will also consider qualitative factors in determining financial strength and creditworthiness.

1. Credit Rating and Internal Credit Score

As previously described in section II.A.3 above, PJM will determine the Internal Credit Score for an Applicant, Market Participant and/or its Guarantor using the credit risk scoring methodologies contained therein. Internal Credit Scores, ranging from 1-6, for each Applicant, Market Participant and/or its Guarantor, will be determined with the following mappings:

- 1 = Very Low Risk (S&P/Fitch: AAA to AA-; Moody's: Aaa to Aa3)
- 2 = Low Risk (S&P/Fitch: A+ to BBB+; Moody's: A1 to Baa1)
- 3 = Low to Medium Risk (S&P/Fitch: BBB; Moody's: Baa2)
- 4 = Medium Risk (S&P/Fitch: BBB-; Moody's: Baa3)
- 5 = Medium to High Risk (S&P/Fitch: BB+ to BB; Moody's Ba1 to Ba2)
- 6 = High Risk (S&P/Fitch: BB- and below; Moody's: Ba3 and below)

In instances where the external credit rating is used to calculate the unsecured credit allowance, PJM may also use the Internal Credit Score as an input into its determination of the overall risk profile of an Applicant and/or its Guarantor

2. Unsecured Credit Allowance

PJM will determine a Participant's Unsecured Credit Allowance based on its external rating or its Internal Credit Score, as applicable, and the parameters in the table below. The maximum Unsecured Credit Allowance is the lower of:

- (a) A percentage of the Participant's Tangible Net Worth, as stated in the table below, with the percentage based on the Participant's external rating or Internal Credit Score, as applicable; and
- (b) A dollar cap based on the external rating or Internal Credit Score, as applicable, as stated in the table below:

Internal Credit Score	Risk Ranking	Tangible Net Worth Factor	Maximum Unsecured Credit Allowance (\$ Million)
1.00 – 1.99	1 – Very Low (AAA to AA-)	Up to 10.00%	\$50
2.00 – 2.99	2 – Low (A+ to BBB+)	Up to 8.00%	\$42
3.00 – 3.49	3 – Low to Medium (BBB)	Up to 6.00%	\$33
3.50 – 4.49	4 – Medium (BBB-)	Up to 5.00%	\$7
4.50 – 5.49	5 – Medium to High (BB+ to BB)	0%	\$0
> 5.49	6 – High (BB- and below)	0%	\$0

If a Corporate Guaranty is utilized to establish an Unsecured Credit Allowance for a Participant, the value of a Corporate Guaranty will be the lesser of:

- (a) The limit imposed in the Corporate Guaranty;
- (b) The Unsecured Credit Allowance calculated for the Guarantor; and
- (c) A portion of the Unsecured Credit Allowance calculated for the Guarantor in the case of Credit Affiliates.

PJM has the right at any time to modify any Unsecured Credit Allowance and/or require additional Collateral as may be deemed reasonably necessary to support current market activity.

Failure to remit the required amount of additional Collateral within the applicable cure period shall be deemed an Event of Default.

PJM will maintain a posting of each Participant's Unsecured Credit Allowance, along with certain other credit related parameters, on the PJM website in a secure, password-protected location. Each Participant will be responsible for monitoring such information and recognizing changes that may occur.

3. Unsecured Credit Limits For Credit Affiliates

If two or more Participants are Credit Affiliates and have requested an Unsecured Credit Allowance, PJM will consider the overall creditworthiness of the Credit Affiliates when determining the Unsecured Credit Allowances in order not to establish more Unsecured Credit for the Credit Affiliates collectively than the overall corporate family could support.

Example: Participants A and B each have a \$10.0 million Corporate Guaranty from their common parent, a holding company with an Unsecured Credit Allowance calculation of \$12.0 million. PJM may limit the Unsecured Credit Allowance for each Participant to \$6.0 million, so the total Unsecured Credit Allowance does not exceed the corporate family total of \$12.0 million.

PJM will work with the Credit Affiliates to allocate the total Unsecured Credit Allowance among the Credit Affiliates while assuring that no individual Participant, nor common guarantor, exceeds the Unsecured Credit Allowance appropriate for its credit strength. The aggregate Unsecured Credit for a Participant, including Unsecured Credit Allowance granted based on its own creditworthiness and risk profile, and any Unsecured Credit Allowance conveyed through a Guaranty shall not exceed \$50 million. The aggregate Unsecured Credit for a Credit Affiliates corporate family shall not exceed \$50 million. A Credit Affiliate corporate family subject to this cap shall request PJM to allocate the maximum Unsecured Credit amongst the corporate family, assuring that no individual Participant or common guarantor, shall exceed the Unsecured Credit level appropriate for its credit strength and activity.

H. Contesting an Unsecured Credit Evaluation

PJM will provide to a Participant, upon request, a written explanation for any determination of or change in Unsecured Credit or credit requirement within ten (10) Business Days of receiving such request.

If a Participant believes that either its level of Unsecured Credit or its credit requirement has been incorrectly determined, according to this Attachment Q, then the Participant may send a request for reconsideration in writing to PJM. Such a request should include:

- (1) A citation to the applicable section(s) of this Attachment Q along with an explanation of how the respective provisions of this Attachment Q were not carried out in the determination as made; and

- (2) A calculation of what the Participant believes should be the appropriate Unsecured Credit or Collateral requirement, according to terms of this Attachment Q.

PJM will provide a written response as promptly as practical, but no more than ten (10) Business Days after receipt of the request. If the Participant still feels that the determination is incorrect, then the Participant may contest that determination. Such contest should be in written form, addressed to PJM, and should contain:

- (1) A complete copy of the Participant's earlier request for reconsideration, including citations and calculations;
- (2) A copy of PJM's written response to its request for reconsideration; and
- (3) An explanation of why it believes that the determination still does not comply with this Attachment Q.

PJM will investigate and will respond to the Participant with a final determination on the matter as promptly as practical, but no more than twenty (20) Business Days after receipt of the request.

Neither requesting reconsideration nor contesting the determination following such request shall relieve or delay Participant's responsibility to comply with all provisions of this Attachment Q, including without limitation posting Collateral, additional Collateral or Restricted Collateral in response to a Collateral Call.

If a Corporate Guaranty is being utilized to establish credit for a Participant, the Guarantor will be evaluated and the Unsecured Credit Allowance granted, if any, based on the financial strength and creditworthiness, and risk profile of the Guarantor. Any utilization of a Corporate Guaranty will only be applicable to non-FTR credit requirements, and will not be applicable to cover FTR credit requirements.

PJM will identify any necessary Collateral requirements and establish a Working Credit Limit for each Participant. Any Unsecured Credit Allowance will only be applicable to non-FTR credit requirements, for positions in PJM Markets other than the FTR market, because all FTR credit requirements must be satisfied by posting Collateral.

III. MINIMUM PARTICIPATION REQUIREMENTS

A Participant seeking to participate in any PJM Markets shall submit to PJM any information or documentation reasonably required for PJM to evaluate its experience and resources. If PJM determines, based on its review of the relevant information and after consultation with the Participant, that the Participant's participation in any PJM Markets presents an unreasonable credit risk, PJM may reject the Participant's application to become a Market Participant, notwithstanding applicant's ability to meet other minimum participation criteria, registration requirements and creditworthiness requirements.

A. Annual Certification

Before they are eligible to transact in any PJM Market, all Applicants shall provide to PJM (i) an executed copy of a credit application and (ii) a copy of the annual certification set forth in Attachment Q, Appendix 1. As a condition to continued eligibility to transact in any PJM Market, Market Participants shall provide to PJM the annual certification set forth in Attachment Q, Appendix 1.

After the initial submission, the annual certification must be submitted each calendar year by all Market Participants between January 1 and April 30. PJM will accept such certifications as a matter of course and the Market Participants will not need further notice from PJM before commencing or maintaining their eligibility to participate in any PJM Markets.

A Market Participant that fails to provide its annual certification by April 30 shall be ineligible to transact in any PJM Markets and PJM will disable the Market Participant's access to any PJM Markets until such time as PJM receives the certification. In addition, failure to provide an executed annual certification in a form acceptable to PJM and by the specified deadlines may result in a default under the Tariff.

Market Participants acknowledge and understand that the annual certification constitutes a representation upon which PJM will rely. Such representation is additionally made under the Tariff, filed with and accepted by FERC, and any false, misleading or incomplete statement knowingly made by the Market Participant and that is material to the Market Participant's ability to perform may be considered a violation of the Tariff and subject the Market Participant to action by FERC. Failure to comply with any of the criteria or requirements listed herein or in the certification may result in suspension or limitation of a Market Participant's transaction rights in any PJM Markets.

Applicants and Market Participants shall submit to PJM, upon request, any information or documentation reasonably and/or legally required to confirm Applicant's or Market Participant's compliance with the Agreements and the annual certification.

B. PJM Market Participation Eligibility Requirements

PJM may conduct periodic verification to confirm that Applicants and Market Participants can demonstrate that they meet the definition of "appropriate person" to further ensure minimum criteria are in place. Such demonstration will consist of the submission of evidence and an executed Annual Officer Certification form as set forth in Attachment Q, Appendix 1 in a form acceptable to PJM. If an Applicant or Market Participant does not provide sufficient evidence for verification to PJM within five (5) Business Days of written request, then such Applicant or Market Participant may result in a default under this Tariff. Demonstration of "appropriate person" status and support of other certifications on the annual certification is one part of the Minimum Participation Requirements for any PJM Markets and does not obviate the need to meet the other Minimum Participation Requirements such as those for minimum capitalization and risk profile as set forth in this Attachment Q.

To be eligible to transact in any PJM Markets, an Applicant or Participant must demonstrate in accordance with the Risk Management and Verification processes set forth below that it qualifies in one of the following ways:

1. an “appropriate person,” as that term is defined under Commodity Exchange Act, section 4(c)(3), or successor provision, or;
2. an “eligible contract participant,” as that term is defined in Commodity Exchange Act, section 1a(18), or successor provision, or;
3. a business entity or person who is in the business of: (1) generating, transmitting, or distributing electric energy, or (2) providing electric energy services that are necessary to support the reliable operation of the transmission system, or;
4. an Applicant or Market Participant seeking eligibility as an “appropriate person” providing an unlimited Corporate Guaranty in a form acceptable to PJM as described in section V below from a Guarantor that has demonstrated it is an “appropriate person,” and has at least \$1 million of total net worth or \$5 million of total assets per Applicant and Market Participant for which the Guarantor has issued an unlimited Corporate Guaranty, or;
5. an Applicant or Market Participant providing a Letter of Credit of at least \$5 million to PJM in a form acceptable to PJM as described in section V below, that the Applicant or Market Participant acknowledges is separate from, and cannot be applied to meet, its credit requirements to PJM, or;
6. an Applicant or Market Participant providing a surety bond of at least \$5 million to PJM in a form acceptable to PJM as described in section V below, that the Applicant or Market Participant acknowledges is separate from, and cannot be applied to meet, its credit requirements to PJM.

If, at any time, a Market Participant cannot meet the eligibility requirements set forth above, it shall immediately notify PJM and immediately cease conducting transactions in any PJM Markets. PJM may terminate a Market Participant’s transaction rights in any PJM Markets if, at any time, it becomes aware that the Market Participant does not meet the minimum eligibility requirements set forth above.

In the event that a Market Participant is no longer able to demonstrate it meets the minimum eligibility requirements set forth above, and possesses, obtains or has rights to possess or obtain, any open or forward positions in any PJM Markets, PJM may take any such action it deems necessary with respect to such open or forward positions, including, but not limited to, liquidation, transfer, assignment or sale; provided, however, that the Market Participant will, notwithstanding its ineligibility to participate in any PJM Markets, be entitled to any positive market value of those positions, net of any obligations due and owing to PJM.

C. Risk Management and Verification

All Market Participants must maintain current written risk management policies, procedures, or controls to address how market and credit risk is managed, and are required to submit to PJM (at the time they make their annual certification) a copy of their current governing risk control policies, procedures and controls applicable to their market activities. PJM will review such documentation to verify that it appears generally to conform to prudent risk management practices for entities participating in any PJM Markets.

All Market Participants subject to this provision shall make a one-time payment of \$1,500.00 to PJM to cover administrative costs. Thereafter, if such Participant's risk policies, procedures and controls applicable to its market activities change substantively, it shall submit such modified documentation, with applicable administrative charge determined by PJM, to PJM for review and verification at the time it makes its annual certification. All Market Participant's continued eligibility to participate in any PJM Markets is conditioned on PJM notifying a Participant that its annual certification, including the submission of its risk policies, procedures and controls, has been accepted by PJM. PJM may retain outside expertise to perform the review and verification function described in this section, however, in all circumstances, PJM and any third-party it may retain will treat as confidential the documentation provided by a Participant under this section, consistent with the applicable provisions of the Operating Agreement.

Participants must demonstrate that they have implemented prudent risk management policies and procedures in order to be eligible to participate in any PJM Markets. Participants must demonstrate on at least an annual basis that they have implemented and maintained prudent risk management policies and procedures in order to continue to participate in any PJM Markets. Upon written request, the Participant will have fourteen (14) calendar days to provide to PJM current governing risk management policies, procedures, or controls applicable to Participant's activities in any PJM Markets.

D. Capitalization

In advance of certification, Applicants shall meet the minimum capitalization requirements below. In addition to the annual certification requirements in Attachment Q, Appendix 1, a Market Participant shall satisfy the minimum capitalization requirements on an annual basis thereafter. A Participant must demonstrate that it meets the minimum financial requirements appropriate for the PJM Markets in which it transacts by satisfying either the minimum capitalization or the provision of Collateral requirements listed below:

1. Minimum Capitalization

Minimum capitalization may be met by demonstrating minimum levels of Tangible Net Worth or tangible assets. FTR Participants must demonstrate a Tangible Net Worth in excess of \$1 million or tangible assets in excess of \$10 million. Other Market Participants must demonstrate a Tangible Net Worth in excess of \$500,000 or tangible assets in excess of \$5 million.

(a) Consideration of tangible assets and Tangible Net Worth shall exclude assets which PJM reasonably believes to be restricted, highly risky, or potentially unavailable to settle a claim in

the event of default. Examples include, but are not limited to, restricted assets, derivative assets, goodwill, and other intangible assets.

(b) Demonstration of “tangible” assets and Tangible Net Worth may be satisfied through presentation of an acceptable Corporate Guaranty, provided that both:

- (i) the Guarantor is a Credit Affiliate company that satisfies the Tangible Net Worth or tangible assets requirements herein, and;
- (ii) the Corporate Guaranty is either unlimited or at least \$500,000.

If the Corporate Guaranty presented by the Participant to satisfy these capitalization requirements is limited in value, then the Participant’s resulting Unsecured Credit Allowance shall be the lesser of:

- (1) the applicable Unsecured Credit Allowance available to the Participant by the Corporate Guaranty pursuant to the creditworthiness provisions of this Attachment Q, or,
- (2) the face value of the Corporate Guaranty, reduced by \$500,000 and further reduced by 10%. (For example, a \$10.5 million Corporate Guaranty would be reduced first by \$500,000 to \$10 million and then further reduced 10% more to \$9 million. The resulting \$9 million would be the Participant’s Unsecured Credit Allowance available through the Corporate Guaranty).

In the event that a Participant provides Collateral in addition to a limited Corporate Guaranty to increase its available credit, the value of such Collateral shall be reduced by 10%. This reduced value shall be considered the amount available to satisfy requirements of this Attachment Q.

(c) Demonstrations of minimum capitalization (minimum Tangible Net Worth or tangible assets) must be presented in the form of audited financial statements for the Participant’s most recent fiscal year during the initial risk evaluation process and ongoing risk evaluation process.

2. Provision of Collateral

If a Participant does not demonstrate compliance with its applicable minimum capitalization requirements above, it may still qualify to participate in any PJM Markets by posting Collateral, additional Collateral, and/or Restricted Collateral, subject to the terms and conditions set forth herein.

Any Collateral provided by a Participant unable to satisfy the minimum capitalization requirements above will also be restricted in the following manner:

- (a) Collateral provided by Market Participants that engage in FTR transactions shall be reduced by an amount of the current risk plus any future risk to any PJM Markets and PJM membership in general, and may coincide with limitations on market participation. The amount of this Restricted Collateral shall not be available to cover any credit requirements from market activity. The remaining value shall be considered the amount available to satisfy requirements of this Attachment Q.
- (b) Collateral provided by other Participants that engage in Virtual Transactions or Export Transactions shall be reduced by \$200,000 and then further reduced by 10%. The amount of this Restricted Collateral shall not be available to cover any credit requirements from market activity. The remaining value shall be considered the amount available to satisfy requirements of this Attachment Q.
- (c) Collateral provided by other Participants that do not engage in Virtual Transactions or Export Transactions shall be reduced by 10%. The amount of this Restricted Collateral shall not be available to cover any credit requirements from market activity. The remaining value shall be considered the amount available to satisfy requirements of this Attachment Q.

In the event a Participant that satisfies the minimum capital requirement through provision of Collateral also provides a Corporate Guaranty to increase its available credit, then the Participant's resulting Unsecured Credit Allowance conveyed through such Corporate Guaranty shall be the lesser of:

- (a) the applicable Unsecured Credit Allowance available to the Participant by the Corporate Guaranty pursuant to the creditworthiness provisions of this Attachment Q; or
- (b) the face value of the Corporate Guaranty, reduced commensurate with the amount of the current risk plus any anticipated future risk to any PJM Markets and PJM membership in general, and may coincide with limitations on market participation.

IV. ONGOING COVENANTS

A. Ongoing Obligation to Provide Information to PJM

So long as a Participant is eligible to participate, or participates or holds positions, in any PJM Markets, it shall deliver to PJM, in form and detail satisfactory to PJM:

- (1) All financial statements and other financial disclosures as required by section II.E.2 by the deadline set forth therein;
- (2) Notice, within five (5) Business Days, of any Principal becoming aware that the Participant does not meet the Minimum Participation Requirements set forth in section III;
- (3) Notice when any Principal becomes aware of any matter that has resulted or would reasonably be expected to result in a Material Adverse Change in the financial condition of the Participant or its Guarantor, if any, a description of such Material Adverse Change in detail reasonable to allow PJM to determine its potential effect on, or any change in, the Participant's risk profile as a participant in any PJM Markets, by the deadline set forth in section II.E.3 above;
- (4) Notice, within the deadline set forth therein, of any Principal becoming aware of a litigation or contingency event described in section II.E.4, or of a Material Adverse Change in any such litigation or contingency event previously disclosed to PJM, information in detail reasonable to allow PJM to determine its potential effect on, or any change in, the Market Participant's risk profile as a participant in any PJM Markets by the deadline set forth therein;
- (5) Notice, within two (2) Business Days after any Principal becomes aware of a Credit Breach, Financial Default, or Credit Support Default, that includes a description of such default or event and the Participant's proposals for addressing the default or event;
- (6) As soon as available but not later than April 30th of any calendar year, the annual Certification described in section III.A in a form set forth in Attachment Q, Appendix 1;
- (7) Concurrently with submission of the annual certification, demonstration that the Participant meets the minimum capitalization requirements set forth in section III.D;
- (8) Concurrently with submission of the annual certification and within the applicable deadline of any substantive change, or within the applicable deadline of a request from PJM, a copy of the Participant's written risk management policies, procedures or controls addressing how the Participant manages market and credit risk in the PJM Markets in which it participates, as well as a high level summary by the chief risk officer or other Principal regarding any material violations, breaches, or compliance or disciplinary actions related to the risk management policies, by the Participant under the policies, procedures or controls within the prior 12 months, as set forth in section IV.B below;
- (9) Within five (5) Business Days of request by PJM, evidence demonstrating the Participant meets the definition of "appropriate person" or "eligible contract participant," as those terms are defined in the Commodity Exchange Act and the CFTC regulations promulgated thereunder, or of any other certification in the annual Certification; or

- (10) Within a reasonable time after PJM requests, any other information or documentation reasonably and/or legally required by PJM to confirm Participant's compliance with the Tariff and its eligibility to participate in any PJM Markets.

Participants acknowledge and understand that the deliveries constitute representations upon which PJM will rely in allowing the Participant to continue to participate in its markets, with the Internal Credit Score and Unsecured Credit Allowance, if any, previously determined by PJM.

B. Risk Management Review

PJM shall also conduct a periodic compliance verification process to review and verify, as applicable, Participants' risk management policies, practices, and procedures pertaining to the Participant's activities in any PJM Markets. PJM shall review such documentation to verify that it appears generally to conform to prudent risk management practices for entities trading in any PJM Markets. Participant shall also provide a high level summary by the chief risk officer or other Principal regarding any material violations, breaches, or compliance or disciplinary actions in connection with such risk management policies, practices and procedures within the prior twelve (12) months.

If a third-party industry association publishes or modifies principles or best practices relating to risk management in North American markets for electricity, natural gas or electricity-related commodity products, PJM may, following stakeholder discussion and with no less than six (6) months prior notice to stakeholders, consider such principles or best practices in evaluating the Participant's risk controls.

PJM will prioritize the verification of risk management policies based on a number of criteria, including but not limited to how long the entity has been in business, the Participant's and its Principals' history of participation in any PJM Markets, and any other information obtained in determining the risk profile of the Participant.

Each Participant's continued eligibility to participate in any PJM Markets is conditioned upon PJM notifying the Participant of successful completion of PJM's verification of the Participant's risk management policies, practices and procedures, as discussed herein. However, if PJM notifies the Participant in writing that it could not successfully complete the verification process, PJM shall allow such Participant fourteen (14) calendar days to provide sufficient evidence for verification prior to declaring the Participant as ineligible to continue to participate in any PJM Markets, which declaration shall be in writing with an explanation of why PJM could not complete the verification. If the Participant does not provide sufficient evidence for verification to PJM within the required cure period, such Participant will be considered in default under this Tariff. PJM may retain outside expertise to perform the review and verification function described in this paragraph. PJM and any third party it may retain will treat as confidential the documentation provided by a Participant under this paragraph, consistent with the applicable provisions of the Agreements. If PJM retains such outside expertise, a Participant may direct in writing that PJM perform the risk management review and verification for such Participant instead of utilizing a third party, provided however, that employees and contract employees of PJM and PJM shall not be considered to be such outside expertise or third parties.

Participants are solely responsible for the positions they take and the obligations they assume in any PJM Markets. PJM hereby disclaims any and all responsibility to any Participant or PJM

Member associated with Participant's submitting or failure to submit its annual certification or PJM's review and verification of a Participant's risk policies, procedures and controls. Such review and verification is limited to demonstrating basic compliance by a Participant showing the existence of written policies, procedures and controls to limit its risk in any PJM Markets and does not constitute an endorsement of the efficacy of such policies, procedures or controls.

V. FORMS OF CREDIT SUPPORT

In order to satisfy their PJM credit requirements Participants may provide credit support in a PJM-approved form and amount pursuant to the guidelines herein, provided that, notwithstanding anything to the contrary in this section, a Market Participant in PJM's FTR markets shall meet its credit support requirements related to those FTR markets with either cash or Letters of Credit.

Unless otherwise restricted by PJM, credit support provided may be used by PJM to secure the payment of Participant's financial obligations under the Agreements.

Collateral which may no longer be required to be maintained under provisions of the Agreements, shall be returned at the request of a Participant, no later than two (2) Business Days following determination by PJM within a commercially reasonable period of time that such Collateral is not required.

Except when an Event of Default has occurred, a Participant may substitute an approved PJM form of Collateral for another PJM approved form of Collateral of equal value.

A. Cash Deposit

Cash provided by a Participant as Collateral will be held in a depository account by PJM. Interest shall accrue to the benefit of the Participant, provided that PJM may require Participants to provide appropriate tax and other information in order to accrue such interest credits.

PJM may establish an array of investment options among which a Participant may choose to invest its cash deposited as Collateral. The depository account shall be held in PJM's name in a banking or financial institution acceptable to PJM. Where practicable, PJM may establish a means for the Participant to communicate directly with the bank or financial institution to permit the Participant to direct certain activity in the PJM account in which its Collateral is held. PJM will establish and publish procedural rules, identifying the investment options and respective discounts in Collateral value that will be taken to reflect any liquidation, market and/or credit risk presented by such investments.

Cash Collateral may not be pledged or in any way encumbered or restricted from full and timely use by PJM in accordance with terms of the Agreements.

PJM has the right to liquidate all or a portion of the Collateral account balance at its discretion to satisfy a Participant's Total Net Obligation to PJM in the Event of Default under this Attachment Q or one or more of the Agreements.

B. Letter of Credit

An unconditional, irrevocable standby Letter of Credit can be utilized to meet the Collateral requirement. As stated below, the form, substance, and provider of the Letter of Credit must all be acceptable to PJM.

- (1) The Letter of Credit will only be accepted from U.S.-based financial institutions or U.S. branches of foreign financial institutions (“financial institutions”) that have a minimum corporate debt rating of “A” by Standard & Poor’s or Fitch Ratings, or “A2” from Moody’s Investors Service, or an equivalent short term rating from one of these agencies. PJM will consider the lowest applicable rating to be the rating of the financial institution. If the rating of a financial institution providing a Letter of Credit is lowered below A/A2 by any Rating Agency, then PJM may require the Participant to provide a Letter of Credit from another financial institution that is rated A/A2 or better, or to provide a cash deposit. If a Letter of Credit is provided from a U.S. branch of a foreign institution, the U.S. branch must itself comply with the terms of this Attachment Q, including having its own acceptable credit rating.
- (2) The Letter of Credit shall state that it shall renew automatically for successive one-year periods, until terminated upon at least ninety (90) calendar days prior written notice from the issuing financial institution. If PJM or PJM receives notice from the issuing financial institution that the current Letter of Credit is being cancelled or expiring, the Participant will be required to provide evidence, acceptable to PJM, that such Letter of Credit will be replaced with appropriate Collateral, effective as of the cancellation date of the Letter of Credit, no later than thirty (30) calendar days before the cancellation date of the Letter of Credit, and no later than ninety (90) calendar days after the notice of cancellation. Failure to do so will constitute a default under this Attachment Q and one or more of the Agreements.
- (3) PJM will post on its web site an acceptable standard form of a Letter of Credit that should be utilized by a Participant choosing to submit a Letter of Credit to establish credit at PJM. If the Letter of Credit varies in any way from the standard format, it must first be reviewed and approved by PJM. All costs associated with obtaining and maintaining a Letter of Credit and meeting the Attachment Q provisions are the responsibility of the Participant.
- (4) PJM may accept a Letter of Credit from a financial institution that does not meet the credit standards of this Attachment Q provided that the Letter of Credit has third-party support, in a form acceptable to PJM, from a financial institution that does meet the credit standards of this Attachment Q.

C. Corporate Guaranty

An irrevocable and unconditional Corporate Guaranty may be utilized to establish an Unsecured Credit Allowance for a Participant. Such credit will be considered a transfer of Unsecured Credit from the Guarantor to the Participant, and will not be considered a form of Collateral.

PJM will post on its web site an acceptable form that should be utilized by a Participant choosing to establish its credit with a Corporate Guaranty. If the Corporate Guaranty varies in any way from the PJM format, it must first be reviewed and approved by PJM before it may be applied to satisfy the Participant's credit requirements.

The Corporate Guaranty must be signed by an officer of the Guarantor, and must demonstrate that it is duly authorized in a manner acceptable to PJM. Such demonstration may include either a corporate seal on the Corporate Guaranty itself, or an accompanying executed and sealed secretary's certificate from the Guarantor's corporate secretary noting that the Guarantor was duly authorized to provide such Corporate Guaranty and that the person signing the Corporate Guaranty is duly authorized, or other manner acceptable to PJM.

PJM will evaluate the creditworthiness of a Guarantor and will establish any Unsecured Credit granted through a Corporate Guaranty using the methodology and requirements established for Participants requesting an Unsecured Credit Allowance as described herein. Foreign Guaranties and Canadian Guaranties shall be subject to additional requirements as established herein. If PJM determines at any time that a Material Adverse Change in the financial condition of the Guarantor has occurred, or if the Corporate Guaranty comes within thirty (30) calendar days of expiring without renewal, PJM may reduce or eliminate any Unsecured Credit afforded to the Participant through the guaranty. Such reduction or elimination may require the Participant to provide Collateral within the applicable cure period. If the Participant fails to provide the required Collateral, the Participant shall be in default under this Attachment Q.

All costs associated with obtaining and maintaining a Corporate Guaranty and meeting the Attachment Q provisions are the responsibility of the Participant.

1. Foreign Guaranties

A Foreign Guaranty is a Corporate Guaranty that is provided by a Credit Affiliate entity that is domiciled in a country other than the United States or Canada. The entity providing a Foreign Guaranty on behalf of a Participant is a Foreign Guarantor. A Participant may provide a Foreign Guaranty in satisfaction of part of its credit obligations or voluntary credit provision at PJM provided that all of the following conditions are met:

PJM reserves the right to deny, reject, or terminate acceptance of any Foreign Guaranty at any time, including for material adverse circumstances or occurrences.

- (a) A Foreign Guaranty:
 - (i) Must contain provisions equivalent to those contained in PJM's standard form of Foreign Guaranty with any modifications subject to review and approval by PJM counsel.
 - (ii) Must be denominated in US currency.
 - (iii) Must be written and executed solely in English, including any duplicate originals.
 - (iv) Will not be accepted towards a Participant's Unsecured Credit Allowance for more than the following limits, depending on the Foreign Guarantor's credit rating:

Rating of Foreign Guarantor	Maximum Accepted Guaranty if Country Rating is AAA	Maximum Accepted Guaranty if Country Rating is AA+
A- and above	USD50,000,000	USD30,000,000
BBB+	USD30,000,000	USD20,000,000
BBB	USD10,000,000	USD10,000,000
BBB- or below	USD 0	USD 0

- (v) May not exceed 50% of the Participant's total credit, if the Foreign Grantor is rated less than BBB+.
- (b) A Foreign Guarantor:
- (i) Must satisfy all provisions of this Attachment Q applicable to domestic Guarantors.
 - (ii) Must be a Credit Affiliate of the Participant.
 - (iii) Must maintain an agent for acceptance of service of process in the United States; such agent shall be situated in the Commonwealth of Pennsylvania, absent legal constraint.
 - (iv) Must be rated by at least one Rating Agency acceptable to PJM; the credit strength of a Foreign Guarantor may not be determined based on an evaluation of its audited financial statements without an actual credit rating as well.
 - (v) Must have a senior unsecured (or equivalent, in PJM's sole discretion) rating of BBB (one notch above BBB-) or greater by any and all agencies that provide rating coverage of the entity.
 - (vi) Must provide audited financial statements, in US GAAP format or any other format acceptable to PJM, with clear representation of net worth, intangible assets, and any other information PJM may require in order to determine the entity's Unsecured Credit Allowance.
 - (vii) Must provide a Secretary's Certificate from the Participant's corporate secretary certifying the adoption of Corporate Resolutions:
 - 1. Authorizing and approving the Guaranty; and
 - 2. Authorizing the Officers to execute and deliver the Guaranty on behalf of the Guarantor.
 - (viii) Must be domiciled in a country with a minimum long-term sovereign (or equivalent) rating of AA+/Aa1, with the following conditions:
 - 1. Sovereign ratings must be available from at least two rating agencies acceptable to PJM (e.g. S&P, Moody's, Fitch, DBRS).
 - 2. Each agency's sovereign rating for the domicile will be considered to be the lowest of: country ceiling, senior unsecured government debt, long-term foreign currency sovereign rating, long-term local currency sovereign rating, or other equivalent measures, at PJM's sole discretion.
 - 3. Whether ratings are available from two or three agencies, the lowest of the two or three will be used.
 - (ix) Must be domiciled in a country that recognizes and enforces judgments of US courts.

- (x) Must demonstrate financial commitment to activity in the United States as evidenced by one of the following:
 - 1. American Depositary Receipts (ADR) are traded on the New York Stock Exchange, American Stock Exchange, or NASDAQ.
 - 2. Equity ownership worth over USD 100,000,000 in the wholly-owned or majority owned subsidiaries in the United States.
- (xi) Must satisfy all other applicable provisions of the PJM Tariff and/or Operating Agreement, including this Attachment Q.
- (xii) Must pay for all expenses incurred by PJM related to reviewing and accepting a foreign guaranty beyond nominal in-house credit and legal review.
- (xiii) Must, at its own cost, provide PJM with independent legal opinion from an attorney/solicitor of PJM's choosing and licensed to practice law in the United States and/or Guarantor's domicile, in form and substance acceptable to PJM in its sole discretion, confirming the enforceability of the Foreign Guaranty, the Guarantor's legal authorization to grant the Guaranty, the conformance of the Guaranty, Guarantor, and Guarantor's domicile to all of these requirements, and such other matters as PJM may require in its sole discretion.

2. Canadian Guaranties

The entity providing a Canadian Guaranty on behalf of a Participant is a Canadian Guarantor. A Participant may provide a Canadian Guaranty in satisfaction of part of its credit obligations or voluntary credit provision at PJM provided that all of the following conditions are met.

PJM reserves the right to deny, reject, or terminate acceptance of any Canadian Guaranty at any time for reasonable cause, including material adverse circumstances or occurrences.

- (a) A Canadian Guaranty:
 - (i) Must contain provisions equivalent to those contained in PJM's standard form of Foreign Guaranty with any modifications subject to review and approval by PJM counsel.
 - (ii) Must be denominated in US currency.
 - (iii) Must be written and executed solely in English, including any duplicate originals.
- (b) A Canadian Guarantor:
 - (i) Must be a Credit Affiliate of the Participant.
 - (ii) Must satisfy all provisions of this Attachment Q applicable to domestic Guarantors.
 - (iii) Must maintain an agent for acceptance of service of process in the United States; such agent shall be situated in the Commonwealth of Pennsylvania, absent legal constraint.
 - (iv) Must be rated by at least one Rating Agency acceptable to PJM; the credit strength of a Canadian Guarantor may not be determined based on an evaluation of its audited financial statements without an actual credit rating as well.
 - (v) Must provide audited financial statements, in US GAAP format or any other format acceptable to PJM with clear representation of net worth, intangible assets,

and any other information PJM may require in order to determine the entity's Unsecured Credit Allowance.

- (vi) Must satisfy all other applicable provisions of the PJM Tariff and/or Operating Agreement, including this Attachment Q.

D. Surety Bond

An unconditional, irrevocable surety bond can be utilized to meet the Collateral requirement for Participants. As stated below, the form, substance, and provider of the surety bond must all be acceptable to PJM.

- (i) An acceptable surety bond must be payable immediately upon demand without prior demonstration of the validity of the demand. The surety bond will only be accepted from a U.S. Treasury-listed approved surety that has either (i) a minimum corporate debt rating of “A” by Standard & Poor’s or Fitch Ratings, or “A2” from Moody’s Investors Service, or an equivalent short term rating from one of these agencies, or (ii) a minimum insurer rating of “A” by A.M. Best. PJMSettlement will consider the lowest applicable rating to be the rating of the surety. If the rating of a surety providing a surety bond is lowered below A/A2 by any rating agency, then PJMSettlement may require the Participant to provide a surety bond from another surety that is rated A/A2 or better, or to provide another form of Collateral.
- (ii) The surety bond shall have an initial period of at least one year, and shall state that it shall renew automatically for successive one-year periods, until terminated upon at least ninety (90) days prior written notice from the issuing surety. If PJM receives notice from the issuing surety that the current surety bond is being cancelled, the Participant will be required to provide evidence, acceptable to PJM, that such surety bond will be replaced with appropriate Collateral, effective as of the cancellation date of the surety bond, no later than thirty (30) days before the cancellation date of the surety bond, and no later than ninety (90) days after the notice of cancellation. Failure to do so will constitute a default under this Attachment Q and one of more of the Agreements enabling PJM to immediately demand payment of the full value of the surety bond.
- (iii) PJM will post on its web site an acceptable standard form of a surety bond that should be utilized by a Participant choosing to submit a surety bond to establish credit at PJM. The acceptable standard form of surety bond will include non-negotiable provisions, including but not be limited to, a payment on demand feature, requirement that the bond be construed pursuant to Pennsylvania law, making the surety’s obligation to pay out on the bond absolute and unconditional irrespective of the principal’s (Market Participant’s) bankruptcy, terms of any other agreements, investigation of the Market Participant by any entity or governmental authority, or PJM first attempting to collect payment from the Market Participant, and will require, among other things, that (a) the surety waive *all* rights that would be available to a principal or surety under the law, including

but not limited to any right to investigate or verify any matter related to a demand for payment, rights to set-off amounts due by PJM to the Market Participant, and all counterclaims, (b) the surety expressly waive ***all*** of its and the principal's defenses, including illegality, fraud in the inducement, reliance on statements or representations of PJM and every other typically available defense; (c) the language of the bond that is determinative of the surety's obligation, and not the underlying agreement or arrangement between the principal and the obligee; (d) the bond shall not be conditioned on PJM first resorting to any other means of security or collateral, or pursuing any other remedies it may have; and (e) the surety acknowledge the continuing nature of its obligations in the event of termination or nonrenewal of the surety bond to make clear the surety remains liable for any obligations that arose before the effective date of its notice of cancellation of the surety bond. If the surety bond varies in any way from the standard format, it must first be reviewed and approved by PJM. PJM shall not accept any surety bond that varies in any material way from the standard format.

- (iv) All costs associated with obtaining and maintaining a surety bond and meeting the Attachment Q provisions are the responsibility of the Participant.
- (v) PJM shall not accept surety bonds with an aggregate value greater than \$10 million dollars (\$10,000,000) issued by any individual surety on behalf of any individual Participant.
- (vi) PJM shall not accept surety bonds with an aggregate value greater than \$50 million dollars (\$50,000,000) issued by any individual surety.

E. PJM Administrative Charges

Collateral or credit support held by PJM shall also secure obligations to PJM for PJM administrative charges, and may be liquidated to satisfy all such obligations in an Event of Default.

F. Collateral and Credit Support Held by PJM

Collateral or credit support submitted by Participants and held by PJM shall be held by PJM for the benefit of PJM.

VI. SUPPLEMENTAL CREDIT REQUIREMENTS FOR SCREENED TRANSACTIONS

A. Virtual and Export Transaction Screening

1. Credit for Virtual and Export Transactions

Export Transactions and Virtual Transactions both utilize Credit Available for Virtual Transactions to support their credit requirements.

PJM does not require a Market Participant to establish separate or additional credit for submitting Virtual or Export Transactions; however, once transactions are submitted and accepted by PJM, PJM may require credit supporting those transactions to be held until the transactions are completed and their financial impact incorporated into the Market Participant's Obligations. If a Market Participant chooses to establish additional Collateral and/or Unsecured Credit Allowance in order to increase its Credit Available for Virtual Transactions, the Market Participant's Working Credit Limit for Virtual Transactions shall be increased in accordance with the definition thereof. The Collateral and/or Unsecured Credit Allowance available to increase a Market Participant's Credit Available for Virtual Transactions shall be the amount of Collateral and/or Unsecured Credit Allowance available after subtracting any credit required for Minimum Participation Requirements, FTR, RPM or other credit requirement determinants defined in this Attachment Q, as applicable.

If a Market Participant chooses to provide additional Collateral in order to increase its Credit Available for Virtual Transactions PJM may establish a reasonable timeframe, not to exceed three months, for which such Collateral must be maintained. PJM will not impose such restriction on a deposit unless a Market Participant is notified prior to making the deposit. Such restriction, if applied, shall be applied to all future deposits by all Market Participants engaging in Virtual Transactions.

A Market Participant may increase its Credit Available for Virtual Transactions by providing additional Collateral to PJM. PJM will make a good faith effort to make new Collateral available as Credit Available for Virtual Transactions as soon as practicable after confirmation of receipt. In any event, however, Collateral received and confirmed by noon on a Business Day will be applied (as provided under this Attachment Q) to Credit Available for Virtual Transactions no later than 10:00 am on the following Business Day. Receipt and acceptance of wired funds for cash deposit shall mean actual receipt by PJM's bank, deposit into PJM's customer deposit account, confirmation by PJM that such wire has been received and deposited, and entry into PJM's credit system. Receipt and acceptance of letters of credit or surety bonds shall mean receipt of the original Letter of Credit or surety bond, or amendment thereto, confirmation from PJM's credit and legal staffs that such Letter of Credit or surety bond, or amendment thereto conforms to PJM's requirements, which confirmation shall be made in a reasonable and practicable timeframe, and entry into PJM's credit system. To facilitate this process, bidders submitting additional Collateral for the purpose of increasing their Credit Available for Virtual Transactions are advised to submit such Collateral well in advance of the desired time, and to specifically notify PJM of such submission.

A Market Participant wishing to submit Virtual or Export Transactions must allocate within PJM's credit system the appropriate amount of Credit Available for Virtual Transactions to the virtual and export allocation sections within each customer account in which it wishes to submit such transactions.

2. Virtual Transaction Screening

All Virtual Transactions submitted to PJM shall be subject to a credit screen prior to acceptance in the Day-ahead Energy Market. The credit screen is applied separately for each of a Market Participant's customer accounts. The credit screen process will automatically reject Virtual Transactions submitted by the Market Participant in a customer account if the Market Participant's Credit Available for Virtual Transactions, allocated on a customer account basis, is exceeded by the Virtual Credit Exposure that is calculated based on the Market Participant's Virtual Transactions submitted, as described below.

A Market Participant's Virtual Credit Exposure will be calculated separately for each customer account on a daily basis for all Virtual Transactions submitted by the Market Participant for the next Operating Day using the following equation:

Virtual Credit Exposure = INC and DEC Exposure + Up-to Congestion Exposure
Where:

(a) INC and DEC Exposure for each customer account is calculated as:

(i) ((the total MWh bid or offered, whichever is greater, hourly at each node) x the Nodal Reference Price x 1 day) summed over all nodes and all hours; plus (ii) ((the difference between the total bid MWh cleared and total offered MWh cleared hourly at each node) x Nodal Reference Price) summed over all nodes and all hours for the previous cleared Day-ahead Energy Market.

(b) Up-to Congestion Exposure for each customer account is calculated as:

(i) Total MWh bid hourly for each Up-to Congestion Transaction x (price bid – Up-to Congestion Reference Price) summed over all Up-to Congestion Transactions and all hours; plus (ii) Total MWh cleared hourly for each Up-to Congestion Transaction x (cleared price – Up-to Congestion Reference Price) summed over all Up-to Congestion Transactions and all hours for the previous cleared Day-ahead Energy Market, provided that hours for which the calculation for an Up-to Congestion Transaction is negative, it shall be deemed to have a zero contribution to the sum.

3. Export Transaction Screening

Export Transactions in the Real-time Energy Market shall be subject to Export Transaction Screening. Export Transaction Screening may be performed either for the duration of the entire Export Transaction, or separately for each time interval comprising an Export Transaction. PJM will deny or curtail all or a portion (based on the relevant time interval) of an Export Transaction if that Export Transaction, or portion thereof, would otherwise cause the Market Participant's Export Credit Exposure to exceed its Credit Available for Export Transactions. Export Transaction Screening shall be applied separately for each Operating Day and shall also be applied to each Export Transaction one or more times prior to the market clearing process for each relevant time interval. Export Transaction Screening shall not apply to transactions established directly by and between PJM and a neighboring Balancing Authority for the purpose of maintaining reliability.

A Market Participant's credit exposure for an individual Export Transaction shall be the MWh volume of the Export Transaction for each relevant time interval multiplied by each relevant Export Transaction Price Factor and summed over all relevant time intervals of the Export Transaction.

B. RPM Auction and Price Responsive Demand Credit Requirements

Settlement during any Delivery Year of cleared positions resulting or expected to result from any RPM Auction shall be included as appropriate in Peak Market Activity, and the provisions of this Attachment Q shall apply to any such activity and obligations arising therefrom. In addition, the provisions of this section shall apply to any entity seeking to participate in any RPM Auction, to address credit risks unique to such auctions. The provisions of this section also shall apply under certain circumstances to PRD Providers that seek to commit Price Responsive Demand pursuant to the provisions of the Reliability Assurance Agreement.

Credit requirements described herein for RPM Auctions and RPM bilateral transactions are applied separately for each customer account of a Market Participant. Market Participants wishing to participate in an RPM Auction or enter into RPM bilateral transactions must designate the appropriate amount of credit to each account in which their offers are submitted.

1. Applicability

A Market Participant seeking to submit a Sell Offer in any RPM Auction based on any Capacity Resource for which there is a materially increased risk of nonperformance must satisfy the credit requirement specified herein before submitting such Sell Offer. A PRD Provider seeking to commit Price Responsive Demand for which there is a materially increased risk of non-performance must satisfy the credit requirement specified herein before it may commit the Price Responsive Demand. Credit must be maintained until such risk of non-performance is substantially eliminated, but may be reduced commensurate with the reduction in such risk, as set forth in section IV.B.3 below.

For purposes of this provision, a resource for which there is a materially increased risk of nonperformance shall mean: (i) a Planned Generation Capacity Resource; (ii) a Planned Demand Resource or an Energy Efficiency Resource; (iii) a Qualifying Transmission Upgrade; (iv) an existing or Planned Generation Capacity Resource located outside the PJM Region that at the time it is submitted in a Sell Offer has not secured firm transmission service to the border of the PJM Region sufficient to satisfy the deliverability requirements of the Reliability Assurance Agreement; or (v) Price Responsive Demand to the extent the responsible PRD Provider has not registered PRD-eligible load at a PRD Substation level to satisfy its Nominal PRD Value commitment, in accordance with Reliability Assurance Agreement, Schedule 6.1.

2. Reliability Pricing Model Auction and Price Responsive Demand Credit Requirement

Except as provided for Credit-Limited Offers below, for any resource specified in section IV.B.1 above, other than Price Responsive Demand, the credit requirement shall be the RPM Auction Credit Rate, as provided in section IV.B.4 below, times the megawatts to be offered for sale from such resource in an RPM Auction. For Qualified Transmission Upgrades, the credit requirements shall be based on the Locational Deliverability Area in which such upgrade was to increase the Capacity Emergency Transfer Limit. However, the credit requirement for Planned Financed Generation Capacity Resources and Planned External Financed Generation Capacity Resources shall be one half of the product of the RPM Auction Credit Rate, as provided in section IV.B.4 below, times the megawatts to be offered for sale from such resource in a Reliability Pricing Model Auction. The RPM Auction Credit Requirement for each Market Participant shall be determined on a customer account basis, separately for each customer account of a Market Participant, and shall be the sum of the credit requirements for all such resources to be offered by such Market Participant in the auction or, as applicable, cleared by such Market Participant in the relevant auctions. For Price Responsive Demand, the credit requirement shall be based on the Nominal PRD Value (stated in Unforced Capacity terms) times the Price Responsive Demand Credit Rate as set forth in section IV.B.5 below. Except for Credit-Limited Offers, the RPM Auction Credit requirement for a Market Participant will be reduced for any Delivery Year to the extent less than all of such Market Participant's offers clear in the Base Residual Auction or any Incremental Auction for such Delivery Year. Such reduction shall be proportional to the quantity, in megawatts, that failed to clear in such Delivery Year.

A Sell Offer based on a Planned Generation Capacity Resource, Planned Demand Resource, or Energy Efficiency Resource may be submitted as a Credit-Limited Offer. A Market Participant electing this option shall specify a maximum amount of Unforced Capacity, in megawatts, and a maximum credit requirement, in dollars, applicable to the Sell Offer. A Credit-Limited Offer shall clear the RPM Auction in which it is submitted (to the extent it otherwise would clear based on the other offer parameters and the system's need for the offered capacity) only to the extent of the lesser of: (i) the quantity of Unforced Capacity that is the quotient of the division of the specified maximum credit requirement by the Auction Credit Rate resulting from section IV.B.4.b. below; and (ii) the maximum amount of Unforced Capacity specified in the Sell Offer. For a Market Participant electing this alternative, the RPM Auction Credit requirement applicable prior to the posting of results of the auction shall be the maximum credit requirement specified in its Credit-Limited Offer, and the RPM Auction Credit requirement subsequent to posting of the results will be the Auction Credit Rate, as provided in section IV.B.4.b, c. or d. of this Attachment Q, as applicable, times the amount of Unforced Capacity from such Sell Offer that cleared in the auction. The availability and operational details of Credit-Limited Offers shall be as described in the PJM Manuals.

As set forth in section IV.B.4 below, a Market Participant's Auction Credit requirement shall be determined separately for each Delivery Year.

3. Reduction in Credit Requirement

As specified below, the RPM Auction Credit Rate may be reduced under certain circumstances after the auction has closed.

The Price Responsive Demand credit requirement shall be reduced as and to the extent the PRD Provider registers PRD-eligible load at a PRD Substation level to satisfy its Nominal PRD Value commitment, in accordance with Reliability Assurance Agreement, Schedule 6.1.

In addition, the RPM Auction Credit requirement for a Market Participant for any given Delivery Year shall be reduced periodically, after the Market Participant has provided PJM a written request for each reduction, accompanied by documentation sufficient for PJM to verify attainment of required milestones or satisfaction of other requirements, and PJM has verified that the Market Participant has successfully met progress milestones for its Capacity Resource that reduce the risk of non-performance, as follows:

(a) For Planned Demand Resources and Energy Efficiency Resources, the RPM Auction Credit requirement will be reduced in direct proportion to the megawatts of such Demand Resource that the Resource Provider qualifies as a Capacity Resource, in accordance with the procedures established under the Reliability Assurance Agreement.

(b) For Existing Generation Capacity Resources located outside the PJM Region that have not secured sufficient firm transmission to the border of the PJM Region prior to the auction in which such resource is first offered, the RPM Auction Credit requirement shall be reduced in direct proportion to the megawatts of firm transmission service secured by the Market Participant

that qualify such resource under the deliverability requirements of the Reliability Assurance Agreement.

(c) For Planned Generation Capacity Resources located in the PJM Region, the RPM Auction Credit requirement shall be reduced as the Capacity Resource attains the milestones stated in the following table and as further described in the PJM Manuals.

Milestones	Increment of reduction from initial RPM Auction Credit requirement
Effective Date of Interconnection Service Agreement	50%
Financial Close	15%
Full Notice to Proceed and Commencement of Construction (e.g., footers poured)	5%
Main Power Generating Equipment Delivered	5%
Commencement of Interconnection Service	25%

For externally financed projects, the Market Participant must submit with its request for reduction a sworn, notarized certification of a duly authorized independent engineer for the Financial Close, Full Notice to Proceed and Commencement of Construction, and Main Power Generating Equipment Delivered milestones.

For internally financed projects, the Market Participant must submit with its request for reduction a sworn, notarized certification of a duly authorized officer of the Market Participant for the Financial Close milestone and either a duly authorized independent engineer or Professional Engineer for the Full Notice to Proceed and Commencement of Construction and the Main Power Generating Equipment Delivered milestones.

The required certifications must be in a form acceptable to PJM, certifying that the engineer or officer, as applicable, has personal knowledge, or has engaged in a diligent inquiry to determine, that the milestone has been achieved and that, based on its review of the relevant project information, the engineer or officer, as applicable, is not aware of any information that could reasonably cause it to believe that the Capacity Resource will not be in-service by the beginning of the applicable Delivery Year. The Market Participant shall, if requested by PJM, supply to PJM on a confidential basis all records and documents relating to the engineer's and/or officer's certifications.

(d) For Planned External Generation Capacity Resources, the RPM Auction Credit requirement shall be reduced as the Capacity Resource attains the milestones stated in the following table and as further described in the PJM Manuals; provided, however, that the total percentage reduction in the RPM Auction Credit requirement shall be no greater than the quotient of (i) the MWs of firm transmission service that the Market Participant has secured for the complete transmission path divided by (ii) the MWs of firm transmission service required to

qualify such resource under the deliverability requirements of the Reliability Assurance Agreement.

Credit Reduction Milestones for Planned External Generation Capacity Resources	
Milestones	Increment of reduction from initial RPM Auction Credit requirement
Effective Date of the equivalent of an Interconnection Service Agreement	50%
Financial Close	15%
Full Notice to Proceed and Commencement of Construction (e.g., footers poured)	5%
Main Power Generating Equipment Delivered	5%
Commencement of Interconnection Service	25%

To obtain a reduction in its RPM Auction Credit requirement, the Market Participant must demonstrate satisfaction of the applicable milestone in the same manner as set forth for Planned Generation Capacity Resources in subsection (c) above.

(e) For Planned Financed Generation Capacity Resources located in the PJM Region, the RPM Auction Credit requirement shall be reduced as the Capacity Resource attains the milestones stated in the following table and as further described in the PJM Manuals.

Credit Reduction Milestones for Planned Financed Generation Capacity Resources	
Milestones	Increment of reduction from initial RPM Auction Credit requirement
Full Notice to Proceed	50%
Commencement of Construction (e.g., footers poured)	15%
Main Power Generating Equipment Delivered	10%
Commencement of Interconnection Service	25%

To obtain a reduction in its RPM Auction Credit requirement, the Market Participant must demonstrate satisfaction of the applicable milestone in the same manner as set forth for Planned Generation Capacity Resources in subsection (c) above.

(f) For Planned External Financed Generation Capacity Resources, the RPM Auction Credit Requirement shall be reduced as the Capacity Resource attains the milestones stated in the following table and as further described in the PJM Manuals; provided, however, that the total percentage reduction in the RPM Auction Credit requirement, including the initial 50% reduction for being a Planned External Financed Generation Capacity Resources, shall be no greater than the quotient of (i) the MWs of firm transmission service that the Market Participant has secured for the complete transmission path divided by (ii) the MWs of firm transmission service required

to qualify such resource under the deliverability requirements of the Reliability Assurance Agreement.

Credit Reduction Milestones for Planned External Financed Generation Capacity	
Milestones	Increment of reduction from initial RPM Auction Credit requirement
Full Notice to Proceed	50%
Commencement of Construction (e.g., footers poured)	15%
Main Power Generating Equipment Delivered	10%
Commencement of Interconnection Service	25%

To obtain a reduction in its RPM Auction Credit requirement, the Market Participant must demonstrate satisfaction of the applicable milestone in the same manner as set forth for Planned Generation Capacity Resources in subsection (c) above.

(g) For Qualifying Transmission Upgrades, the RPM Auction Credit requirement shall be reduced to 50% of the amount calculated under section IV.B.2 above beginning as of the effective date of the latest associated Interconnection Service Agreement (or, when a project will have no such agreement, an Upgrade Construction Service Agreement), and shall be reduced to zero on the date the Qualifying Transmission Upgrade is placed in service.

4. RPM Auction Credit Rate

As set forth in the PJM Manuals, a separate Auction Credit Rate shall be calculated for each Delivery Year prior to each RPM Auction for such Delivery Year, as follows:

- (a) Prior to the posting of the results of a Base Residual Auction for a Delivery Year, the Auction Credit Rate shall be:
- (i) For all Capacity Resources other than Capacity Performance Resources, (the greater of (A) 0.3 times the Net Cost of New Entry for the PJM Region for such Delivery Year, in MW-day or (B) \$20 per MW-day) times the number of calendar days in such Delivery Year; and
 - (ii) For Capacity Performance Resources, the greater of ((A) 0.5 times the Net Cost of New Entry for the PJM Region for such Delivery Year or for the Relevant LDA, in MW-day or (B) \$20 per MW-day) times the number of calendar days in such Delivery Year.
 - (iii) For Seasonal Capacity Performance Resources, the same as the Auction Credit Rate for Capacity Performance Resources, but reduced to be proportional to the number of calendar days in the relevant season.

(b) Subsequent to the posting of the results from a Base Residual Auction, the Auction Credit Rate used for ongoing credit requirements for supply committed in such auction shall be:

- (i) For all Capacity Resources other than Capacity Performance Resources, (the greater of (A) \$20/MW-day or (B) 0.2 times the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the resource is located) times the number of calendar days in such Delivery Year; and
- (ii) For Capacity Performance Resources, the (greater of [(A) \$20/MW-day or (B) 0.2 times the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the resource is located) or (C) the lesser of (1) 0.5 times the Net Cost of New Entry for the PJM Region for such Delivery Year or for the Relevant LDA, in \$/MW-day or (2) 1.5 times the Net Cost of New Entry (stated on an installed capacity basis) for the PJM Region for such Delivery year or for the Relevant LDA, in \$/MW-day minus (the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the resource is located)] times the number of calendar days in such Delivery Year).
- (iii) For Seasonal Capacity Performance Resources, the same as the Auction Credit Rate for Capacity Performance Resources, but reduced to be proportional to the number of calendar days in the relevant season.

(c) For any resource not previously committed for a Delivery Year that seeks to participate in an Incremental Auction, the Auction Credit Rate shall be:

(i) For all Capacity Resources other than Capacity Performance Resources, (the greater of (A) 0.3 times the Net Cost of New Entry for the PJM Region for such Delivery Year, in MW-day or (B) 0.24 times the Capacity Resource Clearing Price in the Base Residual Auction for such Delivery Year for the Locational Deliverability Area within which the resource is located or (C) \$20 per MW-day) times the number of calendar days in such Delivery Year; and

(ii) For Capacity Performance Resources, the (greater of (A) 0.5 times Net Cost of New Entry for the PJM Region for such Delivery Year or for the Relevant LDA or (B) \$20/MW-day) times the number of calendar days in such Delivery Year.

(d) Subsequent to the posting of the results of an Incremental Auction, the Auction Credit Rate used for ongoing credit requirements for supply committed in such auction shall be:

- (i) For Base Capacity Resources: (the greater of (A) \$20/MW-day or (B) 0.2 times the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the resource is located) times the number of calendar days in such Delivery Year, but no greater than the Auction Credit Rate previously established for such resource's participation in such Incremental Auction pursuant to subsection (c) above) times the number of calendar days in such Delivery Year;

- (ii) For Capacity Performance Resources, the greater of [(A) \$20/MW-day or (B) 0.2 times the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the resource is located or (C) the lesser of (1) 0.5 times the Net Cost of New Entry for the PJM Region for such Delivery Year or for the Relevant LDA, in \$/MW-day or (2) 1.5 times the Net Cost of New Entry (stated on an installed capacity basis) for the PJM Region for such Delivery Year or for the Relevant LDA, in \$/MW-day minus (the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the resource is located)] times the number of calendar days in such Delivery Year); and
 - (iii) For Seasonal Capacity Performance Resources, the same as the Auction Credit Rate for Capacity Performance Resources, but reduced to be proportional to the number of calendar days in the relevant season.
- (e) For the purposes of this section IV.B.4 and section IV.B.5 below, “Relevant LDA” means the Locational Deliverability Area in which the Capacity Performance Resource is located if a separate Variable Resource Requirement Curve has been established for that Locational Deliverability Area for the Base Residual Auction for such Delivery Year.

5. Price Responsive Demand Credit Rate

- (a) For the 2018/2019 through 2022/2023 Delivery Years:
 - (i) Prior to the posting of the results of a Base Residual Auction for a Delivery Year, the Price Responsive Demand Credit Rate shall be (the greater of (A) 0.3 times the Net Cost of New Entry for the PJM Region for such Delivery Year, in MW-day or (B) \$20 per MW-day) times the number of calendar days in such Delivery Year;
 - (ii) Subsequent to the posting of the results from a Base Residual Auction, the Price Responsive Demand Credit Rate used for ongoing credit requirements for Price Responsive Demand committed in such auction shall be (the greater of (A) \$20/MW-day or (B) 0.2 times the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the Price Responsive Demand load is located, in \$/MW-day) times the number of calendar days in such Delivery Year times a final price uncertainty factor of 1.05;
 - (iii) For any additional Price Responsive Demand that seeks to commit in a Third Incremental Auction in response to a qualifying change in the final LDA load forecast, the Price Responsive Demand Credit Rate shall be the same as the rate for Price Responsive Demand that had cleared in the Base Residual Auction; and
 - (iv) Subsequent to the posting of the results of the Third Incremental Auction, the Price Responsive Demand Credit Rate used for ongoing credit requirements for

all Price Responsive Demand, shall be (the greater of (i) \$20/MW-day or (ii) 0.2 times the Final Zonal Capacity Price for the Locational Deliverability Area within which the Price Responsive Demand is located) times the number of calendar days in such Delivery Year, but no greater than the Price Responsive Demand Credit Rate previously established under subsections (a)(i), (a)(ii), or (a)(iii) of this section for such Delivery Year.

(b) For the 2022/2023 Delivery Year and Subsequent Delivery Years:

- (i) Prior to the posting of the results of a Base Residual Auction for a Delivery Year, the Price Responsive Demand Credit Rate shall be (the greater of (A) 0.5 times the Net Cost of New Entry for the PJM Region for such Delivery Year or for the Relevant LDA, in \$/MW-day or (B) \$20 per MW-day) times the number of calendar days in such Delivery Year;
- (ii) Subsequent to the posting of the results from a Base Residual Auction, the Price Responsive Demand Credit Rate used for ongoing credit requirements for Price Responsive Demand committed in such auction shall be (the greater of [(A) \$20/MW-day or (B) 0.2 times the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the Price Responsive Demand is located, in \$/MW-day or (C) the lesser of (1) 0.5 times the Net Cost of New Entry for the PJM Region for such Delivery Year or for the Relevant LDA, in \$/MW-day or (2) 1.5 times the Net Cost of New Entry (stated on an installed capacity basis) for the PJM Region for such Delivery year or for the Relevant LDA, in \$/MW-day minus (the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the Price Responsive Demand is located)] times the number of calendar days in such Delivery Year;
- (iii) For any additional Price Responsive Demand that seeks to commit in a Third Incremental Auction in response to a qualifying change in the final LDA load forecast, the Price Responsive Demand Credit Rate shall be (the greater of (A) 0.5 times Net Cost of New Entry for the PJM Region for such Delivery Year or for the Relevant LDA, in \$/MW-day or (B) \$20/MW-day) times the number of calendar days in such Delivery Year; and
- (iv) Subsequent to the posting of the results of the Third Incremental Auction, the Price Responsive Demand Credit Rate used for ongoing credit requirements for all Price Responsive Demand committed in such auction shall be the greater of [(A) \$20/MW-day or (B) 0.2 times the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the Price Responsive Demand is located or (C) the lesser of (1) 0.5 times the Net Cost of New Entry for the PJM Region for such Delivery Year or for the Relevant LDA, in \$/MW-day or (2) 1.5 times the Net Cost of New Entry (stated on an installed capacity basis) for the PJM Region for such Delivery Year or for the Relevant LDA, in \$/MW-day minus (the Capacity Performance Resource Clearing Price in such Incremental Auction for the Locational Deliverability Areas within which the Price

Responsive Demand is located)] times the number of calendar days in such Delivery Year.

6. RPM Seller Credit - Additional Form of Unsecured Credit for RPM

In addition to the forms of credit specified elsewhere in this Attachment Q, RPM Seller Credit shall be available to Market Participants, but solely for purposes of satisfying RPM Auction Credit requirements. If a supplier has a history of being a net seller into PJM Markets, on average, over the past 12 months, then PJM will count as available Unsecured Credit twice the average of that Market Participant's total net monthly PJM bills over the past 12 months. This RPM Seller Credit shall be subject to the cap on available Unsecured Credit as established in section II.G.3 above.

RPM Seller Credit is calculated as a single value for each Market Participant, not separately by account, and must be designated to specific customer accounts in order to be available to satisfy RPM Auction Credit requirements that are calculated in each such customer account.

7. Credit Responsibility for Traded Planned RPM Capacity Resources

PJM may require that credit and financial responsibility for planned Capacity Resources that are traded remain with the original party (which for these purposes, means the party bearing credit responsibility for the planned Capacity Resource immediately prior to trade) unless the receiving party independently establishes consistent with this Attachment Q, that it has sufficient credit with PJM and agrees by providing written notice to PJM that it will fully assume the credit responsibility associated with the traded planned Capacity Resource.

C. Financial Transmission Right Auctions

Credit requirements described herein for FTR activity are applied separately for each customer account of a Market Participant, unless specified otherwise in this section C. FTR Participants must designate the appropriate amount of credit to each separate customer account in which any activity occurs or will occur.

1. FTR Credit Limit.

Participants must maintain their FTR Credit Limit at a level equal to or greater than their FTR Credit Requirement for each applicable account. FTR Credit Limits will be established only by a Participant providing Collateral and designating the available credit to specific accounts.

2. FTR Credit Requirement.

For each Market Participant with FTR activity, PJM shall calculate an FTR Credit Requirement. The FTR Credit Requirement shall be calculated on a portfolio basis for each Market Participant based on (a) initial margin, (b) Auction Revenue Right Credits, (c) Mark-to-Auction Value, (d) application of a 10¢ per MWh minimum value adjustment, and (e) realized gains and/or losses, as set forth in subsections (a)-(e) of this subsection, employing the formula:

Max { Max (IM – ARR – MTA, Ten Cent per Mwh Minimum) – Realized Gains and/or Losses, 0 }

Where IM is the initial margin, ARR is Auction Revenue Rights Credits and MTA is the Mark-to-Auction Value. The FTR Credit Requirement based on FTR cost, FTR Historical Value and MWh volume, anticipated FTR activity for new Market Participants, and anticipated change in exposure for existing Market Participants newly participating in the FTR market, and may be increased to reflect any change in the value of a Market Participant's portfolio requiring an increase in Collateral exposure based on the most recent applicable FTR auction prices, as further described below.

(a) Initial Margin

Initial margin shall be calculated in accordance with the following formula:

$$\text{IM} = \text{FTR Obligations IM} + \text{FTR Options IM}$$

The model will employ an initial confidence interval of 97 percent.

(i) FTR Obligations IM

Initial margin values for Financial Transmission Right Obligations shall be determined utilizing a historical simulation value-at-risk methodology that calculates the size and value at risk of the applicable FTR portfolio based on a defined confidence interval and subject to a weighted aggregation method that is represented by a straight sum for long term positions and a combination of straight sum (20%) and weighted root sum of squares (80%) for balance of planning period positions.

(ii) FTR Options IM

The initial margin for Financial Transmission Right Options shall be calculated as the FTR cost minus the FTR Historical Values. FTR Historical Values shall be calculated separately for on-peak, off-peak, and 24-hour FTRs for each month of the year. FTR Historical Values shall be adjusted by plus or minus ten percent for cleared counter flow or prevailing flow FTRs, respectively, in order to mitigate exposure due to uncertainty and fluctuations in actual FTR value. Historical values used in the calculation of FTR Historical Values shall be adjusted when the network simulation model utilized in PJM's economic planning process indicates that transmission congestion will decrease due to certain transmission upgrades that are in effect or planned to go into effect for the following Planning Period. The transmission upgrades to be modeled for this purpose shall only include those upgrades that, individually, or together, have 10% or more impact on the transmission congestion on an individual constraint or constraints with congestion of \$5 million or more affecting a common congestion path. The adjustments to historical values shall be the dollar amount of the adjustment shown in the network simulation model.

(b) Auction Revenue Rights Credits

For a given month for which initial margin is calculated, the prorated value of any Auction Revenue Rights Credits held by a Market Participant with Financial Transmission Right Obligations shall be subtracted from the initial margin for that month. In accordance with subsection 3 below, PJM may recalculate Auction Revenue Rights Credits at any time, but shall do so no less frequently than subsequent to each annual FTR auction. If a reduction in such ARR credits at any time increases an FTR Participant's FTR Credit Requirements beyond its credit available for FTR activity, the FTR Participant must increase its Collateral or the FTR Credit Limit.

(c) Mark-to-Auction Value

A Mark-to-Auction Value shall be calculated for each Market Participant in accordance with subsection 7 below.

(d) Ten Cent (10¢) per MWh Minimum Value Adjustment

If the FTR Credit Requirement as calculated pursuant to subsections (a)-(c) above~~cost less the FTR Historical Value, plus any applicable increase related to portfolio diversification as described in section C.6 below~~, results in a value that is less than ten cents (10¢) per MWh, the FTR Credit Requirement shall be increased to ten cents (10¢) per MWh. When calculating the portfolio MWh for this comparison, for cleared "Sell" FTRs, the MWh shall be subtracted from the portfolio total; prior to clearing, the MWh for "Sell" FTRs shall not be included in the portfolio total. ~~FTR Credit Requirements shall be further adjusted by ARR credits available and by an amount based on portfolio diversification, if applicable. The requirement will be based on individual monthly exposures which are then used to derive a total requirement.~~

~~The FTR Credit Requirement shall be calculated by first adding for each month the FTR Monthly Credit Requirement Contribution for each submitted, accepted, and cleared FTR and then subtracting the prorated value of any ARRs held by the Market Participant for that month. The resulting twelve monthly subtotals represent the expected value of net payments between PJM and the Market Participant for FTR activity each month during the Planning Period. Subject to later adjustment by an amount based on portfolio diversification, if applicable, and subject to later adjustment for auction prices, the FTR Credit Requirement shall be the sum of the individual positive monthly subtotals, representing months in which net payments to PJM are expected.~~

(e) Realized Gains and/or Losses

Any realized gains and/or losses resulting from the sale of Financial Transmission Right Obligations will be subtracted from the FTR Credit Requirement. A realized gain will decrease the FTR Credit Requirement (but not below \$0.00), whereas a realized loss will increase the FTR Credit Requirement.

3. Rejection of FTR Bids.

Bids submitted into an auction will be rejected if the Market Participant's FTR Credit Requirement including such submitted bids would exceed the Market Participant's FTR Credit Limit, or if the Market Participant fails to provide ~~additional credit support or~~ additional Collateral as required pursuant to provisions related to ~~portfolio diversification and~~ mark-to-auction.

4. FTR Credit Collateral Returns.

A Market Participant may request from PJM the return of any Collateral no longer required for the FTR markets. PJM is permitted to limit the frequency of such requested Collateral returns, provided that Collateral returns shall be made by PJM at least once per calendar quarter, if requested by a Market Participant.

5. Credit Responsibility for Bilateral Transfers of FTRs.

PJM may require that credit responsibility associated with an FTR bilaterally transferred to a new Market Participant remain with the original party (which for these purposes, means the party bearing credit responsibility for the FTR immediately prior to bilateral transfer) unless and until the receiving party independently establishes, consistent with this Attachment Q, sufficient credit with PJM and agrees through confirmation of the bilateral transfer in PJM's FTR reporting tool that it will meet in full the credit requirements associated with the transferred FTR.

~~6. Portfolio Diversification.~~

~~Portfolio diversification shall be calculated, and the appropriate provisions herein applied, separately for each customer account of a Market Participant, and separately for each month.~~

~~Subsequent to calculating a tentative cleared solution for an FTR auction (or auction round), PJM shall determine the FTR Portfolio Auction Value for each customer account of a Market Participant, including the tentative cleared solution. Any customer accounts with such FTR Portfolio Auction Values that are negative in one or more months shall be deemed "FTR Flow Undiversified."~~

~~For customer accounts that are FTR Flow Undiversified in a month, PJM shall increment the FTR Credit Requirement by an amount equal to three times the absolute value of the FTR Portfolio Auction Value in that month, including the tentative cleared solution. For portfolios that are FTR Flow Undiversified in months subsequent to the current planning year, these incremental amounts, calculated on a monthly basis, shall be reduced (but not below zero) by an amount up to 25% of the monthly value of ARR credits that are held by a Market Participant. Subsequent to the ARR allocation process preceding an annual FTR auction, such ARR credits shall be reduced to zero for months associated with that ARR allocation process. PJM may recalculate such ARR credits at any time, but at a minimum shall do so subsequent to each annual FTR auction. If a reduction in such ARR credits at any time increases an FTR Participant's FTR Credit Requirements beyond its credit available for FTR activity, the FTR Participant must increase its credit to eliminate the shortfall in the applicable customer account(s).~~

~~If the FTR Credit Requirement for any Market Participant's customer account exceeds its credit available for FTRs as a result of these diversification requirements for the tentatively cleared portfolio of FTRs, PJM shall immediately issue a demand for additional credit, and such demand must be fulfilled before 4:00 p.m. on the Business Day following the demand. If any Market Participant does not timely satisfy such demand, PJM shall cause the removal of that Market~~

~~Participant's entire set of bids in that account for that FTR auction (or auction round) and a new cleared solution shall be calculated for the entire auction (or auction round).~~

~~If necessary, PJM shall repeat the auction clearing calculation. PJM shall repeat these portfolio diversification calculations subsequent to any secondary clearing calculation, and PJM shall require affected Market Participants to establish additional credit.~~

67. FTR Administrative Charge Credit Requirement

In addition to any other credit requirements, PJM may apply a credit requirement to cover the maximum administrative fees that may be charged to a Market Participant for its bids and offers.

8. Long-Term FTR Credit Recalculation

~~Long-term FTR Credit Requirement calculations shall be updated annually for known history, consistent with updating of historical values used for FTR Credit Requirement calculations in the annual auctions. If the historical value update results in an FTR Credit Requirement for any Market Participant's customer account that exceeds its credit available for FTR activity, then PJM shall issue a Collateral Call equal to the lesser of the increase in the FTR Credit Requirement from the historical value adjustment and the credit shortfall after the historical value adjustment.~~

79. Mark-to-Auction

A Mark-to-Auction Value shall be calculated separately for each customer account of a Market Participant. For each such customer account, the Mark-to-Auction Value shall be a single number equal to the sum, over all months remaining in the applicable FTR period and for all cleared FTRs in the customer account, of the most recently available cleared auction price applicable to the FTR minus the original transaction price of the FTR, multiplied by the transacted quantity.

The FTR Credit Requirement, as otherwise described above, shall be increased when the Mark-to-Auction Value is negative and decreased when the Mark-to-Auction Value is positive. The increase shall equal the absolute value of the negative Mark-to-Auction Value less the value of ARR credits that are held in the customer account and have not been used to reduce the FTR Credit Requirement prior to application of the Mark-to-Auction Value. PJM shall recalculate ARR credits held by each Market Participant after each annual FTR auction and may also recalculate such ARR credits at any other additional time intervals it deems appropriate. Application of the Mark-to-Auction Value, including the effect from ARR application, shall not decrease the FTR Credit Requirement below the Ten Cent (10¢) per MWh Minimum.

For Market Participant customer accounts for which FTR bids have been submitted into the current FTR auction, if the Market Participant's FTR Credit Requirement exceeds its credit available ~~for FTRs as a result of the mark-to-auction requirements~~ for the Market Participant's portfolio of FTRs in the tentative cleared solution for an FTR auction (or auction round), PJM shall issue a Collateral Call to the Market Participant, and the Market Participant must fulfill

such demand before 4:00 p.m. Eastern Prevailing Time on the following Business Day. If a Market Participant does not timely satisfy such Collateral Call, PJM shall, in coordination with PJM, cause the removal of all of that Market Participant's bids in that FTR auction (or auction round), submitted from such Market Participant's customer account, and a new cleared solution shall be calculated for the FTR auction (or auction round).

If necessary, PJM shall repeat the auction clearing calculation. PJM shall repeat these mark-to-auction calculations subsequent to any secondary clearing calculation, and PJM shall require affected Market Participants to establish additional credit.

Subsequent to final clearing of an FTR auction or an annual FTR auction round, PJM shall recalculate the FTR Credit Requirement for all FTR portfolios, and, as applicable, issue to each Market Participant ~~a request for Collateral~~an MTA Collateral Call for the total amount by which the FTR Credit Requirement exceeds the credit allocated in any of the Market Participant's accounts. The Market Participant must fulfill such demand by 4:00 p.m. Eastern Prevailing Time on the following Business Day.

If the ~~request for Collateral~~MTA Collateral Call is not satisfied within the applicable cure period referenced in Operating Agreement, section 15, then such Market Participant shall be restricted in all of its credit-screened transactions. Specifically, such Market Participant may not engage in any Virtual Transactions or Export Transactions, or participate in RPM Auctions or other RPM activity. Such Market Participant may engage only in the selling of open FTR positions, either in FTR auctions or bilaterally, provided such sales would reduce the Market Participant's FTR Credit Requirements. PJM shall not return any Collateral to such Market Participant, and no payment shall be due or payable to such Market Participant, until its credit shortfall is remedied. Market Participant shall allocate any excess or unallocated Collateral to any of its account in which there is a credit shortfall. Market Participants may remedy their credit shortfall at any time through provision of sufficient Collateral.

If a Market Participant fails to satisfy MTA Collateral Calls for two consecutive auctions of overlapping periods, e.g. two balance of Planning Period auctions, an annual FTR auction and a balance of Planning Period auction, or two long term FTR auctions, (for this purpose the four rounds of an annual FTR auction shall be considered a single auction), the Market Participant shall be declared in default of this Attachment Q.

VII. PEAK MARKET ACTIVITY AND WORKING CREDIT LIMIT

A. Peak Market Activity Credit Requirement

PJM shall calculate a Peak Market Activity credit requirement for each Participant. Each Participant must maintain sufficient Unsecured Credit Allowance and/or Collateral, as applicable, and subject to the provisions herein, to satisfy its Peak Market Activity credit requirement.

Peak Market Activity for Participants will be determined semi-annually, utilizing an initial Peak Market Activity, as explained below, calculated after the first complete billing week in the

months of April and October. Peak Market Activity shall be the greater of the initial Peak Market Activity, or the greatest amount invoiced for the Participant's transaction activity for all PJM Markets and services in any rolling one, two, or three week period, ending within a respective semi-annual period. However, Peak Market Activity shall not exceed the greatest amount invoiced for the Participant's transaction activity for all PJM Markets and services in any rolling one, two or three week period in the prior 52 weeks.

Peak Market Activity shall exclude FTR Net Activity, Virtual Transactions Net Activity, and Export Transactions Net Activity.

When calculating Peak Market Activity, PJM may attribute credits for Regulation service to the days on which they were accrued, rather than including them in the month-end invoice.

The initial Peak Market Activity for Applicants will be determined by PJM based on a review of an estimate of their transactional activity for all PJM Markets and services over the next 52 weeks, which the Applicant shall provide to PJM.

The initial Peak Market Activity for Market Participants and Transmission Customers, calculated at the beginning of each semi-annual period, shall be the three-week average of all non-zero invoice totals over the previous 52 weeks. This calculation shall be performed and applied within three (3) Business Days following the day the invoice is issued for the first full billing week in the current semi-annual period.

Prepayments shall not affect Peak Market Activity unless otherwise agreed to in writing pursuant to this Attachment Q.

Peak Market Activity calculations shall take into account reductions of invoice values effectuated by early payments which are applied to reduce a Participant's Peak Market Activity as contemplated by other terms of this Attachment Q; provided that the initial Peak Market Activity shall not be less than the average value calculated using the weeks for which no early payment was made.

A Participant may reduce its Collateral requirement by agreeing in writing (in a form acceptable to PJM) to make additional payments, including prepayments, as and when necessary to ensure that such Participant's Total Net Obligation at no time exceeds such reduced Collateral requirement.

PJM may, at its discretion, adjust a Participant's Peak Market Activity requirement if PJM determines that the Peak Market Activity is not representative of such Participant's expected activity, as a consequence of known, measurable, and sustained changes. Such changes may include, but shall not be limited to when a Participant makes PJM aware of federal, state or local law that could affect the allocation of charges or credits from a Participant to another party, the loss (without replacement) of short-term load contracts, when such contracts had terms of three months or more and were acquired through state-sponsored retail load programs, but shall not include short-term buying and selling activities.

PJM may waive the credit requirements for a Participant that has no outstanding transactions and agrees in writing that it shall not, after the date of such agreement, incur obligations under any of the Agreements. Such entity's access to all electronic transaction systems administered by PJM shall be terminated.

A Participant receiving unsecured credit may make early payments up to ten times in a rolling 52-week period in order to reduce its Peak Market Activity for credit requirement purposes. Imputed Peak Market Activity reductions for credit purposes will be applied to the billing period for which the payment was received. Payments used as the basis for such reductions must be received prior to issuance or posting of the invoice for the relevant billing period. The imputed Peak Market Activity reduction attributed to any payment may not exceed the amount of Unsecured Credit for which the Participant is eligible.

B. Working Credit Limit

PJM will establish a Working Credit Limit for each Participant against which its Total Net Obligation will be monitored.

If a Participant's Total Net Obligation approaches its Working Credit Limit, PJM may require the Participant to make an advance payment or increase its Collateral in order to maintain its Total Net Obligation below its Working Credit Limit. Except as explicitly provided herein, advance payments shall not serve to reduce the Participant's Peak Market Activity for the purpose of calculating credit requirements.

Example: After ten (10) calendar days, and with five (5) calendar days remaining before the bill is due to be paid, a Participant approaches its \$4.0 million Working Credit Limit. PJM may require a prepayment of \$2.0 million in order that the Total Net Obligation will not exceed the Working Credit Limit.

If a Participant exceeds its Working Credit Limit or is required to make advance payments more than ten times during a 52-week period, PJM may require Collateral in an amount as may be deemed reasonably necessary to support its Total Net Obligation.

When calculating Total Net Obligation, PJM may attribute credits for Regulation service to the days on which they were accrued, rather than including them in the month-end invoice.

VIII. SUSPENSION OR LIMITATION ON MARKET PARTICIPATION

If PJM determines that a Participant presents an unreasonable credit risk as determined pursuant to initial or ongoing risk evaluations, as described in section II above, or in the case of any other event which, after notice, lapse of time, or both, would result in an Event of Default, PJM will take steps to mitigate the exposure of any PJM Markets, which may include, but is not limited to, requiring Collateral, additional Collateral or Restricted Collateral or suspending or limiting the Market Participant's ability to participate in the PJM Markets commensurate to the risk to any PJM Markets.

If a Participant fails to reduce or eliminate any unreasonable credit risks to PJM's satisfaction within the applicable cure period including without limitation by posting Collateral, additional Collateral or Restricted Collateral, PJM may treat such failure as an Event of Default.

Notwithstanding the foregoing, a Participant that transacts in FTRs will be eligible to request that PJM exempt or exclude FTR transactions of such Participant from the effect of any such limitations on market activity established by PJM, and PJM may but shall not be required to so exempt or exclude, any FTR transactions that the Participant reasonably demonstrates to PJM it has entered into to “hedge or mitigate commercial risk” arising from its transactions in the PJM Interchange Energy Market that are intended to result in the actual flow of physical energy or ancillary services in the PJM Region, as the phrase “hedge or mitigate commercial risks” is defined under the CFTC’s regulations defining the end-user exception to clearing set forth in 17 C.F.R. §50.50(c).

IX. REMEDIES FOR CREDIT BREACH, FINANCIAL DEFAULT OR CREDIT SUPPORT DEFAULT; REMEDIES FOR EVENTS OF DEFAULT

If PJM determines that a Market Participant is in Credit Breach, or that a Financial Default or Credit Support Default exists, PJM may issue to the Market Participant a breach notice and/or a Collateral Call or demand for additional documentation or assurances. At such time, PJM may also suspend payments of any amounts due to the Participant and limit, restrict or rescind the Market Participant’s privileges to participate in any or all PJM Markets under the Agreements during any such cure period. Failure to remedy the Credit Breach, Financial Default or to satisfy a Collateral Call or demand for additional documentation or assurances within the applicable cure period described in Operating Agreement, section 15.1.5, shall constitute an Event of Default. If a Participant fails to meet the requirements of this Attachment Q, but then remedies the Credit Breach, Financial Default or Credit Support Default, or satisfies a Collateral Call or demand for additional documentation or assurances within the applicable cure period, then the Participant shall be deemed to again be in compliance with this Attachment Q, so long as no other Credit Breach, Financial Default, Credit Support Default or Collateral Call or demand for additional documentation or assurances has occurred and is continuing.

Only one cure period shall apply to a single event giving rise to a Credit Breach, Financial Default or Credit Support Default. Application of Collateral towards a Financial Default, Credit Breach or Credit Support Breach shall not be considered a cure of such Credit Breach, Financial Default or Credit Support Default unless the Participant is determined by PJM to be in full compliance with all requirements of this Attachment Q after such application.

When an Event of Default under this Attachment Q or one or more of the Agreements has occurred and is continuing, PJM may take such actions as may be required or permitted under the Agreements to protect the PJM Markets and the PJM Members, including but not limited to (a) suspension and/or termination of the Participant’s ongoing Transmission Service, (b) limitation, suspension and/or termination of participation in any PJM Markets, (c) close out and liquidation of the Market Participant’s market portfolio, exercising judgment in the manner in which this is achieved in any PJM Markets. When an Event of Default under this Attachment Q or one or more of the Agreements has occurred and is continuing, PJM also has the immediate right to liquidate all or a portion of a Participant’s Collateral at its discretion to satisfy Total Net Obligations to PJM under this Attachment Q or one or more of the Agreements. No remedy for an Event of Default is or shall be deemed to be exclusive of any other available remedy or

remedies by contract or under applicable laws and regulations. Each such remedy shall be distinct, separate and cumulative, shall not be deemed inconsistent with or in exclusion of any other available remedy, and shall be in addition to and separate and distinct from every other remedy.

When an Event of Default under this Attachment Q or one or more of the Agreements has occurred and is continuing, PJM may continue to retain all payments due to a Participant as a cash security for all such Participant's obligations under the Agreements (regardless of any restrictions placed on such Participant's use of Collateral for any account, market activity or capitalization purpose); provided, however, that an Event of Default will not be deemed cured or no longer continuing because PJM is retaining amounts due the Participant, or because PJM has not yet applied Collateral or credit support to any amounts due PJM, unless PJM determines that the Participant has again satisfied all the Collateral requirements and application requirements as a new Applicant for participation in the PJM Markets, and consistent with the requirements and limitations of Operating Agreement, section 15.

In Event of Default by a Participant, PJM may exercise any remedy or action allowed or prescribed by this Attachment Q immediately or following investigation and determination of an orderly exercise of such remedy or action. Delay in exercising any allowed remedy or action shall not preclude PJM from exercising such remedy or action at a later time.

PJM may hold a defaulting Participant's Collateral for as long as such party's positions exist and consistent with this Attachment Q, in order to protect the PJM Markets and PJM's membership, and minimize or mitigate the impacts or potential impacts or risks associated with such Event of Default when an Event of Default under this Attachment Q or one or more of the Agreements has occurred and is continuing.

PJM may apply towards an ongoing Event of Default any amounts that are held or later become available or due to the defaulting Participant through PJM's markets and systems.

In order to cover the Participant's Obligations, PJM may hold a Participant's Collateral indefinitely and specifically through the end of the billing period which includes the 90th day following the last day a Participant had activity, open positions, or accruing obligations (other than reconciliations and true-ups), until such Participant has satisfactorily paid any obligations invoiced through such period and until PJM determines that the Participant's positions represent no risk exposure to the PJM Markets or the PJM Members. Obligations incurred or accrued through such period shall survive any withdrawal from PJM. When an Event of Default under this Attachment Q or one or more of the Agreements has occurred and is continuing, PJM may apply any Collateral to such Participant's Obligations, even if Participant had previously announced and effected its withdrawal from PJM.

X. FTRS UNDER THE COMMODITY EXCHANGE ACT AND THE BANKRUPTCY CODE

Under the terms of the Tariff, PJM Settlement is the counterparty to all transactions in PJM Markets, including but not limited to all FTR transactions, other than (i) any bilateral

transactions between Participants, or (ii) with respect to self-supplied or self-scheduled transactions reported to the Office of the Interconnection. Pursuant to the “Final Order in Response to a Petition From Certain Independent System Operators and Regional Transmission Organizations To Exempt Specified Transactions Authorized by a Tariff or Protocol Approved by the Federal Energy Regulatory Commission or the Public Utility Commission of Texas From Certain Provisions of the Commodity Exchange Act Pursuant to the Authority Provided in the Act” 78 Fed. Reg. 19880 (April 2, 2013) (the “CFTC RTO/ISO Order”), the Commodity Futures Trading Commission (the “CFTC”) exempts transactions offered or entered into in a market administered by PJM pursuant to the Tariff, including but not limited to FTR transactions, from the provisions of the Commodity Exchange Act and the CFTC’s rules applicable to “swaps,” with the exception of the CFTC’s general anti-fraud and anti-manipulation authority and scienter-based prohibitions.

Notwithstanding the CFTC RTO/ISO Order, for purposes of the United States Bankruptcy Code (“Bankruptcy Code”), all FTR transactions constitute “swap agreements” and/or “forward contracts,” and PJM and each FTR Participant is a “forward contract merchant” and/or a “swap participant” within the meaning of the Bankruptcy Code for purposes of FTR transactions.

Pursuant to this Attachment Q and other provisions of the Agreements, PJM already has, and shall continue to have, the following rights (among other rights) with respect to a Market Participant’s Event of Default: (a) the right to terminate and/or liquidate any FTR transaction held by that Market Participant; (b) the right to immediately proceed against any Collateral provided by the Market Participant; (c) the right to set-off any obligations due or owing to that Market Participant pursuant to any forward contract, swap agreement, or similar agreement against any amounts due and owing by that Market Participant pursuant to any forward contract, swap agreement, or similar agreement, such arrangement to constitute a “master netting agreement” within the meaning of the Bankruptcy Code; and (d) the right to suspend or limit that Market Participant from entering into further FTR transactions.

For the avoidance of doubt, upon the commencement of a voluntary or involuntary proceeding for a Participant under the Bankruptcy Code, and without limiting any other rights of PJM or obligations of any Participant under the Agreements, PJM may exercise any of its rights against such Participant, including, without limitation (1) the right to terminate and/or liquidate any FTR transaction held by that Participant, (2) the right to immediately proceed against any Collateral provided by that Participant, (3) the right to set off any obligations due and owing to that Participant pursuant to any forward contract, swap agreement and/or master netting agreement against any amounts due and owing by that Participant with respect to an FTR transaction including as a result of the actions taken by PJM pursuant to (a) above, and 4) the right to suspend or limit that Participant from entering into future FTR transactions.

For purposes of the Bankruptcy Code, all transactions, including but not limited to FTR transactions, between PJM, on the one hand, and a Market Participant, on the other hand, are intended to be part of a single integrated agreement, and together with the Agreements constitute a “master netting agreement.”

Attachment Q
Appendix 1

PJM MINIMUM PARTICIPATION CRITERIA
ANNUAL OFFICER CERTIFICATION FORM

Participant Name: _____ ("Participant")

I, _____, a duly authorized officer of Participant, understanding that PJM Interconnection, L.L.C. and PJMSettlement, Inc. ("PJMSettlement") are relying on this certification as evidence that Participant meets the minimum requirements set forth in the PJM Open Access Transmission Tariff ("PJM Tariff"), Attachment Q hereby certify that I have full authority to represent on behalf of Participant and further represent as follows, as evidenced by my initialing each representation in the space provided below:

1. All employees or agents transacting in markets or services provided pursuant to the PJM Tariff or PJM Amended and Restated Operating Agreement ("PJM Operating Agreement") on behalf of the Participant have received appropriate training and are authorized to transact on behalf of Participant. As used in this representation, the term "appropriate" as used with respect to training means training that is (i) comparable to generally accepted practices in the energy trading industry, and (ii) commensurate and proportional in sophistication, scope and frequency to the volume of transactions and the nature and extent of the risk taken by the participant. _____
2. Participant has written risk management policies, procedures, and controls, approved by Participant's independent risk management function and applicable to transactions in any PJM Markets in which it participates and for which employees or agents transacting in markets or services provided pursuant to the PJM Tariff or PJM Operating Agreement have been trained, that provide an appropriate, comprehensive risk management framework that, at a minimum, clearly identifies and documents the range of risks to which Participant is exposed, including, but not limited to credit risks, liquidity risks and market risks. As used in this representation, a Participant's "independent risk management function" can include appropriate corporate persons or bodies that are independent of the Participant's trading functions, such as a risk management committee, a risk officer, a Participant's board or board committee, or a board or committee of the Participant's parent company.
 - a. Participant is providing to PJM or PJMSettlement, in accordance with Tariff, Attachment Q, section III, with this Annual Officer Certification Form, a copy of its current governing risk management policies, procedures and controls applicable to its activities in any PJM Markets pursuant to Attachment Q or because there have been substantive changes made to such policies, procedures and controls applicable to its market activities since they were last provided to PJM. _____
 - b. If the risk management policies, procedures and controls applicable to Participant's market activities submitted to PJM or PJMSettlement were submitted prior to the current certification, Participant certifies that no substantive changes have

been made to such policies, procedures and controls applicable to its market activities since such submission. _____

3. An FTR Participant must make either the following 3.a. or 3.b. additional representations, evidenced by the undersigned officer initialing either the one 3.a. representation or the four 3.b. representations in the spaces provided below:

a. Participant transacts in PJM's FTR markets with the sole intent to hedge congestion risk in connection with either obligations Participant has to serve load or rights Participant has to generate electricity in the PJM Region ("physical transactions") and monitors all of the Participant's FTR market activity to endeavor to ensure that its FTR positions, considering both the size and pathways of the positions, are either generally proportionate to or generally do not exceed the Participant's physical transactions, and remain generally consistent with the Participant's intention to hedge its physical transactions. _____

b. On no less than a weekly basis, Participant values its FTR positions and engages in a probabilistic assessment of the hypothetical risk of such positions using analytically based methodologies, predicated on the use of industry accepted valuation methodologies. _____

Such valuation and risk assessment functions are performed either by persons within Participant's organization independent from those trading in PJM's FTR markets or by an outside firm qualified and with expertise in this area of risk management. _____

Having valued its FTR positions and quantified their hypothetical risks, Participant applies its written policies, procedures and controls to limit its risks using industry recognized practices, such as value-at-risk limitations, concentration limits, or other controls designed to prevent Participant from purposefully or unintentionally taking on risk that is not commensurate or proportional to Participant's financial capability to manage such risk. _____

Exceptions to Participant's written risk policies, procedures and controls applicable to Participant's FTR positions are documented and explain a reasoned basis for the granting of any exception. _____

4. Participant has appropriate personnel resources, operating procedures and technical abilities to promptly and effectively respond to all PJM and PJMSettlement communications and directions. _____
5. Participant has demonstrated compliance with the Minimum Capitalization criteria set forth in Tariff, Attachment Q that are applicable to any PJM Markets in which Participant transacts, and is not aware of any change having occurred or being imminent that would invalidate such compliance. _____

6. All Participants must certify and initial in at least one of the four sections below:

- a. I certify that Participant qualifies as an “appropriate person” as that term is defined under section 4(c)(3), or successor provision, of the Commodity Exchange Act or an “eligible contract participant” as that term is defined under section 1a(18), or successor provision, of the Commodity Exchange Act. I certify that Participant will cease transacting in any PJM Markets and notify PJM and PJMSettlement immediately if Participant no longer qualifies as an “appropriate person” or “eligible contract participant.” _____

If providing audited financial statements, which shall be in US GAAP format or any other format acceptable to PJM, to support Participant’s certification of qualification as an “appropriate person:”

I certify, to the best of my knowledge and belief, that the audited financial statements provided to PJM and/or PJMSettlement present fairly, pursuant to such disclosures in such audited financial statements, the financial position of Participant as of the date of those audited financial statements. Further, I certify that Participant continues to maintain the minimum \$1 million total net worth and/or \$5 million total asset levels reflected in these audited financial statements as of the date of this certification. I acknowledge that both PJM and PJMSettlement are relying upon my certification to maintain compliance with federal regulatory requirements. _____

If not providing audited financial statements to support Participant’s certification of qualification as an “appropriate person,” Participant certifies that they qualify as an “appropriate person” under one of the entities defined in section 4(c)(3)(A)-(J) of the Commodities Exchange Act. _____

If providing audited financial statements, which shall be in US GAAP format or any other format acceptable to PJM, to support Participant’s certification of qualification as an “eligible contract participant:”

I certify, to the best of my knowledge and belief, that the audited financial statements provided to PJM and/or PJMSettlement present fairly, pursuant to such disclosures in such audited financial statements, the financial position of Participant as of the date of those audited financial statements. Further, I certify that Participant continues to maintain the minimum \$1 million total net worth and/or \$10 million total asset levels reflected in these audited financial statements as of the date of this certification. I acknowledge that both PJM and PJMSettlement are relying upon my certification to maintain compliance with federal regulatory requirements. _____

If not providing audited financial statements to support Participant’s certification of qualification as an “eligible contract participant,” Participant certifies that they

qualify as an “eligible contract participant” under one of the entities defined in section 1a(18)(A) of the Commodities Exchange Act. _____

- b. I certify that Participant has provided an unlimited Corporate Guaranty in a form acceptable to PJM as described in Tariff, Attachment Q, section III.D from an issuer that has at least \$1 million of total net worth or \$5 million of total assets per Participant for which the issuer has issued an unlimited Corporate Guaranty. I also certify, to the best of my knowledge and belief, that the audited financial statements provided to PJM and/or PJMSettlement present fairly, pursuant to such disclosures in such audited financial statements, the financial position of the issuer as of the date of those audited financial statements. Further, I certify that Participant will cease transacting PJM’s Markets and notify PJM and PJMSettlement immediately if issuer of the unlimited Corporate Guaranty for Participant no longer has at least \$1 million of total net worth or \$5 million of total assets per Participant for which the issuer has issued an unlimited Corporate Guaranty. _____

I certify that the issuer of the unlimited Corporate Guaranty to Participant continues to have at least \$1 million of total net worth or \$5 million of total assets per Participant for which the issuer has issued an unlimited Corporate Guaranty. I acknowledge that PJM and PJMSettlement are relying upon my certifications to maintain compliance with federal regulatory requirements. _____

- c. I certify that Participant fulfills the eligibility requirements of the Commodity Futures Trading Commission exemption order (78 F.R. 19880 – April 2, 2013) by being in the business of at least one of the following in the PJM Region as indicated below (initial those applicable):

1. Generating electric energy, including Participants that resell physical energy acquired from an entity generating electric energy: _____
2. Transmitting electric energy: _____
3. Distributing electric energy delivered under Point-to-Point or Network Integration Transmission Service, including scheduled import, export and wheel through transactions: _____
4. Other electric energy services that are necessary to support the reliable operation of the transmission system: _____

Description only if c(4) is initialed:

Further, I certify that Participant will cease transacting in any PJM Markets and notify PJM and PJMSettlement immediately if Participant no longer performs at least one of the functions noted above in the PJM Region. I acknowledge that PJM and

PJMSettlement are relying on my certification to maintain compliance with federal energy regulatory requirements. _____

- d. I certify that Participant has provided a Letter of Credit of \$5 million or more to PJM or PJMSettlement in a form acceptable to PJM and/or PJMSettlement as described in Tariff, Attachment Q, section V.B that the Participant acknowledges cannot be utilized to meet its credit requirements to PJM and PJMSettlement. I acknowledge that PJM and PJMSettlement are relying on the provision of this letter of credit and my certification to maintain compliance with federal regulatory requirements. _____
- e. I certify that Participant has provided a surety bond of \$5 million or more to PJM or PJMSettlement in a form acceptable to PJM and/or PJMSettlement as described in Tariff, Attachment Q, section V.D. that the Participant acknowledges cannot be utilized to meet its credit requirements to PJM and PJMSettlement. I acknowledge that PJM and PJMSettlement are relying on the provision of this surety bond and my certification to maintain compliance with federal regulatory requirements. _____
7. I acknowledge that I have read and understood the provisions of Tariff, Attachment Q applicable to Participant's business in any PJM Markets, including those provisions describing PJM's Minimum Participation Requirements and the enforcement actions available to PJM and PJMSettlement of a Participant not satisfying those requirements. I acknowledge that the information provided herein is true and accurate to the best of my belief and knowledge after due investigation. In addition, by signing this certification, I acknowledge the potential consequences of making incomplete or false statements in this Certification. _____

Date: _____

Participant (Signature)

Print Name: _____

Title: _____

Attachment B

Revisions to the PJM Open Access Transmission Tariff

(Clean Format)

ATTACHMENT Q

CREDIT RISK MANAGEMENT POLICY

I. INTRODUCTION

It is the policy of PJM that prior to an entity participating in any PJM Markets or in order to take Transmission Service, the entity must demonstrate its ability to meet the requirements in this Attachment Q. This Attachment Q also sets forth PJM's authority to deny, reject, or terminate a Participant's right to participate in any PJM Markets in order to protect the PJM Markets and PJM Members from unreasonable credit risk from any Participant's activities. Given the interconnectedness and overlapping of their responsibilities, PJM Interconnection, L.L.C. and PJM Settlement, Inc. are referred to both individually and collectively herein as "PJM."

PURPOSE

PJMSettlement is the counterparty to transactions in the PJM Markets. As a consequence, if a Participant defaults on its obligations under this Attachment Q, or PJM determines a Participant represents unreasonable credit risk to the PJM Markets, and the Participant does not post Collateral, additional Collateral or Restricted Collateral in response to a Collateral Call, the result is that the Participant represents unsecured credit risk to the PJM Markets. For this reason, PJM must have the authority to monitor and manage credit risk on an ongoing basis, and to act promptly to mitigate or reduce any unsecured credit risk, in order to protect the PJM Markets and PJM Members from losses.

This Attachment Q describes requirements for: (1) eligibility to be a Market Participant, (2) establishment and maintenance of credit by Market Participants, and (3) collateral requirements and forms of credit support that will be deemed as acceptable to mitigate risk to any PJM Markets.

This Attachment Q also sets forth (1) PJM's authority to monitor and manage credit risk that a Participant may represent to the PJM Markets and/or PJM membership in general, (2) the basis for establishing limits that will be imposed on a Market Participant in order to minimize risk, and (3) various obligations and requirements the violation of which will result in an Event of Default pursuant to this Attachment Q and the Agreements.

Attachment Q describes the types of data and information PJM will review in order to determine whether an Applicant or Market Participant presents an unreasonable risk to any PJM Markets and/or PJM membership in general, and the steps PJM may take in order to address that risk.

APPLICABILITY

This Attachment Q applies to all Applicants and Market Participants who take Transmission Service under this Tariff, or participate in any PJM Markets or market activities under the Agreements. Notwithstanding anything to the contrary in this Attachment Q, simply taking

transmission service or procuring Ancillary Services via market-based rates does not imply market participation for purposes of applicability of this Attachment Q.

II. RISK EVALUATION PROCESS

PJM will conduct a risk evaluation to determine eligibility to become and/or remain a Market Participant or Guarantor that: (1) assesses the entity's financial strength, risk profile, creditworthiness, and other relevant factors; (2) determines an Unsecured Credit Allowance, if appropriate; (3) determines appropriate levels of Collateral; and (4) evaluates any Credit Support, including Guaranties or Letters of Credit.

A. Initial Risk Evaluation

PJM will perform an initial risk evaluation of each Applicant and/or its Guarantor. As part of the initial risk evaluation, PJM will consider certain Minimum Participation Requirements, assign an Internal Risk Score, establish an Unsecured Credit Allowance if appropriate, and make a determination regarding required levels of Collateral, creditworthiness, credit support, Restricted Collateral and other assurances for participation in certain PJM Markets.

Each Applicant and/or its Guarantor must provide the information set forth below at the time of its initial application pursuant to this Attachment Q and on an ongoing basis in order to remain eligible to participate in any PJM Markets. The same quantitative and qualitative factors will be used to evaluate Participants whether or not they have rated debt.

1. Rating Agency Reports

PJM will review Rating Agency reports from Standard & Poor's, Moody's Investors Service, Fitch Ratings, or other Nationally Recognized Statistical Rating Organization for each Applicant and/or Guarantor. The review will focus on the Applicant's or its Guarantor's senior unsecured debt ratings. If senior unsecured debt ratings are not available, PJM may consider other ratings, including issuer ratings, corporate ratings and/or an implied rating based on an internally derived Internal Credit Score pursuant to section II.A.3 below.

2. Financial Statements and Related Information

Each Applicant and/or its Guarantor must submit, or cause to be submitted, audited financial statements, except as otherwise indicated below, prepared in accordance with United States Generally Accepted Accounting Principles ("US GAAP") or any other format acceptable to PJM for the three (3) fiscal years most recently ended, or the period of existence of the Applicant and/or its Guarantor, if shorter. Applicants and/or their Guarantors must submit, or cause to be submitted, financial statements, which may be unaudited, for each completed fiscal quarter of the current fiscal year. All audited financial statements provided by the Applicant and/or its Guarantor must be audited by an Independent Auditor.

The information should include, but not be limited to, the following:

- (a) If the Applicant and/or its Guarantor has publicly traded securities:
- (i) Annual reports on Form 10-K, together with any amendments thereto;
 - (ii) Quarterly reports on Form 10-Q, together with any amendments thereto;
 - (iii) Form 8-K reports, if any, that have been filed since the most recent Form 10-K;
 - (iv) A summary provided by the Principal responsible, or to be responsible, for PJM Market activity of: (1) the Participant's primary purpose(s) of activity or anticipated activity in the PJM Markets (investment, trading or "hedging or mitigating commercial risks," as such phrase has meaning in the CFTC's regulations regarding the end-user exception to clearing); (2) the experience of the Participant (and its Principals) in managing risks in similar markets, including other organized RTO/ISO markets or on regulated commodity exchanges; and (3) a high level overview of the Participant's intended participation in the PJM Markets.
 - (v) All audited financial statements provided by an Applicant with publicly traded securities and/or its Guarantor with publicly traded securities must be audited by an Independent Auditor that satisfies the requirements set forth in the Sarbanes-Oxley Act of 2002.
- (b) If the Applicant and/or its Guarantor does not have publicly-traded securities:
- (i) Annual Audited Financial Statements or equivalent independently audited financials, and quarterly financial statements, generally found on:
 - Balance Sheets
 - Income Statements
 - Statements of Cash Flows
 - Statements of Stockholder's or Member's Equity or Net Worth;
 - (ii) Notes to Annual Audited Financial Statements, and notes to quarterly financial statements if any, including disclosures of any material changes from the last report;
 - (iii) Disclosure equivalent to a Management's Discussion & Analysis, including an executive overview of operating results and outlook, and compliance with debt covenants and indentures, and off balance sheet arrangements, if any;
 - (iv) Auditor's Report with an unqualified opinion or written letter from auditor containing the opinion whether the annual audited financial statements comply with the US GAAP or any other format acceptable to PJM; and

- (v) A summary provided by the Principal responsible or to be responsible for PJM Market activity of: (1) the Participant's primary purpose(s) of activity or anticipated activity in the PJM Markets (investment, trading or "hedging or mitigating commercial risks," as such phrase has meaning in the CFTC's regulations regarding the end-user exception to clearing); (2) the experience of the Participant (and its Principals) in managing risks in similar markets, including other organized RTO/ISO markets or on regulated commodity exchanges; and (3) a high level overview of the Participant's intended participation in the PJM Markets.
- (c) If Applicant and/or Guarantor is newly formed, does not yet have three (3) years of audited financials, or does not routinely prepare audited financial statements, PJM may specify other information to allow it to assess the entity's creditworthiness, including but not limited to:
 - (i) Equivalent financial information traditionally found in:
 - Balance Sheets
 - Income Statements
 - Statements of Cash Flows
 - (ii) Disclosure equivalent to a Management's Discussion & Analysis, including an executive overview of operating results and outlook, and compliance with debt covenants and indentures, and off balance sheet arrangements, if any; and
 - (iii) A summary provided by the Principal responsible or to be responsible for PJM Market activity of: (1) the Participant's primary purpose(s) of activity or anticipated activity in the PJM Markets (investment, trading or "hedging or mitigating commercial risks," as such phrase has meaning in the CFTC's regulations regarding the end-user exception to clearing); (2) the experience of the Participant (and its Principals) in managing risks in similar markets, including other organized RTO/ISO markets or on regulated commodity exchanges; and (3) a high level overview of the Participant's intended participation in the PJM Markets.
- (d) During a two year transition period from June 1, 2020 to May 31, 2022, the Applicant or Guarantor may provide a combination of audited financial statements and/or equivalent financial information.

If any of the above information in this section II.A.2 is available on the internet, the Applicant and/or its Guarantor may provide a letter stating where such statements can be located and retrieved by PJM. If an Applicant and/or its Guarantor files Form 10-K, Form 10-Q, or Form 8-K with the SEC, then the Applicant and/or its Guarantor will be deemed to have satisfied the requirement by indicating to PJM where the information in this section II.A.2 can be located on the internet.

If the Applicant and/or its Guarantor fails, for any reason, to provide the information required above in this section II.A.2, PJM has the right to (1) request Collateral and/or Restricted Collateral to cover the amount of risk reasonably associated with the Applicant and/or its Guarantor's expected activity in any PJM Markets, and/or (2) restrict the Applicant from participating in certain PJM Markets, including but not limited to restricting the positions the Applicant (once it becomes a Market Participant) takes in the market.

For certain Applicants and/or their Guarantors, some of the above submittals may not be applicable and alternate requirements for compliant submittals may be specified by PJM. In the credit evaluation of Municipalities and Cooperatives, PJM may also request additional information as part of the initial and ongoing review process and will consider other qualitative factors in determining financial strength and creditworthiness.

3. Credit Rating and Internal Credit Score

PJM will use credit risk scoring methodologies as a tool in determining an Unsecured Credit Allowance for each Applicant and/or its Guarantor. As its source for calculating the Unsecured Credit Allowance, PJM will rely on the ratings from a Rating Agency, if any, on the Applicant's or Guarantor's senior unsecured debt or their issuer ratings or corporate ratings if senior unsecured debt ratings are not available. If there is a split rating between the Rating Agencies, the lower of the ratings shall apply. If no external credit rating is available PJM will utilize its Internal Credit Score in order to calculate the Unsecured Credit Allowance.

The model used to develop the Internal Credit Score will be quantitative, based on financial data found in the income statement, balance sheet, and cash flow statement, and it will be qualitative based on relevant factors that may be internal or external to a particular Applicant and/or its Guarantor.

PJM will employ a framework, as outlined in Tables 1-5 below, based on metrics internal to the Applicant and/or its Guarantor, including capital and leverage, cash flow coverage of fixed obligations, liquidity, profitability, and other qualitative factors. The particular metrics and scoring rules differ according to the Applicant's or Guarantor's line of business and the PJM Markets in which it anticipates participating, in order to account for varying sources and degrees of risk to the PJM Markets and PJM members.

The formulation of each metric will be consistently applied to all Applicants and Guarantors across industries with slight variations based on identifiable differences in entity type, anticipated market activity, and risks to the PJM Markets and PJM members. In instances where the external credit rating is used to calculate the unsecured credit allowance, PJM may also use the Internal Credit Score as an input into determining the overall risk profile of an Applicant and/or its Guarantor.

Table 1. Quantitative Metrics by Line of Business: Leverage and Capital Structure	Investor-Owned Utilities	Municipal Utilities	Co-Operative Utilities	Power Transmission	Merchant Power	Project Developers	Exploration & Production	Financial Institutions	Commodity Trading	Private Equity
Debt / Total Capitalization (%)										
FFO / Debt (%)										
Debt / EBITDA (x)										
Debt / Property, Plant & Equipment (%)										
Retained Earnings / Total Assets (%)										
Debt / Avg Daily Production or Kwh (\$)										
Tangible Net Worth (\$)										
Core Capital / Total Assets (%)										
Risk-Based Capital / RWA (%)										
Tier 1 Capital / RWA (%)										
Equity / Investments (%)										
Debt / Investments (%)										

primary metric secondary metric

FFO = Funds From Operations RWA = Risk-Weighted Assets

Table 2. Quantitative Metrics by Line of Business: Fixed Charge Coverage and Funding	Investor-Owned Utilities	Municipal Utilities	Co-Operative Utilities	Power Transmission	Merchant Power	Project Developers	Exploration & Production	Financial Institutions	Commodity Trading	Private Equity
EBIT / Interest Expense (x)										
EBITDA / Interest Expense (x)										
EBITDA / [Interest Exp + CPLTD] (x)										
[FFO + Interest Exp] / Interest Exp (x)										
Loans / Total Deposits (%)										
NPL / Gross Loans (%)										
NPL / [Net Worth + LLR] (%)										
Market Funding / Tangible Bank Assets (%)										

primary metric secondary metric

CPLTD = Current Portion of Long-Term Debt EBIT = Earnings Before Interest and Taxes EBITDA = Earnings Before Interest, Taxes, Depreciation and Amortization LLR = Loan Loss Reserves NPL = Non-Performing Loans

Table 3. Quantitative Metrics by Line of Business: Liquidity	Investor-Owned Utilities	Municipal Utilities	Co-Operative Utilities	Power Transmission	Merchant Power	Project Developers	Exploration & Production	Financial Institutions	Commodity Trading	Private Equity
CFFO / Total Debt (x)										
Current Assets / Current Liabilities (x)										
Liquid Assets / Tangible Bank Assets (%)										
Sources / Uses of Funds (x)										
Weighted Avg Maturity of Debt (yrs)										
Floating Rate Debt / Total Debt (%)										
primary metric	secondary metric									

CFFO = Cash Flow From Operations

Table 4. Quantitative Metrics by Line of Business: Profitability	Investor-Owned Utilities	Municipal Utilities	Co-Operative Utilities	Power Transmission	Merchant Power	Project Developers	Exploration & Production	Financial Institutions	Commodity Trading	Private Equity
Return on Assets (%)										
Return on Equity (%)										
Profit Volatility (%)										
Return on Revenue (%)										
Net Income / Tangible Assets (%)										
Net Profit (\$)										
Net Income / Dividends (x)										
primary metric	secondary metric									

Table 5. Qualitative Factors: Industry Level	Sample Reference Metrics	Investor-Owned Utilities	Municipal Utilities	Co-Operative Utilities	Power Transmission	Merchant Power	Project Developers	Exploration & Production	Financial Institutions	Commodity Trading	Private Equity
Need for PJM Markets to Achieve Business Goals	Rating Agency criteria or other industry analysis	High	High	High	High	Med	Low	Med	Low	Low	N/A
Ability to Grow/Enter Markets other than PJM	Rating Agency criteria or other industry analysis	Very Low	Very Low	Very Low	Very Low	High	High	Med	Med	High	N/A

Other Participants' Ability to Serve Customers	Rating Agency criteria or other industry analysis	Low	Low	Low	Low	Low	Med	Low	Low	High	N/A
Regulation of Participant's Business	RRA regulatory climate scores, S&P BICRA	PUCS	Govt	N/A	FERC PUCs	N/A	N/A	N/A	N/A	N/A	N/A
Primary Purpose of PJM Activity	Investment ("Inv.")/ Trading ("Trade")/ Hedging or Mitigating Commercial Risk of Operations ("CRH")	CRH	CRH	CRH	CRH/ Trade	CRH/ Trade	CRH/ Trade	CRH/ Trade	Inv./ Trade	Inv./ Trade	Inv./ Trade

RRA = Regulatory Research Associates, a division of S&P Global, Inc.

BICRA = Bank Industry Country Risk Assessment

The scores developed will range from 1-6, with the following mappings:

- 1 = Very Low Risk (S&P/Fitch: AAA to AA-; Moody's: Aaa to Aa3)
- 2 = Low Risk (S&P/Fitch: A+ to BBB+; Moody's: A1 to Baa1)
- 3 = Low to Medium Risk (S&P/Fitch: BBB; Moody's: Baa2)
- 4 = Medium Risk (S&P/Fitch: BBB-; Moody's: Baa3)
- 5 = Medium to High Risk (S&P/Fitch: BB+ to BB; Moody's Ba1 to Ba2)
- 6 = High Risk (S&P/Fitch: BB- and below; Moody's: Ba3 and below)

4. Trade References

If deemed necessary by PJM, whether because the Applicant is newly or recently formed or for any other reason, each Applicant and/or its Guarantor shall provide at least one (1) bank reference and three (3) Trade References to provide PJM with evidence of Applicant's understanding of the markets in which the Applicant is seeking to participate and the Applicant's experience and ability to manage risk. PJM may contact the bank references and Trade References provided by the Applicant to verify their business experience with the Applicant.

5. Litigation and Contingencies

Unless prohibited by law, each Applicant and Guarantor is also required to disclose and provide information as to the occurrence of, within the five (5) years prior to the submission of the information to PJM (i) any litigation, arbitration, investigation (formal inquiry initiated by a governmental or regulatory entity), or proceeding, pending or, to the knowledge of the involving, Applicant or its Guarantor or any of their Principals that would likely have a material adverse impact on its financial condition and/or would likely materially affect the risk of non-payment by the Applicant or Guarantor, or (ii) any finding of material defalcation, market

manipulation or fraud by or involving the Applicant, Guarantor, or any of their Principals, predecessors, subsidiaries, or Credit Affiliates that participate in any United States power markets based upon a final adjudication of regulatory and/or legal proceedings, (iii) any bankruptcy declarations or petitions by or against an Applicant and/or Guarantor, or (iv) any violation by any of the foregoing of any federal or state regulations or laws regarding energy commodities, U.S. Commodity Futures Trading Commission (“CFTC”) or FERC requirements, the rules of any exchange monitored by the National Futures Association, any self-regulatory organization or any other governing, regulatory, or standards body responsible for regulating activity in North American markets for electricity, natural gas or electricity-related commodity products. Each Applicant and Guarantor shall take reasonable measures to obtain permission to disclose information related to a non-public investigation. These disclosures shall be made by Applicant and Guarantor upon application, and within ten (10) Business Days of any material change with respect to any of the above matters.

6. History of Defaults in Energy Projects

Each Applicant and Guarantor shall disclose their current default status and default history for any energy related generation or transmission project (e.g. generation, solar, development), and within any wholesale or retail energy market, including but not limited to within PJM, any Independent System Operator or Regional Transmission Organization, and exchange that has not been cured within the past five (5) years. Defaults of a non-recourse project financed entity may not be included in the default history.

7. Other Disclosures and Additional Information

Each Applicant and Guarantor is required to disclose any Credit Affiliates that are currently Members of PJM, applying for membership with PJM, Transmission Customers, Participants, applying to become Market Participants, or that participate directly or indirectly in any PJM Markets or any other North American markets for electricity, natural gas or electricity-related commodity products. Each Applicant and Guarantor shall also provide a copy of its limited liability company agreement or equivalent agreement, certification of formation, articles of incorporation or other similar organization document, offering memo or equivalent, the names of its five (5) most senior Principals, and information pertaining to any non-compliance with debt covenants and indentures.

Applicants shall provide PJM the credit application referenced in section III.A and any other information or documentation reasonably required for PJM to perform the initial risk evaluation of Applicant’s or Guarantor’s creditworthiness and ability to comply with the requirements contained in the Agreements related to settlements, billing, credit requirements, and other financial matters.

B. Supplemental Risk Evaluation Process

As described in section VI below, PJM will conduct a supplemental risk evaluation process for Applicants, Participants, and Guarantors applying to conduct virtual and export transactions or participate in any PJM Markets.

C. Unsecured Credit Allowance

A Market Participant may request that PJM consider it for an Unsecured Credit Allowance pursuant to the provisions herein. Notwithstanding the foregoing, an FTR Participant shall not be considered for an Unsecured Credit Allowance for participation in the FTR markets.

1. Unsecured Credit Allowance Evaluation

PJM will perform a credit evaluation on each Participant that has requested an Unsecured Credit Allowance, both initially and at least annually thereafter. PJM shall determine the amount of Unsecured Credit Allowance, if any, that can be provided to the Market Participant in accordance with the creditworthiness and other requirements set forth in this Attachment Q. In completing the credit evaluation, PJM will consider:

(a) Rating Agency Reports

PJM will review Rating Agency reports as for each Market Participant on the same basis as described in section II.A.1 above and section II.E.1 below.

(b) Financial Statements and Related Information

All financial statements and related information considered for an Unsecured Credit Allowance must satisfy all of the same requirements described in section II.A.2 above and section II.E.2 below.

2. Material Adverse Changes

Each Market Participant is responsible for informing PJM, in writing, of any Material Adverse Change in its financial condition (or the financial condition of its Guarantor) since the date of the Market Participant or Guarantor's most recent annual financial statements provided to PJM, pursuant to the requirements reflected in section II.A.2 above and section II.E.3 below.

In the event that PJM determines that a Material Adverse Change in the financial condition of a Market Participant warrants a requirement to provide Collateral, additional Collateral or Restricted Collateral, PJM shall comply with the process and requirements described in section II.A above and section II.E below.

3. Other Disclosures

Each Market Participant desiring an Unsecured Credit Allowance is required to make the disclosures and upon the same requirements reflected in section II.A.7 above and section II.E.7 below.

D. Determination of Unreasonable Credit Risk

Unreasonable credit risk shall be determined by the likelihood that an Applicant will default on a financial obligation arising from its participation in any PJM Markets. Indicators of potentially

unreasonable credit risk include, but are not limited to, a history of market manipulation based upon a final adjudication of regulatory and/or legal proceedings, a history of financial defaults, a history of bankruptcy or insolvency within the past five (5) years, or a combination of current market and financial risk factors such as low capitalization, a reasonably likely future material financial liability, a low Internal Credit Score (derived pursuant to section II.A.3 above) and/or a low externally derived credit score. PJM's determination will be based on, but not limited to, information and material provided to PJM during its initial risk evaluation process, information and material provided to PJM in the Officer's Certification, and/or information gleaned by PJM from public and non-public sources.

If PJM determines that an Applicant poses an unreasonable credit risk to the PJM Markets, PJM may require Collateral, additional Collateral, or Restricted Collateral commensurate with the Applicant's risk of financial default, reject an application, and/or limit or deny Applicant's participation in the PJM Markets, to the extent and for the time period it determines is necessary to mitigate the unreasonable credit risk to the PJM Markets. PJM will reject an application if it determines that Collateral, additional Collateral, or Restricted Collateral cannot address the risk.

PJM will communicate its concerns regarding whether the Applicant presents an unreasonable credit risk, if any, in writing to the Applicant and attempt to better understand the circumstances surrounding that Applicant's financial and credit position before making its determination. In the event PJM determines that an Applicant presents an unreasonable credit risk that warrants a requirement to provide Collateral of any type, or some action to mitigate risk, PJM shall provide the Applicant with a written explanation of why such determination was made.

E. Ongoing Risk Evaluation

In addition to the initial risk evaluation set forth in sections II.A through II.D above and the annual certification requirements set forth in section III.A below, each Market Participant and/or its Guarantor has an ongoing obligation to provide PJM with the information required in section IV.A described in more detail below. PJM may also review public information regarding a Market Participant and/or its Guarantor as part of its ongoing risk evaluation. If appropriate, PJM will revise the Market Participant's Unsecured Credit Allowance and/or change its determination of creditworthiness, credit support, Restricted Collateral, required Collateral or other assurances pursuant to PJM's ongoing risk evaluation process.

Each Market Participant and/or its Guarantor must provide the information set forth below on an ongoing basis in order to remain eligible to participate in any PJM Markets. The same quantitative and qualitative factors will be used to evaluate Market Participants whether or not they have rated debt.

1. Rating Agency Reports

PJM will review Rating Agency reports for each Market Participant and/or Guarantor on the same basis as described in section II.A.1 above.

2. Financial Statements and Related Information

On an ongoing basis, Market Participants and/or their Guarantors shall provide the information they are required to provide as described in section II.A.2 above, pursuant to the schedule reflected below, with one exception. With regard to the summary that is required to be provided by the Principal responsible for PJM Market activity, with respect to experience of the Participant or its Principals in managing risks in similar markets, the Principal only needs to provide that information for a new Principal that was not serving in the position when the prior summary was provided. PJM will review financial statements and related information for each Market Participant and/or Guarantor on the same basis as described in section II.A.2 above.

Each Market Participant and/or its Guarantor must submit, or cause to be submitted, annual audited financial statements, except as otherwise indicated below, prepared in accordance with US GAAP or any other format acceptable to PJM for the fiscal year most recently ended within ten (10) calendar days of the financial statements becoming available and no later than one hundred twenty (120) calendar days after its fiscal year end. Market Participants and/or their Guarantors must submit, or cause to be submitted, financial statements, which may be unaudited, for each completed fiscal quarter of the current fiscal year, promptly upon their issuance, but no later than sixty (60) calendar days after the end of each fiscal quarter. All audited financial statements provided by the Market Participant and/or its Guarantor must be audited by an Independent Auditor.

Notwithstanding the foregoing, PJM may upon request, grant a Market Participant or Guarantor an extension of time, if the financials are not available within the time frame stated above.

3. Material Adverse Changes

Each Market Participant and each Guarantor is responsible for informing PJM, in writing, of any Material Adverse Change in its or its Guarantor's financial condition within five (5) Business Days of any Principal becoming aware of the occurrence of a Material Adverse Change since the date of the Market Participant or Guarantor's most recent annual financial statements provided to PJM. However, PJM may also independently establish from available information that a Participant and/or its Guarantor has experienced a Material Adverse Change in its financial condition without regard to whether such Market Participant or Guarantor has informed PJM of the same.

For the purposes of this Attachment Q, a Material Adverse Change in financial condition may include, but is not be limited to, any of the following:

- (a) a bankruptcy filing;
- (b) insolvency;
- (c) a significant decrease in market capitalization;
- (d) restatement of prior financial statements unless required due to regulatory changes;
- (e) the resignation or removal of a Principal unless there is a new Principal appointed or expected to be appointed, a transition plan in place pending the appointment of a new Principal, or a planned restructuring of such roles;

- (f) the filing of a lawsuit or initiation of an arbitration, investigation, or other proceeding that would likely have a material adverse effect on any current or future financial results or financial condition or increase the likelihood of non-payment;
- (g) a material financial default in any other organized energy, ancillary service, financial transmission rights and/or capacity markets including but not limited to those of another Regional Transmission Organization or Independent System Operator, or on any commodity exchange, futures exchange or clearing house, that has not been cured or remedied after any required notice has been given and any cure period has elapsed;
- (h) a revocation of a license or other authority by any Federal or State regulatory agency; where such license or authority is necessary or important to the Participant's continued business, for example, FERC market-based rate authority, or State license to serve retail load;
- (i) a significant change in credit default swap spreads, market capitalization, or other market-based risk measurement criteria, such as a recent increase in Moody's KMV Expected Default Frequency (EDFtm) that is materially greater than the increase in its peers' EDFtm rates, or a collateral default swap (CDS) premium normally associated with an entity rated lower than investment grade;
- (j) a confirmed, undisputed material financial default in a bilateral arrangement with another Participant or counterparty that has not been cured or remedied after any required notice has been given and any cure period has elapsed;
- (k) the sale by a Participant of all or substantially all of its bilateral position(s) in the PJM Markets;
- (l) any adverse changes in financial condition which, individually, or in the aggregate, are material; and,
- (m) any adverse changes, events or occurrences which, individually or in the aggregate, could affect the ability of the entity to pay its debts as they become due or could reasonably be expected to have a material adverse effect on any current or future financial results or financial condition.

Upon identification of a Material Adverse Change, PJM shall evaluate the financial strength and risk profile of the Market Participant and/or its Guarantor at that time and may do so on a more frequent basis going forward. If the result of such evaluation identifies unreasonable credit risk to any PJM Market as further described in section II.E.8 below, PJM will take steps to mitigate the financial exposure to the PJM Markets. These steps include, but are not limited to requiring the Market Participant and/or each Guarantor to provide Collateral, additional Collateral or additional Restricted Collateral that is commensurate with the amount of risk in which the Market Participant wants to engage, and/or limiting the Market Participant's ability to participate in any PJM Market to the extent, and for the time-period necessary to mitigate the unreasonable credit risk. In the event PJM determines that a Material Adverse Change in the financial condition or risk profile of a Market Participant and/or Guarantor, warrants a requirement to provide Collateral of any type, or some action to mitigate risk, PJM shall provide the Market Participant and/or Guarantor, a written explanation of why such determination was made. Conversely, in the event PJM determines there has been an improvement in the financial condition or risk profile of a Market Participant and/or Guarantor such that the amount of

Collateral needed for that Market Participant and/or Guarantor can be reduced, PJM shall provide a written explanation why such determination was made, including the amount of the Collateral reduction and indicating when and how the reduction will be made.

4. Litigation and Contingencies

Each Market Participant and/or Guarantor is required to disclose and provide information regarding litigation and contingencies as outlined in section II.A.5 above.

5. History of Defaults in Energy Projects

Each Market Participant and/or Guarantor is required to disclose current default status and default history as outlined in section II.A.6 above.

6. Internal Credit Score

As part of its ongoing risk evaluation, PJM will use credit risk scoring methodologies as a tool in determining an Internal Credit Score for each Market Participant and/or Guarantor, utilizing the same model and framework outlined in section II.A.3 above.

7. Other Disclosures and Additional Information

Each Market Participant and/or Guarantor is required to make other disclosures and provide additional information outlined in section II.A.7 above.

PJM will monitor each Market Participant's use of services and associated financial obligations on a regular basis to determine their total potential financial exposure and for credit monitoring purposes, and may require the Market Participant and/or Guarantor to provide additional information, pursuant to the terms and provisions described herein.

Market Participants shall provide PJM, upon request, any information or documentation reasonably required for PJM to monitor and evaluate a Market Participant's creditworthiness and compliance with the Agreements related to settlements, billing, credit requirements, and other financial matters.

8. Unreasonable Credit Risk

If PJM has reasonable grounds to believe that a Market Participant and/or its Guarantor poses an unreasonable credit risk to any PJM Markets, PJM may immediately notify the Market Participant of such unreasonable credit risk and (1) issue a Collateral Call to demand Collateral, additional Collateral, or Restricted Collateral or other assurances commensurate with the Market Participant's and/or its Guarantor's risk of financial default or other risk posed by the Market Participant's or Guarantor's financial condition or risk profile to the PJM Markets and PJM members, or (2) limit or suspend the Market Participant's participation in any PJM Markets, to the extent and for such time period PJM determines is necessary to mitigate the unreasonable credit risk to any PJM Markets. PJM will only limit or suspend a Market Participant's market

participation if Collateral, additional Collateral or Restricted Collateral cannot address the unreasonable credit risk.

PJM's determination will be based on, but not limited to, information and material provided to PJM during its ongoing risk evaluation process or in the Officer's Certification, and/or information gleaned by PJM from public and non-public sources. PJM will communicate its concerns, if any, in writing to the Market Participant and attempt to better understand the circumstances surrounding the Market Participant's financial and credit position before making its determination. At PJM's request or upon its own initiative, the Market Participant or its Guarantor may provide supplemental information to PJM that would allow PJM to consider reducing the additional Collateral requested or reducing the severity of limitations or other restrictions designed to mitigate the Market Participant's credit risk. Such information shall include, but not be limited to: (i) the Market Participant's estimated exposure, (ii) explanations for any recent change in the Market Participant's market activity, (iii) any relevant new load or unit outage information; or (iv) any default or supply contract expiration, termination or suspension.

The Market Participant shall have five (5) Business Days to respond to PJM's request for supplemental information. If the requested information is provided in full to PJM's satisfaction during said period, the additional Collateral requirement shall reflect the Market Participant's anticipated exposure based on the information provided. Notwithstanding the foregoing, any additional Collateral requested by PJM in a Collateral Call must be provided by the Market Participant within the applicable cure period.

In the event PJM determines that an Market Participant and/or its Guarantor presents an unreasonable credit risk, as described above, that warrants a requirement to provide Collateral of any type, or some action to mitigate risk, PJM shall provide the Market Participant with a written explanation of why such final determination was made.

PJM has the right at any time to modify any Unsecured Credit Allowance and/or require additional Collateral as may be deemed reasonably necessary to support current or anticipated market activity as set forth in Tariff, Attachment Q, sections II.A.2 and II.C.1.b. Failure to remit the required amount of additional Collateral within the applicable cure period shall constitute an Event of Default.

F. Collateral and Credit Restrictions

PJM may establish certain restrictions on available credit by requiring that some amounts of credit, i.e. Restricted Collateral, may not be available to satisfy credit requirements. Such designations shall be construed to be applicable to the calculation of credit requirements only, and shall not restrict PJM's ability to apply such designated credit to any obligation(s) in case of a default. Any such Restricted Collateral will be held by PJM, as applicable. Such Restricted Collateral will not be returned to the Participant until PJM has determined that the risk for which such Restricted Collateral is being held has subsided or been resolved.

PJM may post on PJM's web site, and may reference on OASIS, a supplementary document which contains additional business practices (such as algorithms for credit scoring) that are not included in this Attachment Q. Changes to the supplementary document will be subject to stakeholder review and comment prior to implementation. PJM may specify a required compliance date, not less than fifteen (15) calendar days from notification, by which time all Participants and their Guarantors must comply with provisions that have been revised in the supplementary document.

PJM will regularly post each Participant's and/or its Guarantor's credit requirements and credit provisions on the PJM web site in a secure, password-protected location. Each Participant and/or its Guarantor is responsible for monitoring such information, and maintaining sufficient credit to satisfy the credit requirements described herein. Failure to maintain credit sufficient to satisfy the credit requirements of the Attachment Q shall constitute a Credit Breach, and the Participant will be subject to the remedies established herein and in any of the Agreements.

G. Unsecured Credit Allowance Calculation

The external rating from a Rating Agency will be used as the source for calculating the Unsecured Credit Allowance, unless no external credit rating is available in which case PJM will utilize its Internal Credit Score for such purposes. If there is a split rating between the Rating Agencies, the lower of the ratings shall apply.

Where two or more entities, including Participants, are considered Credit Affiliates, Unsecured Credit Allowances will be established for each individual Participant, subject to an aggregate maximum amount for all Credit Affiliates as provided for in Attachment Q, section II.G.3.

In its credit evaluation of Municipalities and Cooperatives, PJM may request additional information as part of the ongoing risk evaluation process and will also consider qualitative factors in determining financial strength and creditworthiness.

1. Credit Rating and Internal Credit Score

As previously described in section II.A.3 above, PJM will determine the Internal Credit Score for an Applicant, Market Participant and/or its Guarantor using the credit risk scoring methodologies contained therein. Internal Credit Scores, ranging from 1-6, for each Applicant, Market Participant and/or its Guarantor, will be determined with the following mappings:

- 1 = Very Low Risk (S&P/Fitch: AAA to AA-; Moody's: Aaa to Aa3)
- 2 = Low Risk (S&P/Fitch: A+ to BBB+; Moody's: A1 to Baa1)
- 3 = Low to Medium Risk (S&P/Fitch: BBB; Moody's: Baa2)
- 4 = Medium Risk (S&P/Fitch: BBB-; Moody's: Baa3)
- 5 = Medium to High Risk (S&P/Fitch: BB+ to BB; Moody's Ba1 to Ba2)
- 6 = High Risk (S&P/Fitch: BB- and below; Moody's: Ba3 and below)

In instances where the external credit rating is used to calculate the unsecured credit allowance, PJM may also use the Internal Credit Score as an input into its determination of the overall risk profile of an Applicant and/or its Guarantor

2. Unsecured Credit Allowance

PJM will determine a Participant's Unsecured Credit Allowance based on its external rating or its Internal Credit Score, as applicable, and the parameters in the table below. The maximum Unsecured Credit Allowance is the lower of:

- (a) A percentage of the Participant's Tangible Net Worth, as stated in the table below, with the percentage based on the Participant's external rating or Internal Credit Score, as applicable; and
- (b) A dollar cap based on the external rating or Internal Credit Score, as applicable, as stated in the table below:

Internal Credit Score	Risk Ranking	Tangible Net Worth Factor	Maximum Unsecured Credit Allowance (\$ Million)
1.00 – 1.99	1 – Very Low (AAA to AA-)	Up to 10.00%	\$50
2.00 – 2.99	2 – Low (A+ to BBB+)	Up to 8.00%	\$42
3.00 – 3.49	3 – Low to Medium (BBB)	Up to 6.00%	\$33
3.50 – 4.49	4 – Medium (BBB-)	Up to 5.00%	\$7
4.50 – 5.49	5 – Medium to High (BB+ to BB)	0%	\$0
> 5.49	6 – High (BB- and below)	0%	\$0

If a Corporate Guaranty is utilized to establish an Unsecured Credit Allowance for a Participant, the value of a Corporate Guaranty will be the lesser of:

- (a) The limit imposed in the Corporate Guaranty;
- (b) The Unsecured Credit Allowance calculated for the Guarantor; and
- (c) A portion of the Unsecured Credit Allowance calculated for the Guarantor in the case of Credit Affiliates.

PJM has the right at any time to modify any Unsecured Credit Allowance and/or require additional Collateral as may be deemed reasonably necessary to support current market activity.

Failure to remit the required amount of additional Collateral within the applicable cure period shall be deemed an Event of Default.

PJM will maintain a posting of each Participant's Unsecured Credit Allowance, along with certain other credit related parameters, on the PJM website in a secure, password-protected location. Each Participant will be responsible for monitoring such information and recognizing changes that may occur.

3. Unsecured Credit Limits For Credit Affiliates

If two or more Participants are Credit Affiliates and have requested an Unsecured Credit Allowance, PJM will consider the overall creditworthiness of the Credit Affiliates when determining the Unsecured Credit Allowances in order not to establish more Unsecured Credit for the Credit Affiliates collectively than the overall corporate family could support.

Example: Participants A and B each have a \$10.0 million Corporate Guaranty from their common parent, a holding company with an Unsecured Credit Allowance calculation of \$12.0 million. PJM may limit the Unsecured Credit Allowance for each Participant to \$6.0 million, so the total Unsecured Credit Allowance does not exceed the corporate family total of \$12.0 million.

PJM will work with the Credit Affiliates to allocate the total Unsecured Credit Allowance among the Credit Affiliates while assuring that no individual Participant, nor common guarantor, exceeds the Unsecured Credit Allowance appropriate for its credit strength. The aggregate Unsecured Credit for a Participant, including Unsecured Credit Allowance granted based on its own creditworthiness and risk profile, and any Unsecured Credit Allowance conveyed through a Guaranty shall not exceed \$50 million. The aggregate Unsecured Credit for a Credit Affiliates corporate family shall not exceed \$50 million. A Credit Affiliate corporate family subject to this cap shall request PJM to allocate the maximum Unsecured Credit amongst the corporate family, assuring that no individual Participant or common guarantor, shall exceed the Unsecured Credit level appropriate for its credit strength and activity.

H. Contesting an Unsecured Credit Evaluation

PJM will provide to a Participant, upon request, a written explanation for any determination of or change in Unsecured Credit or credit requirement within ten (10) Business Days of receiving such request.

If a Participant believes that either its level of Unsecured Credit or its credit requirement has been incorrectly determined, according to this Attachment Q, then the Participant may send a request for reconsideration in writing to PJM. Such a request should include:

- (1) A citation to the applicable section(s) of this Attachment Q along with an explanation of how the respective provisions of this Attachment Q were not carried out in the determination as made; and

- (2) A calculation of what the Participant believes should be the appropriate Unsecured Credit or Collateral requirement, according to terms of this Attachment Q.

PJM will provide a written response as promptly as practical, but no more than ten (10) Business Days after receipt of the request. If the Participant still feels that the determination is incorrect, then the Participant may contest that determination. Such contest should be in written form, addressed to PJM, and should contain:

- (1) A complete copy of the Participant's earlier request for reconsideration, including citations and calculations;
- (2) A copy of PJM's written response to its request for reconsideration; and
- (3) An explanation of why it believes that the determination still does not comply with this Attachment Q.

PJM will investigate and will respond to the Participant with a final determination on the matter as promptly as practical, but no more than twenty (20) Business Days after receipt of the request.

Neither requesting reconsideration nor contesting the determination following such request shall relieve or delay Participant's responsibility to comply with all provisions of this Attachment Q, including without limitation posting Collateral, additional Collateral or Restricted Collateral in response to a Collateral Call.

If a Corporate Guaranty is being utilized to establish credit for a Participant, the Guarantor will be evaluated and the Unsecured Credit Allowance granted, if any, based on the financial strength and creditworthiness, and risk profile of the Guarantor. Any utilization of a Corporate Guaranty will only be applicable to non-FTR credit requirements, and will not be applicable to cover FTR credit requirements.

PJM will identify any necessary Collateral requirements and establish a Working Credit Limit for each Participant. Any Unsecured Credit Allowance will only be applicable to non-FTR credit requirements, for positions in PJM Markets other than the FTR market, because all FTR credit requirements must be satisfied by posting Collateral.

III. MINIMUM PARTICIPATION REQUIREMENTS

A Participant seeking to participate in any PJM Markets shall submit to PJM any information or documentation reasonably required for PJM to evaluate its experience and resources. If PJM determines, based on its review of the relevant information and after consultation with the Participant, that the Participant's participation in any PJM Markets presents an unreasonable credit risk, PJM may reject the Participant's application to become a Market Participant, notwithstanding applicant's ability to meet other minimum participation criteria, registration requirements and creditworthiness requirements.

A. Annual Certification

Before they are eligible to transact in any PJM Market, all Applicants shall provide to PJM (i) an executed copy of a credit application and (ii) a copy of the annual certification set forth in Attachment Q, Appendix 1. As a condition to continued eligibility to transact in any PJM Market, Market Participants shall provide to PJM the annual certification set forth in Attachment Q, Appendix 1.

After the initial submission, the annual certification must be submitted each calendar year by all Market Participants between January 1 and April 30. PJM will accept such certifications as a matter of course and the Market Participants will not need further notice from PJM before commencing or maintaining their eligibility to participate in any PJM Markets.

A Market Participant that fails to provide its annual certification by April 30 shall be ineligible to transact in any PJM Markets and PJM will disable the Market Participant's access to any PJM Markets until such time as PJM receives the certification. In addition, failure to provide an executed annual certification in a form acceptable to PJM and by the specified deadlines may result in a default under the Tariff.

Market Participants acknowledge and understand that the annual certification constitutes a representation upon which PJM will rely. Such representation is additionally made under the Tariff, filed with and accepted by FERC, and any false, misleading or incomplete statement knowingly made by the Market Participant and that is material to the Market Participant's ability to perform may be considered a violation of the Tariff and subject the Market Participant to action by FERC. Failure to comply with any of the criteria or requirements listed herein or in the certification may result in suspension or limitation of a Market Participant's transaction rights in any PJM Markets.

Applicants and Market Participants shall submit to PJM, upon request, any information or documentation reasonably and/or legally required to confirm Applicant's or Market Participant's compliance with the Agreements and the annual certification.

B. PJM Market Participation Eligibility Requirements

PJM may conduct periodic verification to confirm that Applicants and Market Participants can demonstrate that they meet the definition of "appropriate person" to further ensure minimum criteria are in place. Such demonstration will consist of the submission of evidence and an executed Annual Officer Certification form as set forth in Attachment Q, Appendix 1 in a form acceptable to PJM. If an Applicant or Market Participant does not provide sufficient evidence for verification to PJM within five (5) Business Days of written request, then such Applicant or Market Participant may result in a default under this Tariff. Demonstration of "appropriate person" status and support of other certifications on the annual certification is one part of the Minimum Participation Requirements for any PJM Markets and does not obviate the need to meet the other Minimum Participation Requirements such as those for minimum capitalization and risk profile as set forth in this Attachment Q.

To be eligible to transact in any PJM Markets, an Applicant or Participant must demonstrate in accordance with the Risk Management and Verification processes set forth below that it qualifies in one of the following ways:

1. an “appropriate person,” as that term is defined under Commodity Exchange Act, section 4(c)(3), or successor provision, or;
2. an “eligible contract participant,” as that term is defined in Commodity Exchange Act, section 1a(18), or successor provision, or;
3. a business entity or person who is in the business of: (1) generating, transmitting, or distributing electric energy, or (2) providing electric energy services that are necessary to support the reliable operation of the transmission system, or;
4. an Applicant or Market Participant seeking eligibility as an “appropriate person” providing an unlimited Corporate Guaranty in a form acceptable to PJM as described in section V below from a Guarantor that has demonstrated it is an “appropriate person,” and has at least \$1 million of total net worth or \$5 million of total assets per Applicant and Market Participant for which the Guarantor has issued an unlimited Corporate Guaranty, or;
5. an Applicant or Market Participant providing a Letter of Credit of at least \$5 million to PJM in a form acceptable to PJM as described in section V below, that the Applicant or Market Participant acknowledges is separate from, and cannot be applied to meet, its credit requirements to PJM, or;
6. an Applicant or Market Participant providing a surety bond of at least \$5 million to PJM in a form acceptable to PJM as described in section V below, that the Applicant or Market Participant acknowledges is separate from, and cannot be applied to meet, its credit requirements to PJM.

If, at any time, a Market Participant cannot meet the eligibility requirements set forth above, it shall immediately notify PJM and immediately cease conducting transactions in any PJM Markets. PJM may terminate a Market Participant’s transaction rights in any PJM Markets if, at any time, it becomes aware that the Market Participant does not meet the minimum eligibility requirements set forth above.

In the event that a Market Participant is no longer able to demonstrate it meets the minimum eligibility requirements set forth above, and possesses, obtains or has rights to possess or obtain, any open or forward positions in any PJM Markets, PJM may take any such action it deems necessary with respect to such open or forward positions, including, but not limited to, liquidation, transfer, assignment or sale; provided, however, that the Market Participant will, notwithstanding its ineligibility to participate in any PJM Markets, be entitled to any positive market value of those positions, net of any obligations due and owing to PJM.

C. Risk Management and Verification

All Market Participants must maintain current written risk management policies, procedures, or controls to address how market and credit risk is managed, and are required to submit to PJM (at the time they make their annual certification) a copy of their current governing risk control policies, procedures and controls applicable to their market activities. PJM will review such documentation to verify that it appears generally to conform to prudent risk management practices for entities participating in any PJM Markets.

All Market Participants subject to this provision shall make a one-time payment of \$1,500.00 to PJM to cover administrative costs. Thereafter, if such Participant's risk policies, procedures and controls applicable to its market activities change substantively, it shall submit such modified documentation, with applicable administrative charge determined by PJM, to PJM for review and verification at the time it makes its annual certification. All Market Participant's continued eligibility to participate in any PJM Markets is conditioned on PJM notifying a Participant that its annual certification, including the submission of its risk policies, procedures and controls, has been accepted by PJM. PJM may retain outside expertise to perform the review and verification function described in this section, however, in all circumstances, PJM and any third-party it may retain will treat as confidential the documentation provided by a Participant under this section, consistent with the applicable provisions of the Operating Agreement.

Participants must demonstrate that they have implemented prudent risk management policies and procedures in order to be eligible to participate in any PJM Markets. Participants must demonstrate on at least an annual basis that they have implemented and maintained prudent risk management policies and procedures in order to continue to participate in any PJM Markets. Upon written request, the Participant will have fourteen (14) calendar days to provide to PJM current governing risk management policies, procedures, or controls applicable to Participant's activities in any PJM Markets.

D. Capitalization

In advance of certification, Applicants shall meet the minimum capitalization requirements below. In addition to the annual certification requirements in Attachment Q, Appendix 1, a Market Participant shall satisfy the minimum capitalization requirements on an annual basis thereafter. A Participant must demonstrate that it meets the minimum financial requirements appropriate for the PJM Markets in which it transacts by satisfying either the minimum capitalization or the provision of Collateral requirements listed below:

1. Minimum Capitalization

Minimum capitalization may be met by demonstrating minimum levels of Tangible Net Worth or tangible assets. FTR Participants must demonstrate a Tangible Net Worth in excess of \$1 million or tangible assets in excess of \$10 million. Other Market Participants must demonstrate a Tangible Net Worth in excess of \$500,000 or tangible assets in excess of \$5 million.

(a) Consideration of tangible assets and Tangible Net Worth shall exclude assets which PJM reasonably believes to be restricted, highly risky, or potentially unavailable to settle a claim in

the event of default. Examples include, but are not limited to, restricted assets, derivative assets, goodwill, and other intangible assets.

(b) Demonstration of “tangible” assets and Tangible Net Worth may be satisfied through presentation of an acceptable Corporate Guaranty, provided that both:

- (i) the Guarantor is a Credit Affiliate company that satisfies the Tangible Net Worth or tangible assets requirements herein, and;
- (ii) the Corporate Guaranty is either unlimited or at least \$500,000.

If the Corporate Guaranty presented by the Participant to satisfy these capitalization requirements is limited in value, then the Participant’s resulting Unsecured Credit Allowance shall be the lesser of:

- (1) the applicable Unsecured Credit Allowance available to the Participant by the Corporate Guaranty pursuant to the creditworthiness provisions of this Attachment Q, or,
- (2) the face value of the Corporate Guaranty, reduced by \$500,000 and further reduced by 10%. (For example, a \$10.5 million Corporate Guaranty would be reduced first by \$500,000 to \$10 million and then further reduced 10% more to \$9 million. The resulting \$9 million would be the Participant’s Unsecured Credit Allowance available through the Corporate Guaranty).

In the event that a Participant provides Collateral in addition to a limited Corporate Guaranty to increase its available credit, the value of such Collateral shall be reduced by 10%. This reduced value shall be considered the amount available to satisfy requirements of this Attachment Q.

(c) Demonstrations of minimum capitalization (minimum Tangible Net Worth or tangible assets) must be presented in the form of audited financial statements for the Participant’s most recent fiscal year during the initial risk evaluation process and ongoing risk evaluation process.

2. Provision of Collateral

If a Participant does not demonstrate compliance with its applicable minimum capitalization requirements above, it may still qualify to participate in any PJM Markets by posting Collateral, additional Collateral, and/or Restricted Collateral, subject to the terms and conditions set forth herein.

Any Collateral provided by a Participant unable to satisfy the minimum capitalization requirements above will also be restricted in the following manner:

- (a) Collateral provided by Market Participants that engage in FTR transactions shall be reduced by an amount of the current risk plus any future risk to any PJM Markets and PJM membership in general, and may coincide with limitations on market participation. The amount of this Restricted Collateral shall not be available to cover any credit requirements from market activity. The remaining value shall be considered the amount available to satisfy requirements of this Attachment Q.
- (b) Collateral provided by other Participants that engage in Virtual Transactions or Export Transactions shall be reduced by \$200,000 and then further reduced by 10%. The amount of this Restricted Collateral shall not be available to cover any credit requirements from market activity. The remaining value shall be considered the amount available to satisfy requirements of this Attachment Q.
- (c) Collateral provided by other Participants that do not engage in Virtual Transactions or Export Transactions shall be reduced by 10%. The amount of this Restricted Collateral shall not be available to cover any credit requirements from market activity. The remaining value shall be considered the amount available to satisfy requirements of this Attachment Q.

In the event a Participant that satisfies the minimum capital requirement through provision of Collateral also provides a Corporate Guaranty to increase its available credit, then the Participant's resulting Unsecured Credit Allowance conveyed through such Corporate Guaranty shall be the lesser of:

- (a) the applicable Unsecured Credit Allowance available to the Participant by the Corporate Guaranty pursuant to the creditworthiness provisions of this Attachment Q; or
- (b) the face value of the Corporate Guaranty, reduced commensurate with the amount of the current risk plus any anticipated future risk to any PJM Markets and PJM membership in general, and may coincide with limitations on market participation.

IV. ONGOING COVENANTS

A. Ongoing Obligation to Provide Information to PJM

So long as a Participant is eligible to participate, or participates or holds positions, in any PJM Markets, it shall deliver to PJM, in form and detail satisfactory to PJM:

- (1) All financial statements and other financial disclosures as required by section II.E.2 by the deadline set forth therein;
- (2) Notice, within five (5) Business Days, of any Principal becoming aware that the Participant does not meet the Minimum Participation Requirements set forth in section III;
- (3) Notice when any Principal becomes aware of any matter that has resulted or would reasonably be expected to result in a Material Adverse Change in the financial condition of the Participant or its Guarantor, if any, a description of such Material Adverse Change in detail reasonable to allow PJM to determine its potential effect on, or any change in, the Participant's risk profile as a participant in any PJM Markets, by the deadline set forth in section II.E.3 above;
- (4) Notice, within the deadline set forth therein, of any Principal becoming aware of a litigation or contingency event described in section II.E.4, or of a Material Adverse Change in any such litigation or contingency event previously disclosed to PJM, information in detail reasonable to allow PJM to determine its potential effect on, or any change in, the Market Participant's risk profile as a participant in any PJM Markets by the deadline set forth therein;
- (5) Notice, within two (2) Business Days after any Principal becomes aware of a Credit Breach, Financial Default, or Credit Support Default, that includes a description of such default or event and the Participant's proposals for addressing the default or event;
- (6) As soon as available but not later than April 30th of any calendar year, the annual Certification described in section III.A in a form set forth in Attachment Q, Appendix 1;
- (7) Concurrently with submission of the annual certification, demonstration that the Participant meets the minimum capitalization requirements set forth in section III.D;
- (8) Concurrently with submission of the annual certification and within the applicable deadline of any substantive change, or within the applicable deadline of a request from PJM, a copy of the Participant's written risk management policies, procedures or controls addressing how the Participant manages market and credit risk in the PJM Markets in which it participates, as well as a high level summary by the chief risk officer or other Principal regarding any material violations, breaches, or compliance or disciplinary actions related to the risk management policies, by the Participant under the policies, procedures or controls within the prior 12 months, as set forth in section IV.B below;
- (9) Within five (5) Business Days of request by PJM, evidence demonstrating the Participant meets the definition of "appropriate person" or "eligible contract participant," as those terms are defined in the Commodity Exchange Act and the CFTC regulations promulgated thereunder, or of any other certification in the annual Certification; or

- (10) Within a reasonable time after PJM requests, any other information or documentation reasonably and/or legally required by PJM to confirm Participant's compliance with the Tariff and its eligibility to participate in any PJM Markets.

Participants acknowledge and understand that the deliveries constitute representations upon which PJM will rely in allowing the Participant to continue to participate in its markets, with the Internal Credit Score and Unsecured Credit Allowance, if any, previously determined by PJM.

B. Risk Management Review

PJM shall also conduct a periodic compliance verification process to review and verify, as applicable, Participants' risk management policies, practices, and procedures pertaining to the Participant's activities in any PJM Markets. PJM shall review such documentation to verify that it appears generally to conform to prudent risk management practices for entities trading in any PJM Markets. Participant shall also provide a high level summary by the chief risk officer or other Principal regarding any material violations, breaches, or compliance or disciplinary actions in connection with such risk management policies, practices and procedures within the prior twelve (12) months.

If a third-party industry association publishes or modifies principles or best practices relating to risk management in North American markets for electricity, natural gas or electricity-related commodity products, PJM may, following stakeholder discussion and with no less than six (6) months prior notice to stakeholders, consider such principles or best practices in evaluating the Participant's risk controls.

PJM will prioritize the verification of risk management policies based on a number of criteria, including but not limited to how long the entity has been in business, the Participant's and its Principals' history of participation in any PJM Markets, and any other information obtained in determining the risk profile of the Participant.

Each Participant's continued eligibility to participate in any PJM Markets is conditioned upon PJM notifying the Participant of successful completion of PJM's verification of the Participant's risk management policies, practices and procedures, as discussed herein. However, if PJM notifies the Participant in writing that it could not successfully complete the verification process, PJM shall allow such Participant fourteen (14) calendar days to provide sufficient evidence for verification prior to declaring the Participant as ineligible to continue to participate in any PJM Markets, which declaration shall be in writing with an explanation of why PJM could not complete the verification. If the Participant does not provide sufficient evidence for verification to PJM within the required cure period, such Participant will be considered in default under this Tariff. PJM may retain outside expertise to perform the review and verification function described in this paragraph. PJM and any third party it may retain will treat as confidential the documentation provided by a Participant under this paragraph, consistent with the applicable provisions of the Agreements. If PJM retains such outside expertise, a Participant may direct in writing that PJM perform the risk management review and verification for such Participant instead of utilizing a third party, provided however, that employees and contract employees of PJM and PJM shall not be considered to be such outside expertise or third parties.

Participants are solely responsible for the positions they take and the obligations they assume in any PJM Markets. PJM hereby disclaims any and all responsibility to any Participant or PJM

Member associated with Participant's submitting or failure to submit its annual certification or PJM's review and verification of a Participant's risk policies, procedures and controls. Such review and verification is limited to demonstrating basic compliance by a Participant showing the existence of written policies, procedures and controls to limit its risk in any PJM Markets and does not constitute an endorsement of the efficacy of such policies, procedures or controls.

V. FORMS OF CREDIT SUPPORT

In order to satisfy their PJM credit requirements Participants may provide credit support in a PJM-approved form and amount pursuant to the guidelines herein, provided that, notwithstanding anything to the contrary in this section, a Market Participant in PJM's FTR markets shall meet its credit support requirements related to those FTR markets with either cash or Letters of Credit.

Unless otherwise restricted by PJM, credit support provided may be used by PJM to secure the payment of Participant's financial obligations under the Agreements.

Collateral which may no longer be required to be maintained under provisions of the Agreements, shall be returned at the request of a Participant, no later than two (2) Business Days following determination by PJM within a commercially reasonable period of time that such Collateral is not required.

Except when an Event of Default has occurred, a Participant may substitute an approved PJM form of Collateral for another PJM approved form of Collateral of equal value.

A. Cash Deposit

Cash provided by a Participant as Collateral will be held in a depository account by PJM. Interest shall accrue to the benefit of the Participant, provided that PJM may require Participants to provide appropriate tax and other information in order to accrue such interest credits.

PJM may establish an array of investment options among which a Participant may choose to invest its cash deposited as Collateral. The depository account shall be held in PJM's name in a banking or financial institution acceptable to PJM. Where practicable, PJM may establish a means for the Participant to communicate directly with the bank or financial institution to permit the Participant to direct certain activity in the PJM account in which its Collateral is held. PJM will establish and publish procedural rules, identifying the investment options and respective discounts in Collateral value that will be taken to reflect any liquidation, market and/or credit risk presented by such investments.

Cash Collateral may not be pledged or in any way encumbered or restricted from full and timely use by PJM in accordance with terms of the Agreements.

PJM has the right to liquidate all or a portion of the Collateral account balance at its discretion to satisfy a Participant's Total Net Obligation to PJM in the Event of Default under this Attachment Q or one or more of the Agreements.

B. Letter of Credit

An unconditional, irrevocable standby Letter of Credit can be utilized to meet the Collateral requirement. As stated below, the form, substance, and provider of the Letter of Credit must all be acceptable to PJM.

- (1) The Letter of Credit will only be accepted from U.S.-based financial institutions or U.S. branches of foreign financial institutions (“financial institutions”) that have a minimum corporate debt rating of “A” by Standard & Poor’s or Fitch Ratings, or “A2” from Moody’s Investors Service, or an equivalent short term rating from one of these agencies. PJM will consider the lowest applicable rating to be the rating of the financial institution. If the rating of a financial institution providing a Letter of Credit is lowered below A/A2 by any Rating Agency, then PJM may require the Participant to provide a Letter of Credit from another financial institution that is rated A/A2 or better, or to provide a cash deposit. If a Letter of Credit is provided from a U.S. branch of a foreign institution, the U.S. branch must itself comply with the terms of this Attachment Q, including having its own acceptable credit rating.
- (2) The Letter of Credit shall state that it shall renew automatically for successive one-year periods, until terminated upon at least ninety (90) calendar days prior written notice from the issuing financial institution. If PJM or PJM receives notice from the issuing financial institution that the current Letter of Credit is being cancelled or expiring, the Participant will be required to provide evidence, acceptable to PJM, that such Letter of Credit will be replaced with appropriate Collateral, effective as of the cancellation date of the Letter of Credit, no later than thirty (30) calendar days before the cancellation date of the Letter of Credit, and no later than ninety (90) calendar days after the notice of cancellation. Failure to do so will constitute a default under this Attachment Q and one or more of the Agreements.
- (3) PJM will post on its web site an acceptable standard form of a Letter of Credit that should be utilized by a Participant choosing to submit a Letter of Credit to establish credit at PJM. If the Letter of Credit varies in any way from the standard format, it must first be reviewed and approved by PJM. All costs associated with obtaining and maintaining a Letter of Credit and meeting the Attachment Q provisions are the responsibility of the Participant.
- (4) PJM may accept a Letter of Credit from a financial institution that does not meet the credit standards of this Attachment Q provided that the Letter of Credit has third-party support, in a form acceptable to PJM, from a financial institution that does meet the credit standards of this Attachment Q.

C. Corporate Guaranty

An irrevocable and unconditional Corporate Guaranty may be utilized to establish an Unsecured Credit Allowance for a Participant. Such credit will be considered a transfer of Unsecured Credit from the Guarantor to the Participant, and will not be considered a form of Collateral.

PJM will post on its web site an acceptable form that should be utilized by a Participant choosing to establish its credit with a Corporate Guaranty. If the Corporate Guaranty varies in any way from the PJM format, it must first be reviewed and approved by PJM before it may be applied to satisfy the Participant's credit requirements.

The Corporate Guaranty must be signed by an officer of the Guarantor, and must demonstrate that it is duly authorized in a manner acceptable to PJM. Such demonstration may include either a corporate seal on the Corporate Guaranty itself, or an accompanying executed and sealed secretary's certificate from the Guarantor's corporate secretary noting that the Guarantor was duly authorized to provide such Corporate Guaranty and that the person signing the Corporate Guaranty is duly authorized, or other manner acceptable to PJM.

PJM will evaluate the creditworthiness of a Guarantor and will establish any Unsecured Credit granted through a Corporate Guaranty using the methodology and requirements established for Participants requesting an Unsecured Credit Allowance as described herein. Foreign Guaranties and Canadian Guaranties shall be subject to additional requirements as established herein. If PJM determines at any time that a Material Adverse Change in the financial condition of the Guarantor has occurred, or if the Corporate Guaranty comes within thirty (30) calendar days of expiring without renewal, PJM may reduce or eliminate any Unsecured Credit afforded to the Participant through the guaranty. Such reduction or elimination may require the Participant to provide Collateral within the applicable cure period. If the Participant fails to provide the required Collateral, the Participant shall be in default under this Attachment Q.

All costs associated with obtaining and maintaining a Corporate Guaranty and meeting the Attachment Q provisions are the responsibility of the Participant.

1. Foreign Guaranties

A Foreign Guaranty is a Corporate Guaranty that is provided by a Credit Affiliate entity that is domiciled in a country other than the United States or Canada. The entity providing a Foreign Guaranty on behalf of a Participant is a Foreign Guarantor. A Participant may provide a Foreign Guaranty in satisfaction of part of its credit obligations or voluntary credit provision at PJM provided that all of the following conditions are met:

PJM reserves the right to deny, reject, or terminate acceptance of any Foreign Guaranty at any time, including for material adverse circumstances or occurrences.

- (a) A Foreign Guaranty:
 - (i) Must contain provisions equivalent to those contained in PJM's standard form of Foreign Guaranty with any modifications subject to review and approval by PJM counsel.
 - (ii) Must be denominated in US currency.
 - (iii) Must be written and executed solely in English, including any duplicate originals.
 - (iv) Will not be accepted towards a Participant's Unsecured Credit Allowance for more than the following limits, depending on the Foreign Guarantor's credit rating:

Rating of Foreign Guarantor	Maximum Accepted Guaranty if Country Rating is AAA	Maximum Accepted Guaranty if Country Rating is AA+
A- and above	USD50,000,000	USD30,000,000
BBB+	USD30,000,000	USD20,000,000
BBB	USD10,000,000	USD10,000,000
BBB- or below	USD 0	USD 0

- (v) May not exceed 50% of the Participant's total credit, if the Foreign Grantor is rated less than BBB+.
- (b) A Foreign Guarantor:
- (i) Must satisfy all provisions of this Attachment Q applicable to domestic Guarantors.
 - (ii) Must be a Credit Affiliate of the Participant.
 - (iii) Must maintain an agent for acceptance of service of process in the United States; such agent shall be situated in the Commonwealth of Pennsylvania, absent legal constraint.
 - (iv) Must be rated by at least one Rating Agency acceptable to PJM; the credit strength of a Foreign Guarantor may not be determined based on an evaluation of its audited financial statements without an actual credit rating as well.
 - (v) Must have a senior unsecured (or equivalent, in PJM's sole discretion) rating of BBB (one notch above BBB-) or greater by any and all agencies that provide rating coverage of the entity.
 - (vi) Must provide audited financial statements, in US GAAP format or any other format acceptable to PJM, with clear representation of net worth, intangible assets, and any other information PJM may require in order to determine the entity's Unsecured Credit Allowance.
 - (vii) Must provide a Secretary's Certificate from the Participant's corporate secretary certifying the adoption of Corporate Resolutions:
 1. Authorizing and approving the Guaranty; and
 2. Authorizing the Officers to execute and deliver the Guaranty on behalf of the Guarantor.
 - (viii) Must be domiciled in a country with a minimum long-term sovereign (or equivalent) rating of AA+/Aa1, with the following conditions:
 1. Sovereign ratings must be available from at least two rating agencies acceptable to PJM (e.g. S&P, Moody's, Fitch, DBRS).
 2. Each agency's sovereign rating for the domicile will be considered to be the lowest of: country ceiling, senior unsecured government debt, long-term foreign currency sovereign rating, long-term local currency sovereign rating, or other equivalent measures, at PJM's sole discretion.
 3. Whether ratings are available from two or three agencies, the lowest of the two or three will be used.
 - (ix) Must be domiciled in a country that recognizes and enforces judgments of US courts.

- (x) Must demonstrate financial commitment to activity in the United States as evidenced by one of the following:
 - 1. American Depositary Receipts (ADR) are traded on the New York Stock Exchange, American Stock Exchange, or NASDAQ.
 - 2. Equity ownership worth over USD 100,000,000 in the wholly-owned or majority owned subsidiaries in the United States.
- (xi) Must satisfy all other applicable provisions of the PJM Tariff and/or Operating Agreement, including this Attachment Q.
- (xii) Must pay for all expenses incurred by PJM related to reviewing and accepting a foreign guaranty beyond nominal in-house credit and legal review.
- (xiii) Must, at its own cost, provide PJM with independent legal opinion from an attorney/solicitor of PJM's choosing and licensed to practice law in the United States and/or Guarantor's domicile, in form and substance acceptable to PJM in its sole discretion, confirming the enforceability of the Foreign Guaranty, the Guarantor's legal authorization to grant the Guaranty, the conformance of the Guaranty, Guarantor, and Guarantor's domicile to all of these requirements, and such other matters as PJM may require in its sole discretion.

2. Canadian Guaranties

The entity providing a Canadian Guaranty on behalf of a Participant is a Canadian Guarantor. A Participant may provide a Canadian Guaranty in satisfaction of part of its credit obligations or voluntary credit provision at PJM provided that all of the following conditions are met.

PJM reserves the right to deny, reject, or terminate acceptance of any Canadian Guaranty at any time for reasonable cause, including material adverse circumstances or occurrences.

- (a) A Canadian Guaranty:
 - (i) Must contain provisions equivalent to those contained in PJM's standard form of Foreign Guaranty with any modifications subject to review and approval by PJM counsel.
 - (ii) Must be denominated in US currency.
 - (iii) Must be written and executed solely in English, including any duplicate originals.
- (b) A Canadian Guarantor:
 - (i) Must be a Credit Affiliate of the Participant.
 - (ii) Must satisfy all provisions of this Attachment Q applicable to domestic Guarantors.
 - (iii) Must maintain an agent for acceptance of service of process in the United States; such agent shall be situated in the Commonwealth of Pennsylvania, absent legal constraint.
 - (iv) Must be rated by at least one Rating Agency acceptable to PJM; the credit strength of a Canadian Guarantor may not be determined based on an evaluation of its audited financial statements without an actual credit rating as well.
 - (v) Must provide audited financial statements, in US GAAP format or any other format acceptable to PJM with clear representation of net worth, intangible assets,

- and any other information PJM may require in order to determine the entity's Unsecured Credit Allowance.
- (vi) Must satisfy all other applicable provisions of the PJM Tariff and/or Operating Agreement, including this Attachment Q.

D. Surety Bond

An unconditional, irrevocable surety bond can be utilized to meet the Collateral requirement for Participants. As stated below, the form, substance, and provider of the surety bond must all be acceptable to PJM.

- (i) An acceptable surety bond must be payable immediately upon demand without prior demonstration of the validity of the demand. The surety bond will only be accepted from a U.S. Treasury-listed approved surety that has either (i) a minimum corporate debt rating of “A” by Standard & Poor’s or Fitch Ratings, or “A2” from Moody’s Investors Service, or an equivalent short term rating from one of these agencies, or (ii) a minimum insurer rating of “A” by A.M. Best. PJMSettlement will consider the lowest applicable rating to be the rating of the surety. If the rating of a surety providing a surety bond is lowered below A/A2 by any rating agency, then PJMSettlement may require the Participant to provide a surety bond from another surety that is rated A/A2 or better, or to provide another form of Collateral.
- (ii) The surety bond shall have an initial period of at least one year, and shall state that it shall renew automatically for successive one-year periods, until terminated upon at least ninety (90) days prior written notice from the issuing surety. If PJM receives notice from the issuing surety that the current surety bond is being cancelled, the Participant will be required to provide evidence, acceptable to PJM, that such surety bond will be replaced with appropriate Collateral, effective as of the cancellation date of the surety bond, no later than thirty (30) days before the cancellation date of the surety bond, and no later than ninety (90) days after the notice of cancellation. Failure to do so will constitute a default under this Attachment Q and one of more of the Agreements enabling PJM to immediately demand payment of the full value of the surety bond.
- (iii) PJM will post on its web site an acceptable standard form of a surety bond that should be utilized by a Participant choosing to submit a surety bond to establish credit at PJM. The acceptable standard form of surety bond will include non-negotiable provisions, including but not be limited to, a payment on demand feature, requirement that the bond be construed pursuant to Pennsylvania law, making the surety’s obligation to pay out on the bond absolute and unconditional irrespective of the principal’s (Market Participant’s) bankruptcy, terms of any other agreements, investigation of the Market Participant by any entity or governmental authority, or PJM first attempting to collect payment from the Market Participant, and will require, among other things, that (a) the surety waive *all* rights that would be available to a principal or surety under the law, including

but not limited to any right to investigate or verify any matter related to a demand for payment, rights to set-off amounts due by PJM to the Market Participant, and all counterclaims, (b) the surety expressly waive ***all*** of its and the principal's defenses, including illegality, fraud in the inducement, reliance on statements or representations of PJM and every other typically available defense; (c) the language of the bond that is determinative of the surety's obligation, and not the underlying agreement or arrangement between the principal and the obligee; (d) the bond shall not be conditioned on PJM first resorting to any other means of security or collateral, or pursuing any other remedies it may have; and (e) the surety acknowledge the continuing nature of its obligations in the event of termination or nonrenewal of the surety bond to make clear the surety remains liable for any obligations that arose before the effective date of its notice of cancellation of the surety bond. If the surety bond varies in any way from the standard format, it must first be reviewed and approved by PJM. PJM shall not accept any surety bond that varies in any material way from the standard format.

- (iv) All costs associated with obtaining and maintaining a surety bond and meeting the Attachment Q provisions are the responsibility of the Participant.
- (v) PJM shall not accept surety bonds with an aggregate value greater than \$10 million dollars (\$10,000,000) issued by any individual surety on behalf of any individual Participant.
- (vi) PJM shall not accept surety bonds with an aggregate value greater than \$50 million dollars (\$50,000,000) issued by any individual surety.

E. PJM Administrative Charges

Collateral or credit support held by PJM shall also secure obligations to PJM for PJM administrative charges, and may be liquidated to satisfy all such obligations in an Event of Default.

F. Collateral and Credit Support Held by PJM

Collateral or credit support submitted by Participants and held by PJM shall be held by PJM for the benefit of PJM.

VI. SUPPLEMENTAL CREDIT REQUIREMENTS FOR SCREENED TRANSACTIONS

A. Virtual and Export Transaction Screening

1. Credit for Virtual and Export Transactions

Export Transactions and Virtual Transactions both utilize Credit Available for Virtual Transactions to support their credit requirements.

PJM does not require a Market Participant to establish separate or additional credit for submitting Virtual or Export Transactions; however, once transactions are submitted and accepted by PJM, PJM may require credit supporting those transactions to be held until the transactions are completed and their financial impact incorporated into the Market Participant's Obligations. If a Market Participant chooses to establish additional Collateral and/or Unsecured Credit Allowance in order to increase its Credit Available for Virtual Transactions, the Market Participant's Working Credit Limit for Virtual Transactions shall be increased in accordance with the definition thereof. The Collateral and/or Unsecured Credit Allowance available to increase a Market Participant's Credit Available for Virtual Transactions shall be the amount of Collateral and/or Unsecured Credit Allowance available after subtracting any credit required for Minimum Participation Requirements, FTR, RPM or other credit requirement determinants defined in this Attachment Q, as applicable.

If a Market Participant chooses to provide additional Collateral in order to increase its Credit Available for Virtual Transactions PJM may establish a reasonable timeframe, not to exceed three months, for which such Collateral must be maintained. PJM will not impose such restriction on a deposit unless a Market Participant is notified prior to making the deposit. Such restriction, if applied, shall be applied to all future deposits by all Market Participants engaging in Virtual Transactions.

A Market Participant may increase its Credit Available for Virtual Transactions by providing additional Collateral to PJM. PJM will make a good faith effort to make new Collateral available as Credit Available for Virtual Transactions as soon as practicable after confirmation of receipt. In any event, however, Collateral received and confirmed by noon on a Business Day will be applied (as provided under this Attachment Q) to Credit Available for Virtual Transactions no later than 10:00 am on the following Business Day. Receipt and acceptance of wired funds for cash deposit shall mean actual receipt by PJM's bank, deposit into PJM's customer deposit account, confirmation by PJM that such wire has been received and deposited, and entry into PJM's credit system. Receipt and acceptance of letters of credit or surety bonds shall mean receipt of the original Letter of Credit or surety bond, or amendment thereto, confirmation from PJM's credit and legal staffs that such Letter of Credit or surety bond, or amendment thereto conforms to PJM's requirements, which confirmation shall be made in a reasonable and practicable timeframe, and entry into PJM's credit system. To facilitate this process, bidders submitting additional Collateral for the purpose of increasing their Credit Available for Virtual Transactions are advised to submit such Collateral well in advance of the desired time, and to specifically notify PJM of such submission.

A Market Participant wishing to submit Virtual or Export Transactions must allocate within PJM's credit system the appropriate amount of Credit Available for Virtual Transactions to the virtual and export allocation sections within each customer account in which it wishes to submit such transactions.

2. Virtual Transaction Screening

All Virtual Transactions submitted to PJM shall be subject to a credit screen prior to acceptance in the Day-ahead Energy Market. The credit screen is applied separately for each of a Market Participant's customer accounts. The credit screen process will automatically reject Virtual Transactions submitted by the Market Participant in a customer account if the Market Participant's Credit Available for Virtual Transactions, allocated on a customer account basis, is exceeded by the Virtual Credit Exposure that is calculated based on the Market Participant's Virtual Transactions submitted, as described below.

A Market Participant's Virtual Credit Exposure will be calculated separately for each customer account on a daily basis for all Virtual Transactions submitted by the Market Participant for the next Operating Day using the following equation:

Virtual Credit Exposure = INC and DEC Exposure + Up-to Congestion Exposure
Where:

(a) INC and DEC Exposure for each customer account is calculated as:

(i) ((the total MWh bid or offered, whichever is greater, hourly at each node) x the Nodal Reference Price x 1 day) summed over all nodes and all hours; plus (ii) ((the difference between the total bid MWh cleared and total offered MWh cleared hourly at each node) x Nodal Reference Price) summed over all nodes and all hours for the previous cleared Day-ahead Energy Market.

(b) Up-to Congestion Exposure for each customer account is calculated as:

(i) Total MWh bid hourly for each Up-to Congestion Transaction x (price bid – Up-to Congestion Reference Price) summed over all Up-to Congestion Transactions and all hours; plus (ii) Total MWh cleared hourly for each Up-to Congestion Transaction x (cleared price – Up-to Congestion Reference Price) summed over all Up-to Congestion Transactions and all hours for the previous cleared Day-ahead Energy Market, provided that hours for which the calculation for an Up-to Congestion Transaction is negative, it shall be deemed to have a zero contribution to the sum.

3. Export Transaction Screening

Export Transactions in the Real-time Energy Market shall be subject to Export Transaction Screening. Export Transaction Screening may be performed either for the duration of the entire Export Transaction, or separately for each time interval comprising an Export Transaction. PJM will deny or curtail all or a portion (based on the relevant time interval) of an Export Transaction if that Export Transaction, or portion thereof, would otherwise cause the Market Participant's Export Credit Exposure to exceed its Credit Available for Export Transactions. Export Transaction Screening shall be applied separately for each Operating Day and shall also be applied to each Export Transaction one or more times prior to the market clearing process for each relevant time interval. Export Transaction Screening shall not apply to transactions established directly by and between PJM and a neighboring Balancing Authority for the purpose of maintaining reliability.

A Market Participant's credit exposure for an individual Export Transaction shall be the MWh volume of the Export Transaction for each relevant time interval multiplied by each relevant Export Transaction Price Factor and summed over all relevant time intervals of the Export Transaction.

B. RPM Auction and Price Responsive Demand Credit Requirements

Settlement during any Delivery Year of cleared positions resulting or expected to result from any RPM Auction shall be included as appropriate in Peak Market Activity, and the provisions of this Attachment Q shall apply to any such activity and obligations arising therefrom. In addition, the provisions of this section shall apply to any entity seeking to participate in any RPM Auction, to address credit risks unique to such auctions. The provisions of this section also shall apply under certain circumstances to PRD Providers that seek to commit Price Responsive Demand pursuant to the provisions of the Reliability Assurance Agreement.

Credit requirements described herein for RPM Auctions and RPM bilateral transactions are applied separately for each customer account of a Market Participant. Market Participants wishing to participate in an RPM Auction or enter into RPM bilateral transactions must designate the appropriate amount of credit to each account in which their offers are submitted.

1. Applicability

A Market Participant seeking to submit a Sell Offer in any RPM Auction based on any Capacity Resource for which there is a materially increased risk of nonperformance must satisfy the credit requirement specified herein before submitting such Sell Offer. A PRD Provider seeking to commit Price Responsive Demand for which there is a materially increased risk of non-performance must satisfy the credit requirement specified herein before it may commit the Price Responsive Demand. Credit must be maintained until such risk of non-performance is substantially eliminated, but may be reduced commensurate with the reduction in such risk, as set forth in section IV.B.3 below.

For purposes of this provision, a resource for which there is a materially increased risk of nonperformance shall mean: (i) a Planned Generation Capacity Resource; (ii) a Planned Demand Resource or an Energy Efficiency Resource; (iii) a Qualifying Transmission Upgrade; (iv) an existing or Planned Generation Capacity Resource located outside the PJM Region that at the time it is submitted in a Sell Offer has not secured firm transmission service to the border of the PJM Region sufficient to satisfy the deliverability requirements of the Reliability Assurance Agreement; or (v) Price Responsive Demand to the extent the responsible PRD Provider has not registered PRD-eligible load at a PRD Substation level to satisfy its Nominal PRD Value commitment, in accordance with Reliability Assurance Agreement, Schedule 6.1.

2. Reliability Pricing Model Auction and Price Responsive Demand Credit Requirement

Except as provided for Credit-Limited Offers below, for any resource specified in section IV.B.1 above, other than Price Responsive Demand, the credit requirement shall be the RPM Auction Credit Rate, as provided in section IV.B.4 below, times the megawatts to be offered for sale from such resource in an RPM Auction. For Qualified Transmission Upgrades, the credit requirements shall be based on the Locational Deliverability Area in which such upgrade was to increase the Capacity Emergency Transfer Limit. However, the credit requirement for Planned Financed Generation Capacity Resources and Planned External Financed Generation Capacity Resources shall be one half of the product of the RPM Auction Credit Rate, as provided in section IV.B.4 below, times the megawatts to be offered for sale from such resource in a Reliability Pricing Model Auction. The RPM Auction Credit Requirement for each Market Participant shall be determined on a customer account basis, separately for each customer account of a Market Participant, and shall be the sum of the credit requirements for all such resources to be offered by such Market Participant in the auction or, as applicable, cleared by such Market Participant in the relevant auctions. For Price Responsive Demand, the credit requirement shall be based on the Nominal PRD Value (stated in Unforced Capacity terms) times the Price Responsive Demand Credit Rate as set forth in section IV.B.5 below. Except for Credit-Limited Offers, the RPM Auction Credit requirement for a Market Participant will be reduced for any Delivery Year to the extent less than all of such Market Participant's offers clear in the Base Residual Auction or any Incremental Auction for such Delivery Year. Such reduction shall be proportional to the quantity, in megawatts, that failed to clear in such Delivery Year.

A Sell Offer based on a Planned Generation Capacity Resource, Planned Demand Resource, or Energy Efficiency Resource may be submitted as a Credit-Limited Offer. A Market Participant electing this option shall specify a maximum amount of Unforced Capacity, in megawatts, and a maximum credit requirement, in dollars, applicable to the Sell Offer. A Credit-Limited Offer shall clear the RPM Auction in which it is submitted (to the extent it otherwise would clear based on the other offer parameters and the system's need for the offered capacity) only to the extent of the lesser of: (i) the quantity of Unforced Capacity that is the quotient of the division of the specified maximum credit requirement by the Auction Credit Rate resulting from section IV.B.4.b. below; and (ii) the maximum amount of Unforced Capacity specified in the Sell Offer. For a Market Participant electing this alternative, the RPM Auction Credit requirement applicable prior to the posting of results of the auction shall be the maximum credit requirement specified in its Credit-Limited Offer, and the RPM Auction Credit requirement subsequent to posting of the results will be the Auction Credit Rate, as provided in section IV.B.4.b, c. or d. of this Attachment Q, as applicable, times the amount of Unforced Capacity from such Sell Offer that cleared in the auction. The availability and operational details of Credit-Limited Offers shall be as described in the PJM Manuals.

As set forth in section IV.B.4 below, a Market Participant's Auction Credit requirement shall be determined separately for each Delivery Year.

3. Reduction in Credit Requirement

As specified below, the RPM Auction Credit Rate may be reduced under certain circumstances after the auction has closed.

The Price Responsive Demand credit requirement shall be reduced as and to the extent the PRD Provider registers PRD-eligible load at a PRD Substation level to satisfy its Nominal PRD Value commitment, in accordance with Reliability Assurance Agreement, Schedule 6.1.

In addition, the RPM Auction Credit requirement for a Market Participant for any given Delivery Year shall be reduced periodically, after the Market Participant has provided PJM a written request for each reduction, accompanied by documentation sufficient for PJM to verify attainment of required milestones or satisfaction of other requirements, and PJM has verified that the Market Participant has successfully met progress milestones for its Capacity Resource that reduce the risk of non-performance, as follows:

(a) For Planned Demand Resources and Energy Efficiency Resources, the RPM Auction Credit requirement will be reduced in direct proportion to the megawatts of such Demand Resource that the Resource Provider qualifies as a Capacity Resource, in accordance with the procedures established under the Reliability Assurance Agreement.

(b) For Existing Generation Capacity Resources located outside the PJM Region that have not secured sufficient firm transmission to the border of the PJM Region prior to the auction in which such resource is first offered, the RPM Auction Credit requirement shall be reduced in direct proportion to the megawatts of firm transmission service secured by the Market Participant

that qualify such resource under the deliverability requirements of the Reliability Assurance Agreement.

(c) For Planned Generation Capacity Resources located in the PJM Region, the RPM Auction Credit requirement shall be reduced as the Capacity Resource attains the milestones stated in the following table and as further described in the PJM Manuals.

Milestones	Increment of reduction from initial RPM Auction Credit requirement
Effective Date of Interconnection Service Agreement	50%
Financial Close	15%
Full Notice to Proceed and Commencement of Construction (e.g., footers poured)	5%
Main Power Generating Equipment Delivered	5%
Commencement of Interconnection Service	25%

For externally financed projects, the Market Participant must submit with its request for reduction a sworn, notarized certification of a duly authorized independent engineer for the Financial Close, Full Notice to Proceed and Commencement of Construction, and Main Power Generating Equipment Delivered milestones.

For internally financed projects, the Market Participant must submit with its request for reduction a sworn, notarized certification of a duly authorized officer of the Market Participant for the Financial Close milestone and either a duly authorized independent engineer or Professional Engineer for the Full Notice to Proceed and Commencement of Construction and the Main Power Generating Equipment Delivered milestones.

The required certifications must be in a form acceptable to PJM, certifying that the engineer or officer, as applicable, has personal knowledge, or has engaged in a diligent inquiry to determine, that the milestone has been achieved and that, based on its review of the relevant project information, the engineer or officer, as applicable, is not aware of any information that could reasonably cause it to believe that the Capacity Resource will not be in-service by the beginning of the applicable Delivery Year. The Market Participant shall, if requested by PJM, supply to PJM on a confidential basis all records and documents relating to the engineer's and/or officer's certifications.

(d) For Planned External Generation Capacity Resources, the RPM Auction Credit requirement shall be reduced as the Capacity Resource attains the milestones stated in the following table and as further described in the PJM Manuals; provided, however, that the total percentage reduction in the RPM Auction Credit requirement shall be no greater than the quotient of (i) the MWs of firm transmission service that the Market Participant has secured for the complete transmission path divided by (ii) the MWs of firm transmission service required to

qualify such resource under the deliverability requirements of the Reliability Assurance Agreement.

Credit Reduction Milestones for Planned External Generation Capacity Resources	
Milestones	Increment of reduction from initial RPM Auction Credit requirement
Effective Date of the equivalent of an Interconnection Service Agreement	50%
Financial Close	15%
Full Notice to Proceed and Commencement of Construction (e.g., footers poured)	5%
Main Power Generating Equipment Delivered	5%
Commencement of Interconnection Service	25%

To obtain a reduction in its RPM Auction Credit requirement, the Market Participant must demonstrate satisfaction of the applicable milestone in the same manner as set forth for Planned Generation Capacity Resources in subsection (c) above.

(e) For Planned Financed Generation Capacity Resources located in the PJM Region, the RPM Auction Credit requirement shall be reduced as the Capacity Resource attains the milestones stated in the following table and as further described in the PJM Manuals.

Credit Reduction Milestones for Planned Financed Generation Capacity Resources	
Milestones	Increment of reduction from initial RPM Auction Credit requirement
Full Notice to Proceed	50%
Commencement of Construction (e.g., footers poured)	15%
Main Power Generating Equipment Delivered	10%
Commencement of Interconnection Service	25%

To obtain a reduction in its RPM Auction Credit requirement, the Market Participant must demonstrate satisfaction of the applicable milestone in the same manner as set forth for Planned Generation Capacity Resources in subsection (c) above.

(f) For Planned External Financed Generation Capacity Resources, the RPM Auction Credit Requirement shall be reduced as the Capacity Resource attains the milestones stated in the following table and as further described in the PJM Manuals; provided, however, that the total percentage reduction in the RPM Auction Credit requirement, including the initial 50% reduction for being a Planned External Financed Generation Capacity Resources, shall be no greater than the quotient of (i) the MWs of firm transmission service that the Market Participant has secured for the complete transmission path divided by (ii) the MWs of firm transmission service required

to qualify such resource under the deliverability requirements of the Reliability Assurance Agreement.

Credit Reduction Milestones for Planned External Financed Generation Capacity	
Milestones	Increment of reduction from initial RPM Auction Credit requirement
Full Notice to Proceed	50%
Commencement of Construction (e.g., footers poured)	15%
Main Power Generating Equipment Delivered	10%
Commencement of Interconnection Service	25%

To obtain a reduction in its RPM Auction Credit requirement, the Market Participant must demonstrate satisfaction of the applicable milestone in the same manner as set forth for Planned Generation Capacity Resources in subsection (c) above.

(g) For Qualifying Transmission Upgrades, the RPM Auction Credit requirement shall be reduced to 50% of the amount calculated under section IV.B.2 above beginning as of the effective date of the latest associated Interconnection Service Agreement (or, when a project will have no such agreement, an Upgrade Construction Service Agreement), and shall be reduced to zero on the date the Qualifying Transmission Upgrade is placed in service.

4. RPM Auction Credit Rate

As set forth in the PJM Manuals, a separate Auction Credit Rate shall be calculated for each Delivery Year prior to each RPM Auction for such Delivery Year, as follows:

- (a) Prior to the posting of the results of a Base Residual Auction for a Delivery Year, the Auction Credit Rate shall be:
- (i) For all Capacity Resources other than Capacity Performance Resources, (the greater of (A) 0.3 times the Net Cost of New Entry for the PJM Region for such Delivery Year, in MW-day or (B) \$20 per MW-day) times the number of calendar days in such Delivery Year; and
 - (ii) For Capacity Performance Resources, the greater of ((A) 0.5 times the Net Cost of New Entry for the PJM Region for such Delivery Year or for the Relevant LDA, in MW-day or (B) \$20 per MW-day) times the number of calendar days in such Delivery Year.
 - (iii) For Seasonal Capacity Performance Resources, the same as the Auction Credit Rate for Capacity Performance Resources, but reduced to be proportional to the number of calendar days in the relevant season.

(b) Subsequent to the posting of the results from a Base Residual Auction, the Auction Credit Rate used for ongoing credit requirements for supply committed in such auction shall be:

- (i) For all Capacity Resources other than Capacity Performance Resources, (the greater of (A) \$20/MW-day or (B) 0.2 times the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the resource is located) times the number of calendar days in such Delivery Year; and
- (ii) For Capacity Performance Resources, the (greater of [(A) \$20/MW-day or (B) 0.2 times the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the resource is located) or (C) the lesser of (1) 0.5 times the Net Cost of New Entry for the PJM Region for such Delivery Year or for the Relevant LDA, in \$/MW-day or (2) 1.5 times the Net Cost of New Entry (stated on an installed capacity basis) for the PJM Region for such Delivery year or for the Relevant LDA, in \$/MW-day minus (the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the resource is located)] times the number of calendar days in such Delivery Year).
- (iii) For Seasonal Capacity Performance Resources, the same as the Auction Credit Rate for Capacity Performance Resources, but reduced to be proportional to the number of calendar days in the relevant season.

(c) For any resource not previously committed for a Delivery Year that seeks to participate in an Incremental Auction, the Auction Credit Rate shall be:

(i) For all Capacity Resources other than Capacity Performance Resources, (the greater of (A) 0.3 times the Net Cost of New Entry for the PJM Region for such Delivery Year, in MW-day or (B) 0.24 times the Capacity Resource Clearing Price in the Base Residual Auction for such Delivery Year for the Locational Deliverability Area within which the resource is located or (C) \$20 per MW-day) times the number of calendar days in such Delivery Year; and

(ii) For Capacity Performance Resources, the (greater of (A) 0.5 times Net Cost of New Entry for the PJM Region for such Delivery Year or for the Relevant LDA or (B) \$20/MW-day) times the number of calendar days in such Delivery Year.

(d) Subsequent to the posting of the results of an Incremental Auction, the Auction Credit Rate used for ongoing credit requirements for supply committed in such auction shall be:

- (i) For Base Capacity Resources: (the greater of (A) \$20/MW-day or (B) 0.2 times the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the resource is located) times the number of calendar days in such Delivery Year, but no greater than the Auction Credit Rate previously established for such resource's participation in such Incremental Auction pursuant to subsection (c) above) times the number of calendar days in such Delivery Year;

- (ii) For Capacity Performance Resources, the greater of [(A) \$20/MW-day or (B) 0.2 times the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the resource is located or (C) the lesser of (1) 0.5 times the Net Cost of New Entry for the PJM Region for such Delivery Year or for the Relevant LDA, in \$/MW-day or (2) 1.5 times the Net Cost of New Entry (stated on an installed capacity basis) for the PJM Region for such Delivery Year or for the Relevant LDA, in \$/MW-day minus (the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the resource is located)] times the number of calendar days in such Delivery Year); and
 - (iii) For Seasonal Capacity Performance Resources, the same as the Auction Credit Rate for Capacity Performance Resources, but reduced to be proportional to the number of calendar days in the relevant season.
- (e) For the purposes of this section IV.B.4 and section IV.B.5 below, “Relevant LDA” means the Locational Deliverability Area in which the Capacity Performance Resource is located if a separate Variable Resource Requirement Curve has been established for that Locational Deliverability Area for the Base Residual Auction for such Delivery Year.

5. Price Responsive Demand Credit Rate

- (a) For the 2018/2019 through 2022/2023 Delivery Years:
 - (i) Prior to the posting of the results of a Base Residual Auction for a Delivery Year, the Price Responsive Demand Credit Rate shall be (the greater of (A) 0.3 times the Net Cost of New Entry for the PJM Region for such Delivery Year, in MW-day or (B) \$20 per MW-day) times the number of calendar days in such Delivery Year;
 - (ii) Subsequent to the posting of the results from a Base Residual Auction, the Price Responsive Demand Credit Rate used for ongoing credit requirements for Price Responsive Demand committed in such auction shall be (the greater of (A) \$20/MW-day or (B) 0.2 times the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the Price Responsive Demand load is located, in \$/MW-day) times the number of calendar days in such Delivery Year times a final price uncertainty factor of 1.05;
 - (iii) For any additional Price Responsive Demand that seeks to commit in a Third Incremental Auction in response to a qualifying change in the final LDA load forecast, the Price Responsive Demand Credit Rate shall be the same as the rate for Price Responsive Demand that had cleared in the Base Residual Auction; and
 - (iv) Subsequent to the posting of the results of the Third Incremental Auction, the Price Responsive Demand Credit Rate used for ongoing credit requirements for

all Price Responsive Demand, shall be (the greater of (i) \$20/MW-day or (ii) 0.2 times the Final Zonal Capacity Price for the Locational Deliverability Area within which the Price Responsive Demand is located) times the number of calendar days in such Delivery Year, but no greater than the Price Responsive Demand Credit Rate previously established under subsections (a)(i), (a)(ii), or (a)(iii) of this section for such Delivery Year.

(b) For the 2022/2023 Delivery Year and Subsequent Delivery Years:

- (i) Prior to the posting of the results of a Base Residual Auction for a Delivery Year, the Price Responsive Demand Credit Rate shall be (the greater of (A) 0.5 times the Net Cost of New Entry for the PJM Region for such Delivery Year or for the Relevant LDA, in \$/MW-day or (B) \$20 per MW-day) times the number of calendar days in such Delivery Year;
- (ii) Subsequent to the posting of the results from a Base Residual Auction, the Price Responsive Demand Credit Rate used for ongoing credit requirements for Price Responsive Demand committed in such auction shall be (the greater of [(A) \$20/MW-day or (B) 0.2 times the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the Price Responsive Demand is located, in \$/MW-day or (C) the lesser of (1) 0.5 times the Net Cost of New Entry for the PJM Region for such Delivery Year or for the Relevant LDA, in \$/MW-day or (2) 1.5 times the Net Cost of New Entry (stated on an installed capacity basis) for the PJM Region for such Delivery year or for the Relevant LDA, in \$/MW-day minus (the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the Price Responsive Demand is located)] times the number of calendar days in such Delivery Year;
- (iii) For any additional Price Responsive Demand that seeks to commit in a Third Incremental Auction in response to a qualifying change in the final LDA load forecast, the Price Responsive Demand Credit Rate shall be (the greater of (A) 0.5 times Net Cost of New Entry for the PJM Region for such Delivery Year or for the Relevant LDA, in \$/MW-day or (B) \$20/MW-day) times the number of calendar days in such Delivery Year; and
- (iv) Subsequent to the posting of the results of the Third Incremental Auction, the Price Responsive Demand Credit Rate used for ongoing credit requirements for all Price Responsive Demand committed in such auction shall be the greater of [(A) \$20/MW-day or (B) 0.2 times the Capacity Resource Clearing Price in such auction for the Locational Deliverability Area within which the Price Responsive Demand is located or (C) the lesser of (1) 0.5 times the Net Cost of New Entry for the PJM Region for such Delivery Year or for the Relevant LDA, in \$/MW-day or (2) 1.5 times the Net Cost of New Entry (stated on an installed capacity basis) for the PJM Region for such Delivery Year or for the Relevant LDA, in \$/MW-day minus (the Capacity Performance Resource Clearing Price in such Incremental Auction for the Locational Deliverability Areas within which the Price

Responsive Demand is located)] times the number of calendar days in such Delivery Year.

6. RPM Seller Credit - Additional Form of Unsecured Credit for RPM

In addition to the forms of credit specified elsewhere in this Attachment Q, RPM Seller Credit shall be available to Market Participants, but solely for purposes of satisfying RPM Auction Credit requirements. If a supplier has a history of being a net seller into PJM Markets, on average, over the past 12 months, then PJM will count as available Unsecured Credit twice the average of that Market Participant's total net monthly PJM bills over the past 12 months. This RPM Seller Credit shall be subject to the cap on available Unsecured Credit as established in section II.G.3 above.

RPM Seller Credit is calculated as a single value for each Market Participant, not separately by account, and must be designated to specific customer accounts in order to be available to satisfy RPM Auction Credit requirements that are calculated in each such customer account.

7. Credit Responsibility for Traded Planned RPM Capacity Resources

PJM may require that credit and financial responsibility for planned Capacity Resources that are traded remain with the original party (which for these purposes, means the party bearing credit responsibility for the planned Capacity Resource immediately prior to trade) unless the receiving party independently establishes consistent with this Attachment Q, that it has sufficient credit with PJM and agrees by providing written notice to PJM that it will fully assume the credit responsibility associated with the traded planned Capacity Resource.

C. Financial Transmission Right Auctions

Credit requirements described herein for FTR activity are applied separately for each customer account of a Market Participant, unless specified otherwise in this section C. FTR Participants must designate the appropriate amount of credit to each separate customer account in which any activity occurs or will occur.

1. FTR Credit Limit.

Participants must maintain their FTR Credit Limit at a level equal to or greater than their FTR Credit Requirement for each applicable account. FTR Credit Limits will be established only by a Participant providing Collateral and designating the available credit to specific accounts.

2. FTR Credit Requirement.

For each Market Participant with FTR activity, PJM shall calculate an FTR Credit Requirement. The FTR Credit Requirement shall be calculated on a portfolio basis for each Market Participant based on (a) initial margin, (b) Auction Revenue Right Credits, (c) Mark-to-Auction Value, (d) application of a 10¢ per MWh minimum value adjustment, and (e) realized gains and/or losses, as set forth in subsections (a)-(e) of this subsection, employing the formula:

$\text{Max} \{ \text{Max} (\text{IM} - \text{ARR} - \text{MTA}, \text{Ten Cent per Mwh Minimum}) - \text{Realized Gains and/or Losses}, 0 \}$

Where IM is the initial margin, ARR is Auction Revenue Rights Credits and MTA is the Mark-to-Auction Value. The FTR Credit Requirement may be increased to reflect any change in the value of a Market Participant's portfolio requiring an increase in Collateral as further described below.

(a) Initial Margin

Initial margin shall be calculated in accordance with the following formula:

$$\text{IM} = \text{FTR Obligations IM} + \text{FTR Options IM}$$

The model will employ an initial confidence interval of 97 percent.

(i) FTR Obligations IM

Initial margin values for Financial Transmission Right Obligations shall be determined utilizing a historical simulation value-at-risk methodology that calculates the size and value at risk of the applicable FTR portfolio based on a defined confidence interval and subject to a weighted aggregation method that is represented by a straight sum for long term positions and a combination of straight sum (20%) and weighted root sum of squares (80%) for balance of planning period positions.

(ii) FTR Options IM

The initial margin for Financial Transmission Right Options shall be calculated as the FTR cost minus the FTR Historical Values. FTR Historical Values shall be calculated separately for on-peak, off-peak, and 24-hour FTRs for each month of the year. FTR Historical Values shall be adjusted by plus or minus ten percent for cleared counter flow or prevailing flow FTRs, respectively, in order to mitigate exposure due to uncertainty and fluctuations in actual FTR value. Historical values used in the calculation of FTR Historical Values shall be adjusted when the network simulation model utilized in PJM's economic planning process indicates that transmission congestion will decrease due to certain transmission upgrades that are in effect or planned to go into effect for the following Planning Period. The transmission upgrades to be modeled for this purpose shall only include those upgrades that, individually, or together, have 10% or more impact on the transmission congestion on an individual constraint or constraints with congestion of \$5 million or more affecting a common congestion path. The adjustments to historical values shall be the dollar amount of the adjustment shown in the network simulation model.

(b) Auction Revenue Rights Credits

For a given month for which initial margin is calculated, the prorated value of any Auction Revenue Rights Credits held by a Market Participant with Financial Transmission Right Obligations shall be subtracted from the initial margin for that month. In accordance with subsection 3 below, PJM may recalculate Auction Revenue Rights Credits at any time, but shall do so no less frequently than subsequent to each annual FTR auction. If a reduction in such ARR credits at any time increases an FTR Participant's FTR Credit Requirements beyond its credit available for FTR activity, the FTR Participant must increase its Collateral or the FTR Credit Limit.

(c) Mark-to-Auction Value

A Mark-to-Auction Value shall be calculated for each Market Participant in accordance with subsection 7 below.

(d) Ten Cent (10¢) per MWh Minimum Value Adjustment

If the FTR Credit Requirement as calculated pursuant to subsections (a)-(c) above, results in a value that is less than ten cents (10¢) per MWh, the FTR Credit Requirement shall be increased to ten cents (10¢) per MWh. When calculating the portfolio MWh for this comparison, for cleared "Sell" FTRs, the MWh shall be subtracted from the portfolio total; prior to clearing, the MWh for "Sell" FTRs shall not be included in the portfolio total.

(e) Realized Gains and/or Losses

Any realized gains and/or losses resulting from the sale of Financial Transmission Right Obligations will be subtracted from the FTR Credit Requirement. A realized gain will decrease the FTR Credit Requirement (but not below \$0.00), whereas a realized loss will increase the FTR Credit Requirement.

3. Rejection of FTR Bids.

Bids submitted into an auction will be rejected if the Market Participant's FTR Credit Requirement including such submitted bids would exceed the Market Participant's FTR Credit Limit, or if the Market Participant fails to provide additional Collateral as required pursuant to provisions related to mark-to-auction.

4. FTR Credit Collateral Returns.

A Market Participant may request from PJM the return of any Collateral no longer required for the FTR markets. PJM is permitted to limit the frequency of such requested Collateral returns, provided that Collateral returns shall be made by PJM at least once per calendar quarter, if requested by a Market Participant.

5. Credit Responsibility for Bilateral Transfers of FTRs.

PJM may require that credit responsibility associated with an FTR bilaterally transferred to a new Market Participant remain with the original party (which for these purposes, means the party bearing credit responsibility for the FTR immediately prior to bilateral transfer) unless and until the receiving party independently establishes, consistent with this Attachment Q, sufficient credit with PJM and agrees through confirmation of the bilateral transfer in PJM's FTR reporting tool that it will meet in full the credit requirements associated with the transferred FTR.

6. FTR Administrative Charge Credit Requirement

In addition to any other credit requirements, PJM may apply a credit requirement to cover the maximum administrative fees that may be charged to a Market Participant for its bids and offers.

7. Mark-to-Auction

A Mark-to-Auction Value shall be calculated separately for each customer account of a Market Participant. For each such customer account, the Mark-to-Auction Value shall be a single number equal to the sum, over all months remaining in the applicable FTR period and for all cleared FTRs in the customer account, of the most recently available cleared auction price applicable to the FTR minus the original transaction price of the FTR, multiplied by the transacted quantity.

The FTR Credit Requirement, as otherwise described above, shall be increased when the Mark-to-Auction Value is negative and decreased when the Mark-to-Auction Value is positive. The increase shall equal the absolute value of the negative Mark-to-Auction Value less the value of ARR credits that are held in the customer account and have not been used to reduce the FTR Credit Requirement prior to application of the Mark-to-Auction Value. PJM shall recalculate ARR credits held by each Market Participant after each annual FTR auction and may also recalculate such ARR credits at any other additional time intervals it deems appropriate. Application of the Mark-to-Auction Value, including the effect from ARR application, shall not decrease the FTR Credit Requirement below the Ten Cent (10¢) per MWh Minimum.

For Market Participant customer accounts for which FTR bids have been submitted into the current FTR auction, if the Market Participant's FTR Credit Requirement exceeds its credit available for the Market Participant's portfolio of FTRs in the tentative cleared solution for an FTR auction (or auction round), PJM shall issue a Collateral Call to the Market Participant, and the Market Participant must fulfill such demand before 4:00 p.m. Eastern Prevailing Time on the following Business Day. If a Market Participant does not timely satisfy such Collateral Call,

PJM shall, in coordination with PJM, cause the removal of all of that Market Participant's bids in that FTR auction (or auction round), submitted from such Market Participant's customer account, and a new cleared solution shall be calculated for the FTR auction (or auction round).

If necessary, PJM shall repeat the auction clearing calculation. PJM shall repeat these mark-to-auction calculations subsequent to any secondary clearing calculation, and PJM shall require affected Market Participants to establish additional credit.

Subsequent to final clearing of an FTR auction or an annual FTR auction round, PJM shall recalculate the FTR Credit Requirement for all FTR portfolios, and, as applicable, issue to each Market Participant a request for Collateral for the total amount by which the FTR Credit Requirement exceeds the credit allocated in any of the Market Participant's accounts. The Market Participant must fulfill such demand by 4:00 p.m. Eastern Prevailing Time on the following Business Day.

If the request for Collateral is not satisfied within the applicable cure period referenced in Operating Agreement, section 15, then such Market Participant shall be restricted in all of its credit-screened transactions. Specifically, such Market Participant may not engage in any Virtual Transactions or Export Transactions, or participate in RPM Auctions or other RPM activity. Such Market Participant may engage only in the selling of open FTR positions, either in FTR auctions or bilaterally, provided such sales would reduce the Market Participant's FTR Credit Requirements. PJM shall not return any Collateral to such Market Participant, and no payment shall be due or payable to such Market Participant, until its credit shortfall is remedied. Market Participant shall allocate any excess or unallocated Collateral to any of its account in which there is a credit shortfall. Market Participants may remedy their credit shortfall at any time through provision of sufficient Collateral.

If a Market Participant fails to satisfy MTA Collateral Calls for two consecutive auctions of overlapping periods, e.g. two balance of Planning Period auctions, an annual FTR auction and a balance of Planning Period auction, or two long term FTR auctions, (for this purpose the four rounds of an annual FTR auction shall be considered a single auction), the Market Participant shall be declared in default of this Attachment Q.

VII. PEAK MARKET ACTIVITY AND WORKING CREDIT LIMIT

A. Peak Market Activity Credit Requirement

PJM shall calculate a Peak Market Activity credit requirement for each Participant. Each Participant must maintain sufficient Unsecured Credit Allowance and/or Collateral, as applicable, and subject to the provisions herein, to satisfy its Peak Market Activity credit requirement.

Peak Market Activity for Participants will be determined semi-annually, utilizing an initial Peak Market Activity, as explained below, calculated after the first complete billing week in the months of April and October. Peak Market Activity shall be the greater of the initial Peak Market Activity, or the greatest amount invoiced for the Participant's transaction activity for all

PJM Markets and services in any rolling one, two, or three week period, ending within a respective semi-annual period. However, Peak Market Activity shall not exceed the greatest amount invoiced for the Participant's transaction activity for all PJM Markets and services in any rolling one, two or three week period in the prior 52 weeks.

Peak Market Activity shall exclude FTR Net Activity, Virtual Transactions Net Activity, and Export Transactions Net Activity.

When calculating Peak Market Activity, PJM may attribute credits for Regulation service to the days on which they were accrued, rather than including them in the month-end invoice.

The initial Peak Market Activity for Applicants will be determined by PJM based on a review of an estimate of their transactional activity for all PJM Markets and services over the next 52 weeks, which the Applicant shall provide to PJM.

The initial Peak Market Activity for Market Participants and Transmission Customers, calculated at the beginning of each semi-annual period, shall be the three-week average of all non-zero invoice totals over the previous 52 weeks. This calculation shall be performed and applied within three (3) Business Days following the day the invoice is issued for the first full billing week in the current semi-annual period.

Prepayments shall not affect Peak Market Activity unless otherwise agreed to in writing pursuant to this Attachment Q.

Peak Market Activity calculations shall take into account reductions of invoice values effectuated by early payments which are applied to reduce a Participant's Peak Market Activity as contemplated by other terms of this Attachment Q; provided that the initial Peak Market Activity shall not be less than the average value calculated using the weeks for which no early payment was made.

A Participant may reduce its Collateral requirement by agreeing in writing (in a form acceptable to PJM) to make additional payments, including prepayments, as and when necessary to ensure that such Participant's Total Net Obligation at no time exceeds such reduced Collateral requirement.

PJM may, at its discretion, adjust a Participant's Peak Market Activity requirement if PJM determines that the Peak Market Activity is not representative of such Participant's expected activity, as a consequence of known, measurable, and sustained changes. Such changes may include, but shall not be limited to when a Participant makes PJM aware of federal, state or local law that could affect the allocation of charges or credits from a Participant to another party, the loss (without replacement) of short-term load contracts, when such contracts had terms of three months or more and were acquired through state-sponsored retail load programs, but shall not include short-term buying and selling activities.

PJM may waive the credit requirements for a Participant that has no outstanding transactions and agrees in writing that it shall not, after the date of such agreement, incur obligations under any of

the Agreements. Such entity's access to all electronic transaction systems administered by PJM shall be terminated.

A Participant receiving unsecured credit may make early payments up to ten times in a rolling 52-week period in order to reduce its Peak Market Activity for credit requirement purposes. Imputed Peak Market Activity reductions for credit purposes will be applied to the billing period for which the payment was received. Payments used as the basis for such reductions must be received prior to issuance or posting of the invoice for the relevant billing period. The imputed Peak Market Activity reduction attributed to any payment may not exceed the amount of Unsecured Credit for which the Participant is eligible.

B. Working Credit Limit

PJM will establish a Working Credit Limit for each Participant against which its Total Net Obligation will be monitored.

If a Participant's Total Net Obligation approaches its Working Credit Limit, PJM may require the Participant to make an advance payment or increase its Collateral in order to maintain its Total Net Obligation below its Working Credit Limit. Except as explicitly provided herein, advance payments shall not serve to reduce the Participant's Peak Market Activity for the purpose of calculating credit requirements.

Example: After ten (10) calendar days, and with five (5) calendar days remaining before the bill is due to be paid, a Participant approaches its \$4.0 million Working Credit Limit. PJM may require a prepayment of \$2.0 million in order that the Total Net Obligation will not exceed the Working Credit Limit.

If a Participant exceeds its Working Credit Limit or is required to make advance payments more than ten times during a 52-week period, PJM may require Collateral in an amount as may be deemed reasonably necessary to support its Total Net Obligation.

When calculating Total Net Obligation, PJM may attribute credits for Regulation service to the days on which they were accrued, rather than including them in the month-end invoice.

VIII. SUSPENSION OR LIMITATION ON MARKET PARTICIPATION

If PJM determines that a Participant presents an unreasonable credit risk as determined pursuant to initial or ongoing risk evaluations, as described in section II above, or in the case of any other event which, after notice, lapse of time, or both, would result in an Event of Default, PJM will take steps to mitigate the exposure of any PJM Markets, which may include, but is not limited to, requiring Collateral, additional Collateral or Restricted Collateral or suspending or limiting the Market Participant's ability to participate in the PJM Markets commensurate to the risk to any PJM Markets.

If a Participant fails to reduce or eliminate any unreasonable credit risks to PJM's satisfaction within the applicable cure period including without limitation by posting Collateral, additional Collateral or Restricted Collateral, PJM may treat such failure as an Event of Default.

Notwithstanding the foregoing, a Participant that transacts in FTRs will be eligible to request that PJM exempt or exclude FTR transactions of such Participant from the effect of any such limitations on market activity established by PJM, and PJM may but shall not be required to so exempt or exclude, any FTR transactions that the Participant reasonably demonstrates to PJM it has entered into to “hedge or mitigate commercial risk” arising from its transactions in the PJM Interchange Energy Market that are intended to result in the actual flow of physical energy or ancillary services in the PJM Region, as the phrase “hedge or mitigate commercial risks” is defined under the CFTC’s regulations defining the end-user exception to clearing set forth in 17 C.F.R. §50.50(c).

IX. REMEDIES FOR CREDIT BREACH, FINANCIAL DEFAULT OR CREDIT SUPPORT DEFAULT; REMEDIES FOR EVENTS OF DEFAULT

If PJM determines that a Market Participant is in Credit Breach, or that a Financial Default or Credit Support Default exists, PJM may issue to the Market Participant a breach notice and/or a Collateral Call or demand for additional documentation or assurances. At such time, PJM may also suspend payments of any amounts due to the Participant and limit, restrict or rescind the Market Participant’s privileges to participate in any or all PJM Markets under the Agreements during any such cure period. Failure to remedy the Credit Breach, Financial Default or to satisfy a Collateral Call or demand for additional documentation or assurances within the applicable cure period described in Operating Agreement, section 15.1.5, shall constitute an Event of Default. If a Participant fails to meet the requirements of this Attachment Q, but then remedies the Credit Breach, Financial Default or Credit Support Default, or satisfies a Collateral Call or demand for additional documentation or assurances within the applicable cure period, then the Participant shall be deemed to again be in compliance with this Attachment Q, so long as no other Credit Breach, Financial Default, Credit Support Default or Collateral Call or demand for additional documentation or assurances has occurred and is continuing.

Only one cure period shall apply to a single event giving rise to a Credit Breach, Financial Default or Credit Support Default. Application of Collateral towards a Financial Default, Credit Breach or Credit Support Breach shall not be considered a cure of such Credit Breach, Financial Default or Credit Support Default unless the Participant is determined by PJM to be in full compliance with all requirements of this Attachment Q after such application.

When an Event of Default under this Attachment Q or one or more of the Agreements has occurred and is continuing, PJM may take such actions as may be required or permitted under the Agreements to protect the PJM Markets and the PJM Members, including but not limited to (a) suspension and/or termination of the Participant’s ongoing Transmission Service, (b) limitation, suspension and/or termination of participation in any PJM Markets, (c) close out and liquidation of the Market Participant’s market portfolio, exercising judgment in the manner in which this is achieved in any PJM Markets. When an Event of Default under this Attachment Q or one or more of the Agreements has occurred and is continuing, PJM also has the immediate right to liquidate all or a portion of a Participant’s Collateral at its discretion to satisfy Total Net Obligations to PJM under this Attachment Q or one or more of the Agreements. No remedy for an Event of Default is or shall be deemed to be exclusive of any other available remedy or remedies by contract or under applicable laws and regulations. Each such remedy shall be

distinct, separate and cumulative, shall not be deemed inconsistent with or in exclusion of any other available remedy, and shall be in addition to and separate and distinct from every other remedy.

When an Event of Default under this Attachment Q or one or more of the Agreements has occurred and is continuing, PJM may continue to retain all payments due to a Participant as a cash security for all such Participant's obligations under the Agreements (regardless of any restrictions placed on such Participant's use of Collateral for any account, market activity or capitalization purpose); provided, however, that an Event of Default will not be deemed cured or no longer continuing because PJM is retaining amounts due the Participant, or because PJM has not yet applied Collateral or credit support to any amounts due PJM, unless PJM determines that the Participant has again satisfied all the Collateral requirements and application requirements as a new Applicant for participation in the PJM Markets, and consistent with the requirements and limitations of Operating Agreement, section 15.

In Event of Default by a Participant, PJM may exercise any remedy or action allowed or prescribed by this Attachment Q immediately or following investigation and determination of an orderly exercise of such remedy or action. Delay in exercising any allowed remedy or action shall not preclude PJM from exercising such remedy or action at a later time.

PJM may hold a defaulting Participant's Collateral for as long as such party's positions exist and consistent with this Attachment Q, in order to protect the PJM Markets and PJM's membership, and minimize or mitigate the impacts or potential impacts or risks associated with such Event of Default when an Event of Default under this Attachment Q or one or more of the Agreements has occurred and is continuing.

PJM may apply towards an ongoing Event of Default any amounts that are held or later become available or due to the defaulting Participant through PJM's markets and systems.

In order to cover the Participant's Obligations, PJM may hold a Participant's Collateral indefinitely and specifically through the end of the billing period which includes the 90th day following the last day a Participant had activity, open positions, or accruing obligations (other than reconciliations and true-ups), until such Participant has satisfactorily paid any obligations invoiced through such period and until PJM determines that the Participant's positions represent no risk exposure to the PJM Markets or the PJM Members. Obligations incurred or accrued through such period shall survive any withdrawal from PJM. When an Event of Default under this Attachment Q or one or more of the Agreements has occurred and is continuing, PJM may apply any Collateral to such Participant's Obligations, even if Participant had previously announced and effected its withdrawal from PJM.

X. FTRS UNDER THE COMMODITY EXCHANGE ACT AND THE BANKRUPTCY CODE

Under the terms of the Tariff, PJM Settlement is the counterparty to all transactions in PJM Markets, including but not limited to all FTR transactions, other than (i) any bilateral transactions between Participants, or (ii) with respect to self-supplied or self-scheduled

transactions reported to the Office of the Interconnection. Pursuant to the “Final Order in Response to a Petition From Certain Independent System Operators and Regional Transmission Organizations To Exempt Specified Transactions Authorized by a Tariff or Protocol Approved by the Federal Energy Regulatory Commission or the Public Utility Commission of Texas From Certain Provisions of the Commodity Exchange Act Pursuant to the Authority Provided in the Act” 78 Fed. Reg. 19880 (April 2, 2013) (the “CFTC RTO/ISO Order”), the Commodity Futures Trading Commission (the “CFTC”) exempts transactions offered or entered into in a market administered by PJM pursuant to the Tariff, including but not limited to FTR transactions, from the provisions of the Commodity Exchange Act and the CFTC’s rules applicable to “swaps,” with the exception of the CFTC’s general anti-fraud and anti-manipulation authority and scienter-based prohibitions.

Notwithstanding the CFTC RTO/ISO Order, for purposes of the United States Bankruptcy Code (“Bankruptcy Code”), all FTR transactions constitute “swap agreements” and/or “forward contracts,” and PJM and each FTR Participant is a “forward contract merchant” and/or a “swap participant” within the meaning of the Bankruptcy Code for purposes of FTR transactions.

Pursuant to this Attachment Q and other provisions of the Agreements, PJM already has, and shall continue to have, the following rights (among other rights) with respect to a Market Participant’s Event of Default: (a) the right to terminate and/or liquidate any FTR transaction held by that Market Participant; (b) the right to immediately proceed against any Collateral provided by the Market Participant; (c) the right to set-off any obligations due or owing to that Market Participant pursuant to any forward contract, swap agreement, or similar agreement against any amounts due and owing by that Market Participant pursuant to any forward contract, swap agreement, or similar agreement, such arrangement to constitute a “master netting agreement” within the meaning of the Bankruptcy Code; and (d) the right to suspend or limit that Market Participant from entering into further FTR transactions.

For the avoidance of doubt, upon the commencement of a voluntary or involuntary proceeding for a Participant under the Bankruptcy Code, and without limiting any other rights of PJM or obligations of any Participant under the Agreements, PJM may exercise any of its rights against such Participant, including, without limitation (1) the right to terminate and/or liquidate any FTR transaction held by that Participant, (2) the right to immediately proceed against any Collateral provided by that Participant, (3) the right to set off any obligations due and owing to that Participant pursuant to any forward contract, swap agreement and/or master netting agreement against any amounts due and owing by that Participant with respect to an FTR transaction including as a result of the actions taken by PJM pursuant to (a) above, and 4) the right to suspend or limit that Participant from entering into future FTR transactions.

For purposes of the Bankruptcy Code, all transactions, including but not limited to FTR transactions, between PJM, on the one hand, and a Market Participant, on the other hand, are intended to be part of a single integrated agreement, and together with the Agreements constitute a “master netting agreement.”

Attachment Q
Appendix 1

PJM MINIMUM PARTICIPATION CRITERIA
ANNUAL OFFICER CERTIFICATION FORM

Participant Name: _____ ("Participant")

I, _____, a duly authorized officer of Participant, understanding that PJM Interconnection, L.L.C. and PJMSettlement, Inc. ("PJMSettlement") are relying on this certification as evidence that Participant meets the minimum requirements set forth in the PJM Open Access Transmission Tariff ("PJM Tariff"), Attachment Q hereby certify that I have full authority to represent on behalf of Participant and further represent as follows, as evidenced by my initialing each representation in the space provided below:

1. All employees or agents transacting in markets or services provided pursuant to the PJM Tariff or PJM Amended and Restated Operating Agreement ("PJM Operating Agreement") on behalf of the Participant have received appropriate training and are authorized to transact on behalf of Participant. As used in this representation, the term "appropriate" as used with respect to training means training that is (i) comparable to generally accepted practices in the energy trading industry, and (ii) commensurate and proportional in sophistication, scope and frequency to the volume of transactions and the nature and extent of the risk taken by the participant. _____
2. Participant has written risk management policies, procedures, and controls, approved by Participant's independent risk management function and applicable to transactions in any PJM Markets in which it participates and for which employees or agents transacting in markets or services provided pursuant to the PJM Tariff or PJM Operating Agreement have been trained, that provide an appropriate, comprehensive risk management framework that, at a minimum, clearly identifies and documents the range of risks to which Participant is exposed, including, but not limited to credit risks, liquidity risks and market risks. As used in this representation, a Participant's "independent risk management function" can include appropriate corporate persons or bodies that are independent of the Participant's trading functions, such as a risk management committee, a risk officer, a Participant's board or board committee, or a board or committee of the Participant's parent company.
 - a. Participant is providing to PJM or PJMSettlement, in accordance with Tariff, Attachment Q, section III, with this Annual Officer Certification Form, a copy of its current governing risk management policies, procedures and controls applicable to its activities in any PJM Markets pursuant to Attachment Q or because there have been substantive changes made to such policies, procedures and controls applicable to its market activities since they were last provided to PJM. _____
 - b. If the risk management policies, procedures and controls applicable to Participant's market activities submitted to PJM or PJMSettlement were submitted prior to the current certification, Participant certifies that no substantive changes have

been made to such policies, procedures and controls applicable to its market activities since such submission._____

3. An FTR Participant must make either the following 3.a. or 3.b. additional representations, evidenced by the undersigned officer initialing either the one 3.a. representation or the four 3.b. representations in the spaces provided below:

a. Participant transacts in PJM's FTR markets with the sole intent to hedge congestion risk in connection with either obligations Participant has to serve load or rights Participant has to generate electricity in the PJM Region ("physical transactions") and monitors all of the Participant's FTR market activity to endeavor to ensure that its FTR positions, considering both the size and pathways of the positions, are either generally proportionate to or generally do not exceed the Participant's physical transactions, and remain generally consistent with the Participant's intention to hedge its physical transactions._____

b. On no less than a weekly basis, Participant values its FTR positions and engages in a probabilistic assessment of the hypothetical risk of such positions using analytically based methodologies, predicated on the use of industry accepted valuation methodologies._____

Such valuation and risk assessment functions are performed either by persons within Participant's organization independent from those trading in PJM's FTR markets or by an outside firm qualified and with expertise in this area of risk management._____

Having valued its FTR positions and quantified their hypothetical risks, Participant applies its written policies, procedures and controls to limit its risks using industry recognized practices, such as value-at-risk limitations, concentration limits, or other controls designed to prevent Participant from purposefully or unintentionally taking on risk that is not commensurate or proportional to Participant's financial capability to manage such risk._____

Exceptions to Participant's written risk policies, procedures and controls applicable to Participant's FTR positions are documented and explain a reasoned basis for the granting of any exception._____

4. Participant has appropriate personnel resources, operating procedures and technical abilities to promptly and effectively respond to all PJM and PJMSettlement communications and directions._____
5. Participant has demonstrated compliance with the Minimum Capitalization criteria set forth in Tariff, Attachment Q that are applicable to any PJM Markets in which Participant transacts, and is not aware of any change having occurred or being imminent that would invalidate such compliance._____

6. All Participants must certify and initial in at least one of the four sections below:

- a. I certify that Participant qualifies as an “appropriate person” as that term is defined under section 4(c)(3), or successor provision, of the Commodity Exchange Act or an “eligible contract participant” as that term is defined under section 1a(18), or successor provision, of the Commodity Exchange Act. I certify that Participant will cease transacting in any PJM Markets and notify PJM and PJMSettlement immediately if Participant no longer qualifies as an “appropriate person” or “eligible contract participant.” _____

If providing audited financial statements, which shall be in US GAAP format or any other format acceptable to PJM, to support Participant’s certification of qualification as an “appropriate person:”

I certify, to the best of my knowledge and belief, that the audited financial statements provided to PJM and/or PJMSettlement present fairly, pursuant to such disclosures in such audited financial statements, the financial position of Participant as of the date of those audited financial statements. Further, I certify that Participant continues to maintain the minimum \$1 million total net worth and/or \$5 million total asset levels reflected in these audited financial statements as of the date of this certification. I acknowledge that both PJM and PJMSettlement are relying upon my certification to maintain compliance with federal regulatory requirements. _____

If not providing audited financial statements to support Participant’s certification of qualification as an “appropriate person,” Participant certifies that they qualify as an “appropriate person” under one of the entities defined in section 4(c)(3)(A)-(J) of the Commodities Exchange Act. _____

If providing audited financial statements, which shall be in US GAAP format or any other format acceptable to PJM, to support Participant’s certification of qualification as an “eligible contract participant:”

I certify, to the best of my knowledge and belief, that the audited financial statements provided to PJM and/or PJMSettlement present fairly, pursuant to such disclosures in such audited financial statements, the financial position of Participant as of the date of those audited financial statements. Further, I certify that Participant continues to maintain the minimum \$1 million total net worth and/or \$10 million total asset levels reflected in these audited financial statements as of the date of this certification. I acknowledge that both PJM and PJMSettlement are relying upon my certification to maintain compliance with federal regulatory requirements. _____

If not providing audited financial statements to support Participant’s certification of qualification as an “eligible contract participant,” Participant certifies that they

qualify as an “eligible contract participant” under one of the entities defined in section 1a(18)(A) of the Commodities Exchange Act. _____

- b. I certify that Participant has provided an unlimited Corporate Guaranty in a form acceptable to PJM as described in Tariff, Attachment Q, section III.D from an issuer that has at least \$1 million of total net worth or \$5 million of total assets per Participant for which the issuer has issued an unlimited Corporate Guaranty. I also certify, to the best of my knowledge and belief, that the audited financial statements provided to PJM and/or PJMSettlement present fairly, pursuant to such disclosures in such audited financial statements, the financial position of the issuer as of the date of those audited financial statements. Further, I certify that Participant will cease transacting PJM’s Markets and notify PJM and PJMSettlement immediately if issuer of the unlimited Corporate Guaranty for Participant no longer has at least \$1 million of total net worth or \$5 million of total assets per Participant for which the issuer has issued an unlimited Corporate Guaranty. _____

I certify that the issuer of the unlimited Corporate Guaranty to Participant continues to have at least \$1 million of total net worth or \$5 million of total assets per Participant for which the issuer has issued an unlimited Corporate Guaranty. I acknowledge that PJM and PJMSettlement are relying upon my certifications to maintain compliance with federal regulatory requirements. _____

- c. I certify that Participant fulfills the eligibility requirements of the Commodity Futures Trading Commission exemption order (78 F.R. 19880 – April 2, 2013) by being in the business of at least one of the following in the PJM Region as indicated below (initial those applicable):

1. Generating electric energy, including Participants that resell physical energy acquired from an entity generating electric energy: _____
2. Transmitting electric energy: _____
3. Distributing electric energy delivered under Point-to-Point or Network Integration Transmission Service, including scheduled import, export and wheel through transactions: _____
4. Other electric energy services that are necessary to support the reliable operation of the transmission system: _____

Description only if c(4) is initialed:

Further, I certify that Participant will cease transacting in any PJM Markets and notify PJM and PJMSettlement immediately if Participant no longer performs at least one of the functions noted above in the PJM Region. I acknowledge that PJM and

PJMSettlement are relying on my certification to maintain compliance with federal energy regulatory requirements. _____

- d. I certify that Participant has provided a Letter of Credit of \$5 million or more to PJM or PJMSettlement in a form acceptable to PJM and/or PJMSettlement as described in Tariff, Attachment Q, section V.B that the Participant acknowledges cannot be utilized to meet its credit requirements to PJM and PJMSettlement. I acknowledge that PJM and PJMSettlement are relying on the provision of this letter of credit and my certification to maintain compliance with federal regulatory requirements. _____
- e. I certify that Participant has provided a surety bond of \$5 million or more to PJM or PJMSettlement in a form acceptable to PJM and/or PJMSettlement as described in Tariff, Attachment Q, section V.D. that the Participant acknowledges cannot be utilized to meet its credit requirements to PJM and PJMSettlement. I acknowledge that PJM and PJMSettlement are relying on the provision of this surety bond and my certification to maintain compliance with federal regulatory requirements. _____
7. I acknowledge that I have read and understood the provisions of Tariff, Attachment Q applicable to Participant's business in any PJM Markets, including those provisions describing PJM's Minimum Participation Requirements and the enforcement actions available to PJM and PJMSettlement of a Participant not satisfying those requirements. I acknowledge that the information provided herein is true and accurate to the best of my belief and knowledge after due investigation. In addition, by signing this certification, I acknowledge the potential consequences of making incomplete or false statements in this Certification. _____

Date: _____

Participant (Signature)

Print Name: _____

Title: _____

Attachment C

Affidavit of Nigeria Bloczynski
on Behalf of PJM Interconnection, L.L.C.

**UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION**

PJM Interconnection, L.L.C.

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Docket No. ER22-____

**AFFIDAVIT OF
NIGERIA BLOczynski
ON BEHALF OF PJM INTERCONNECTION, L.L.C.**

1 **1. PERSONAL AND PROFESSIONAL QUALIFICATIONS**

2 **Q 1.1 PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.**

3 A. My name is Nigeria Błoczynski. My business address is PJM Interconnection,
4 L.L.C., located at 2750 Monroe Blvd., Audubon, PA 19403.

5 **Q 1.2 BY WHOM AND IN WHAT CAPACITY ARE YOU EMPLOYED?**

6 A. Since July 2019, I have been Vice President and Chief Risk Officer of PJM
7 Interconnection, L.L.C. (“PJM”). In this capacity, I am responsible for identifying,
8 assessing and helping to mitigate risks across PJM, including implementing and
9 advancing risk management practices in PJM’s Financial Transmission Rights
10 (“FTR”) market.

11 **Q 1.3 PLEASE DESCRIBE YOUR PROFESSIONAL EXPERIENCE.**

12 A. Prior to my employment at PJM, I worked as the Head of Commodity & Corporate
13 Risk Management at WGL, a division of AltaGas, Ltd., a diversified energy
14 business that provides natural gas, electricity, green power, carbon reduction and
15 energy services, from August 2008 to July 2019. I also served as a Member of the
16 Board of Directors of the Committee of Chief Risk Officers from November 2016

1 to October 2020. Prior to joining WGL, I served in compliance and risk
2 management roles at various regulated, energy markets and financial services
3 institutions between 1998 and 2008.

4 **Q 1.4 PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND.**

5 A. I have a Bachelor of Science in Theoretical Mathematics from Morgan State
6 University and Masters in Business Administration from Johns Hopkins University.

7 **2. PURPOSE OF AFFIDAVIT**

8 **Q 2.1 WHAT IS THE PURPOSE OF YOUR AFFIDAVIT?**

9 A. My affidavit supports PJM's request in this proceeding by: (1) describing the
10 current FTR Credit Requirement, (2) describing the PJM stakeholder process
11 associated with the proposed change; (3) describing the proposed FTR Credit
12 Requirement and historical simulation ("HSIM") model; (4) explaining the impact
13 of the revision to the FTR Credit Requirement on PJM FTR Participants and
14 Members; and (5) describing the implementation of the proposed revisions to the
15 FTR Credit Requirement.

16 **3. DESCRIPTION OF THE CURRENT FTR CREDIT REQUIREMENT**

17 **Q 3.1 PLEASE DESCRIBE THE CURRENT FTR CREDIT REQUIREMENT.**

18 A. The FTR Credit Requirement is defined in PJM's Tariff as the amount of credit that
19 a Participant must provide in order to support the FTR positions that it holds and/or
20 for which it is bidding.

21 **Q 3.2 WHAT ARE THE COMPONENTS OF THE CURRENT FTR CREDIT**
22 **REQUIREMENT?**

23 A. The five (5) components of the current FTR Credit Requirement calculation are
24 (1) the monthly path-specific requirements (also known as the FTR Historical

1 Values) and any adjustments, if applicable; (2) an undiversified adder of 3x the net
2 negative clearing cost, which is incrementally applied to participants that has a
3 negative clearing cost in a given month; (3) an application of the 10¢ per MWh
4 volumetric adder that is applied on a monthly basis; (4) an adjustment for Auction
5 Revenue Rights (“ARR”) Credits which is currently used as an offset to FTR Credit
6 Requirements and assumed to be guaranteed revenue; and (5) the application of
7 Mark-to-Auction, which is the difference between the original cleared price and the
8 most recent auction price multiplied by the megawatt quantity, however it is only
9 applied if the most recent auction prices are indicating that a portfolio is
10 experiencing a loss in forward value. Any gains in the forward values for FTR
11 participants are excluded. It should also be noted that the calculation is order
12 specific.

13 **Q 3.3 WHY DOES THE CURRENT FTR CREDIT REQUIREMENT NEED TO**
14 **BE ENHANCED?**

15 A. One of the recommendations made in the Report of the Independent Consultants on
16 the GreenHat Default (“GreenHat Report”), was to significantly improve PJM’s
17 risk management procedures, including its collateral and margin policies.
18 Previously, PJM has worked with its Members on numerous and varied risk
19 management enhancements and it now begins to specifically address FTR collateral
20 and margin risk management with this filing. As PJM continues to enhance its risk
21 management practices, we want to ensure that they align as much as they can to
22 best practices in the energy commodity and financial derivatives industry. Risk
23 management is an evolving practice, and this is another step in mitigating the

1 financial risk associated with a default of a PJM member may pose to the PJM
2 market.

3 **4. STAKEHOLDER PROCESS**

4 **Q 4.1 WHAT WAS THE STAKEHOLDER PROCESS THAT LED TO THIS**
5 **FILING?**

6 A. Since the GreenHat Report, PJM has engaged with its Members in its Financial
7 Risk Mitigation Senior Task Force (“FRMSTF”) to identify, assess, discuss and
8 address enhanced risk mitigation practices issues relating to overall collateral
9 requirements for all PJM market participants, including FTR Participants. As part
10 of that process, PJM has worked through the FRMSTF to educate, assess and
11 improve the FTR Credit Requirement and its components, the use of the HSIM
12 model and its output, including back testing and the confidence interval utilized in
13 the model. Additionally, PJM reviewed the proposed PJM Tariff provisions to
14 implement the FTR Credit Requirement calculation with its membership.

15 **Q 4.2 WHAT WAS THE OUTCOME OF THE STAKEHOLDER PROCESS**
16 **THAT LED TO THIS FILING?**

17 A. After two years of engagement with stakeholders in the FRMSTF, the Risk
18 Management Committee, Markets and Reliability Committee (“MRC”) and the
19 Members Committee, the MC ultimately endorsed the proposed revisions with two
20 objections and one abstention on October 20, 2021.

1 **5. DESCRIPTION OF THE PROPOSED REVISIONS TO THE FTR CREDIT**
2 **REQUIREMENT**

3 **Q 5.1 DESCRIBE THE PROPOSED FTR CREDIT REQUIREMENT.**

4 A. PJM is proposing to replace the FTR Historical Value per path component and the
5 undiversified adder component of its FTR Credit Requirement with an initial
6 margin calculation, based on the output of a HSIM model utilizing a 97%
7 Confidence Interval. Once the initial margin component has been determined, the
8 proposed FTR Credit Requirement calculation will then apply any applicable ARR
9 Credits, the Mark-to-Auction valuation and 10¢ per MWh volumetric minimum
10 value adjustment components of the current FTR Credit Requirement. Finally, the
11 proposed FTR Credit Requirement will apply a separate component to adjust for
12 net realized gains and loss in the FTR portfolio.

13 The new formula will be calculated on an account basis for each FTR
14 Participant's portfolio in the following order (1) initial margin; (2) application of
15 ARR Credits, if applicable; (3) Mark-to-Auction Value; (4) application of the 10¢
16 per MWh volumetric minimum value and (5) net realized gains and/or losses in the
17 portfolio. As noted above, the proposed FTR Credit Requirement reorders certain
18 components of the current FTR Credit Requirement.

Q 5.2 WHAT ARE THE OBJECTIVES OF THE PROPOSED FTR CREDIT REQUIREMENT, THAT IS, HOW DOES THE PROPOSED FTR CREDIT REQUIREMENT IMPROVE PJM'S RISK MANAGEMENT PRACTICES?

A. The proposed FTR Credit Requirement will enable PJM to better manage and mitigate the financial risks that the FTR markets represent by employing industry best practice tools.

PJM reviewed industry practices, relevant regulatory requirements used by risk managers for products similar to FTRs and input from its stakeholders. PJM developed the HSIM model to more accurately determine an appropriate amount of initial margin for a market participant's FTR portfolio using available historical pricing data for FTRs on all paths in PJM since the inception of the FTR markets in 2008. Using statistical analysis techniques, the model can estimate financial outcomes for any individual market participant's portfolio of FTR positions based on how those positions would have fared under historically observed price changes.

Calculation of initial margin using a financial model and applying a high confidence interval to the model output is industry-standard practice for risk managers in commodity and derivatives markets. Use of such risk management tools is required by regulation for central clearing counterparties that manage the market risks associated with commodity futures contracts and commodity swaps with characteristics similar to FTR Obligations. Moreover, industry standard-setting organizations have developed standardized financial models and methodologies to assist markets and market participants in benchmarking their collateralization practices and reduce market risks.

1 The proposed FTR Credit Requirement improves PJM’s risk management
2 practices in several ways. First, the initial margin component of the proposed FTR
3 Credit Requirement an HSIM model developed specifically for PJM’s FTR market
4 to better align the amount of collateral posted to PJM by an FTR market participant
5 with the risks presented by such portfolio should that FTR market participant
6 default on its obligations. Second, use of a high confidence interval in conjunction
7 with the HSIM model minimizes the chance that the collateral posted by FTR
8 market participants will not be adequate to cover potential losses that PJM and its
9 PJM Members would sustain if an FTR market participant defaults. Said another
10 way, the high confidence level improves PJM’s risk management practice because
11 it reduces the chance that PJM will be “under-collateralized” in the event of an FTR
12 market participant default, requiring PJM members to absorb uncollateralized
13 market losses. Finally, by reordering the components of the FTR Credit
14 Requirement calculation, PJM eliminates the potential for an FTR market
15 participant having a zero or minimal collateral requirement as its FTR Credit
16 Requirement, which improves risk management.

17 **Q 5.3 HOW DOES USE OF AN HSIM MODEL, INSTEAD OF THE CURRENT**
18 **FTR HISTORICAL VALUE PER PATH COMPONENT AND**
19 **UNDIVERSIFIED ADDER COMPONENT, BETTER ALIGN THE**
20 **COLLATERAL REQUIRED FROM FTR MARKET PARTICIPANTS**
21 **WITH THE RISKS REPRESENTED BY THE FTR MARKETS?**

22 A. We are proposing to eliminate both the FTR Historical Value per path component
23 and the undiversified adder component, and replace them with an initial margin

1 calculation using the HSIM model has developed, applied at a high confidence
2 interval. PJM considered and reviewed different types of models with experts,
3 independent consultants and stakeholders. The HSIM model, which is a type of
4 Value-at-Risk (or “VaR”) model, was selected because it enhances the initial
5 margin to be more consistent with industry best practices, is more correlated to
6 market risk than the current practice and was considered by PJM members to be
7 more transparent than other models reviewed. PJM’s choice was also influenced
8 by the adoption by ISDA of an HSIM model as part of its methodology for
9 computing initial margin in its industry-leading licensed Standard Initial Margin
10 (“SIMM”) methodology. The ISDA SIMM methodology was developed with input
11 from financial institutions and risk managers around the globe to help market
12 participants calculate and exchange initial margin to facilitate consistent risk
13 management practices for over-the-counter financial derivatives transactions
14 (including swaps). The ISDA team identified certain criteria that an initial margin
15 model should satisfy:

- 16 • Model outputs should be non-procyclical, that is, margin
17 calculations should be a relatively stable risk mitigation tool as
18 applied to an individual market participant over time, provided that
19 a market participant’s portfolio does not change substantially.
20 Market scenarios and models should be updated periodically at the
21 discretion of the risk manager, and phased in where appropriate, so
22 as not to be explicitly linked to increases in market level or volatility.

- 1 • Ease of replication, that is, Initial Margin calculations should be
2 relatively easy to replicate by or for a particular market participant,
3 given the same data inputs and portfolio of positions, such that
4 participants should be able to validate and anticipate the model
5 output.
- 6 • Calculation transparency, that is, allowing market participants
7 access to use the model for scenario analysis and thus understand
8 the drivers of the calculation, which builds confidence in market risk
9 management and enables effective dispute resolution.
- 10 • The model should include a robust set of data points, and be able to
11 calculate Initial Margin quickly, as well as to re-run and validate the
12 calculations to enable more efficient management of the margining
13 process.
- 14 • The model should be adaptable, designed to accommodate
15 incremental changes as more data becomes available and back-
16 testing is performed, such that it is easy for the risk manager to add
17 data points, default scenarios or risk factors, if appropriate or as
18 required by regulators.
- 19 • The model output should be predictable, enabling market
20 participants to accurately price transactions and manage portfolios
21 responsibly, as well as prudently allocate working capital to
22 margining the risks of a specific transaction or an aggregated
23 portfolio of positions.

- Use of the model with large portfolios should not result in significant over- or under-collateralization of risk, in that a portfolio's size or volume metrics are not necessarily correlated with the risk the portfolio represents, and the model should enable inclusion of risk factor offsets where appropriate.

Further, NODAL and ICE Clear, as well as central clearing counterparties and large swap market participants that transact in the commodity and financial derivatives markets, are either utilizing or are in the process of transitioning to HSIM VaR based models to calculate initial margin for electricity-related futures contracts and swaps.

The current model used to calculate the FTR Historical Data per path component uses a limited amount of historical data to calculate initial margin – only incorporating into the analysis pricing data from the immediately preceding three years. The current calculation also assigns a weighting convention to data for each of those three years: data for the most recent year is given a 50% weight, data for the next earlier year, 30% and data for the earliest of the three years, 20%. Limiting historical data to three years may not take into consideration earlier periods of pricing volatility on some or all of the FTR paths, thereby resulting in the potential for under-collateralization. Moreover, there is not a statistical basis for the higher weighting being applied to the most recent year's pricing data, as pricing anomalies may occur with equal frequency in any particular historical period.

We are proposing to remove the undiversified adder because the Independent Consultants determined and we agree, that it is not correlated to risk.

1 The undiversified adder component was an attempt to assess the portfolio risk by
2 looking at a participant's FTR portfolio values that were negative in one or more
3 months and assessing an "adder" of three times the net negative clearing cost. The
4 HSIM model methodology for Initial Margin we are proposing will use available
5 historical pricing data going back to the inception of the PJM FTR markets in 2008
6 to model price volatility per path, and use that data will determine initial margin on
7 a portfolio basis.

8 PJM identified one aspect of the FTR Historical Data per path component
9 that it intends to retain, relating to netting the realized gains and losses from sale of
10 FTRs. Consequently, PJM is adding a new net realized gains and loss component
11 to the FTR Credit Requirement calculation. *See* Q5.5 below.

12 PJM will continue to use the FTR Historical Value per path and the
13 undiversified adder components of the current FTR Credit Requirement in
14 determining initial margin for FTR Options. An HSIM model is not typically used
15 to calculate initial margin for listed commodity options in commodity exchange
16 markets similar to the PJM FTR markets. For markets with significant commodity
17 options contract trading and pricing data points, risk managers are more likely to
18 use an implied volatility model. Implied volatility is a forward looking view and
19 comes from the price of an option and represents future volatility, whereas
20 historical volatility measures price changes over predetermined periods of time and
21 is backward looking. Because the number of FTR Options transacted by market
22 participants in the PJM markets is relatively small compared to FTR Obligations,
23 this filing focuses on getting an HSIM model in place for FTR Obligations.

Q 5.4 HOW DOES A STATISTICAL CONFIDENCE INTERVAL APPLIED TO THE HSIM MODEL’S CALCULATION OF INITIAL MARGIN WORK AS A RISK MANAGEMENT TOOL TO PROTECT PJM AND ITS MEMBERS FROM AN UNDER-COLLATERALIZED DEFAULT SCENARIO IN THE FTR MARKETS?

The reasons for applying a “confidence interval” to a financial model output calculation of initial margin is explained in the Wolkoff/Anderson Affidavit. In simple terms, the Confidence Interval reflects the statistical measure of confidence that the initial margin posted by an FTR market participant will “cover” potential market losses that would result from such FTR market participant’s default, over the time period during which it is expected that the market participant’s portfolio can be liquidated. This liquidation time period is also referred to as the coverage period or the “Margin Period of Risk” which, for PJM’s FTR markets, has been determined and approved by FERC to be two FTR auction periods.

The Confidence Interval is expressed as a percentage, and the higher the percentage the more confident the risk manager is that the initial margin collected will be adequate to cover the potential market loss if an FTR market participant defaults. Another way of looking at the confidence interval is as a measure of confidence that the market will not be “under-collateralized” for the risks represented by the FTR portfolio. The higher the confidence level the more risk protection, however because these are statistical measures, a 97% confidence interval also means an assumed or expected margin “failure rate” in 3% of the default scenarios. Market risk management involves risk mitigation, not complete elimination of market risks.

Q 5.5 WHAT ARE THE OTHER PROPOSED CHANGES TO THE FTR CREDIT REQUIREMENT, AND WHAT IS THE REASONING FOR SUCH CHANGES?

A. While we are not changing the ARR credit component, we are proposing to bring it forward in the aggregation of the FTR Credit requirement. The ARR credit component, if applicable, will be applied as an offset to the FTR Credit Requirement.

The Mark to Auction (“MTA”) component will now being applied on a net basis whereas, in the current FTR Credit Requirement, it is only applied when an updated MTA calculation of initial margin for an FTR market participant’s portfolio based on pricing data from later auctions indicates a loss in initial margin value. Allowing the positive forward value to be netted against the FTR Credit Requirement, removes the perceived penalty that FTR market participants have by reducing the collateral requirement.

Applying the 10¢ per MWh volumetric minimum will serve as a floor value to represent a minimum collateral amount. This is done by comparing the results of the initial margin, less the ARR and MTA credits, against the 10¢ per MWh volumetric minimum and taking the maximum value as the result.

Finally, the revised FTR Credit Requirement applies a separate component to adjust the initial margin level for net realized gains and loss in the FTR portfolio to ensure that any net realized values have appropriate margin held for them until paid.

1 **6. IMPACT OF THE REVISED FTR CREDIT REQUIREMENT**

2 **Q 6.1 WHAT IS THE EFFECT OF THE REVISED FTR CREDIT ON THE**
3 **INITIAL MARGIN REQUIRED FROM FTR PARTICIPENTS?**

4 A. The impact on FTR Participant's initial margin will vary depending on the FTR
5 Participant's FTR portfolio risk. In general, Participant's with well-balanced FTR
6 portfolios, that include offsetting flows and counter flow FTR paths, will likely
7 experience reductions in their FTR Credit Requirement. Likewise, FTR portfolios
8 that are not diversified and do not have offsetting FTR paths will likely experience
9 an increase in their FTR Credit Requirement. The primary factor that influences
10 the initial margin is the risk inherent in a FTR Participants FTR portfolio.

11 **Q 6.2 HOW DOES THE REVISED FTR CREDIT REQUIREMENT BETTER**
12 **PROTECT PJM'S MARKETS AND MEMBERS FROM THE RISKS**
13 **PRESENTED BY THE FTR MARKETS?**

14 A. The PJM membership as a whole will be better protected against potential losses
15 caused by defaults by FTR Participants. The revised FTR Credit Requirements will
16 be better align collateral requirements with known and as yet unknown risks in the
17 FTR market. The revised FTR Credit Requirement improves PJM's risk
18 management practices by enabling better estimates of the potential risk of market
19 losses that would be borne by and allocated among PJM Members.

20 **Q 6.3 WILL THE REVISED FTR CREDIT REQUIREMENT PREVENT**
21 **PARTIES FROM PARTICIPATING IN THE PJM FTR MARKET?**

22 A. No, the revised FTR Credit Requirement will not prevent parties from participating
23 in the PJM FTR market, as long as they are able to post the appropriate collateral
24 requirement. This is consistent with current practices. Additionally, PJM

1 anticipates that some FTR market participants will change modify their FTR trading
2 strategy as a means of lowering their FTR Credit Requirement.

3 **Q 6.4 COULD PJM IN THE FUTURE CHANGE THE 97% CONFIDENCE**
4 **INTERVAL PROPOSED IN THIS FILING?**

5 A. As Chief Risk Officer of PJM, I am supportive of continuing efforts to align PJM's
6 practices with best industry practices for PJM's markets. I consider a 97% to be a
7 high confidence interval and a significant improvement to the PJM collateral
8 practices, but PJM's ongoing efforts to improve its credit practices will not stop
9 with this filing. After the implementation of this filing's Revised FTR Credit
10 Requirement, PJM plans to evaluate the performance of the HSIM model and
11 consider the need for further changes. Any movement thereafter by PJM to a
12 different confidence interval will entail consideration of additional data and
13 experience gained from implementation of the present proposal, appropriate
14 consultation with stakeholders, a subsequent FPA, section 205 filing, and
15 Commission acceptance of any such filing

16 **7. IMPLEMENTATION OF THE REVISED FTR CREDIT REQUIREMENT**

17 **Q 7.1 HOW DOES PJM PLAN TO IMPLEMENT THE REVISED FTR CREDIT**
18 **REQUIREMENT?**

19 A. PJM's implementation plans includes the following: (1) Upon approval of the
20 revised tariff provisions PJM will notify and discuss the tariff changes in advance
21 of their effective date; (2) PJM plans to implement a parallel process in eCredit and
22 FTR center to allow FTR participants to see their total FTR Credit Requirement
23 under both status quo and the proposed HSIM methodology and to continue to use
24 PJM's tools which currently permits FTR participants to perform scenarios to

determine their FTR Credit Requirement; (3) PJM plans to have the FTR Credit Requirement effective in time for the next PJM FTR annual auction which occurs annually in April.

Q 7.2 WHEN DOES PJM PLAN TO IMPLEMENT THE REVISED FTR CREDIT REQUIREMENT AND WHY?

A. PJM plans to have the FTR Credit Requirement effective as soon as practical in advance of the PJM annual FTR auction. We chose the annual auction time period because this is the time when market participants, as a whole, hold the smallest volumetric forward positions which would be impacted by the new HSIM FTR Credit Requirement. This then minimizes the change of market participants' portfolios when switching to the new methodology.

Q 7.3 WHAT COSTS WILL FTR PARTICIPANTS INCUR TO IMPLEMENT THE REVISED FTR CREDIT CALCULATION?

A. FTR participants may use PJM's web based tool to perform Credit Studies in order to test what the FTR credit requirement would be for a sample portfolio at no cost.

Q 7.4 WILL PJM MAKE CHANGES TO THE HSIM MODEL AFTER THE TARIFF CHANGES ARE APPROVED?

A. Yes. The HSIM model, like any financial model, generally consists of three components: inputs which supplies assumptions and data to the model; a processing component, which converts those inputs into estimates; and a reporting component, which interprets those outputs into practical information. Models by their nature are simplifications of the real world, which is in itself ever changing. As market conditions change and FTR participant behaviors change, PJM will need to implement a program of ongoing monitoring and evaluation of model performance,

1 with appropriate stress testing and back testing. This includes, but is not limited to
2 revalidating underlying parameters as new FTR auction prices are included in
3 HSIM. As more data is acquired, the model output will improve and PJM will
4 continue to adjust the model and confirm whether any calibrations are still
5 necessary.

6 This concludes my affidavit.

**UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION**

PJM Interconnection, L.L.C.

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Docket No. ER22-____-000

VERIFICATION

Pursuant to 28 U.S.C. § 1746 (2000), I state under penalty of perjury that I am the Nigeria Bloczynski referred to in the foregoing “Affidavit of Nigeria Bloczynski on Behalf of PJM Interconnection, L.L.C.,” 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 this 17th day of December, 2021.



NIGERIA BLOCZYNSKI

Attachment D

Affidavit of Neal Wolkoff and Robert Anderson
on Behalf of PJM Interconnection, L.L.C.

**UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION**

PJM Interconnection, L.L.C.

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Docket No. ER22-____-000

**AFFIDAVIT OF
NEAL WOLKOFF AND ROBERT ANDERSON
ON BEHALF OF PJM INTERCONNECTION, L.L.C.**

December 21, 2021

I. INTRODUCTION AND BACKGROUND

PJM is voluntarily implementing certain enhancements to its credit risk management policies, and in particular to its method of establishing margin requirements for participants in its Financial Transmission Rights (“FTR”) markets. These enhancements are part of an ongoing effort to ensure that PJM’s risk management practices are positioned appropriately relative to best practices in the energy commodity and financial derivatives industry. The FTR transactions that take place in PJM markets are unique products, and are exempt from the jurisdiction of the Commodity Futures Trading Commission (“CFTC”). Nonetheless, PJM sees great value in continually improving and enhancing its risk management policies using as a guide derivatives industry practices as they evolve over time. Effective risk management practices increase market confidence in the financial stability of the PJM markets by reducing the likelihood that its members will be exposed to unforeseen financial risks.

Since the GreenHat default, PJM has implemented a number of changes to its credit requirements for market participants in the FTR markets (the “FTR Credit Requirements”) to better manage and mitigate the potential risks that the FTR markets, and the activities of participants in the FTR markets, may pose to the PJM community. PJM’s role as a risk manager is to protect the PJM markets as a whole, on behalf of the PJM members that may otherwise bear the cost (market losses) associated with other market participants’ activities, particularly defaults that may result in market losses that are in excess of the aggregate collateral collected and held by PJM for that defaulting party.

Credit risk management policies and procedures that rely on financial models to determine the margin amount to be posted and maintained from time to time by market participants commensurate with the risks of each type of product and market participant portfolio are a current practice found in the commodity and financial derivatives markets. An example is found in the CFTC regulations for “Derivatives Clearing Organizations (DCOs),” also known as central clearing counterparties or “CCPs”. Although the CFTC has not determined that PJM (or any other RTO or ISO) is a DCO, the CFTC used its Core Principles for DCOs in its analysis of the RTOs and their markets, and in its Order exempting RTO transactions from CFTC jurisdiction commented favorably in its analysis on the similarities between the Core Principles for DCOs and the RTOs’ risk management policies developed under FERC Order 741 and FERC Rule 35.47.

PJM’s Initial Margin methodology proposal uses a historical simulation model to determine an Initial Margin requirement. The model generates Initial Margin requirements sufficient to cover potential losses from a default in a market participant’s transaction portfolio, using historically-based price data and based on market price movements over the expected time period during which a defaulting market participant’s portfolio could be liquidated in an orderly fashion. The model then applies a chosen Confidence Interval to determine a potential loss value for the portfolio. As FTR auction prices and portfolio positions change with time, the model re-establishes the Initial Margin requirement based on new information, providing for periodic adjustments to the posted

margin requirements. This methodology is consistent with the broad principles outlined in the CFTC's Core Principles for DCOs. As set out below, DCOs are required to calculate Initial Margin commensurate with the risks of each product and portfolio using a financial model, and at a level that meets a 99% Confidence Interval. PJM has recently obtained a vote of its members in favor of implementing a historical simulation (HSIM) model, using a 97% Confidence Interval, as the basis for generating Initial Margin requirements under its FTR Credit Requirement.

Below is further explanation of the PJM Initial Margin model, how it will be used, and more about the rationale for PJM implementing margining practices for market participants in its FTR markets similar to those used by DCOs in CFTC-regulated markets in keeping with its role as market risk manager for the PJM markets as a whole.

II. QUALIFICATIONS

Q1. Please state your names, titles, and business addresses.

Robert Anderson
Executive Director, Committee of Chief Risk Officers
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Neal L. Wolkoff
CEO, Wolkoff Consulting Services, LLC
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Manchester Center, VT 05255

Q2. Please briefly describe the services provided by you.

A. At PJM's request, we are providing an independent expert assessment of proposed risk management enhancements to PJM's FTR Credit Requirements. Our explanations and opinions specifically cover:

- Review relevant standards and requirements regarding swaps and derivatives margining and clearing whether for listed futures and options or Over-the-Counter ("OTC") derivatives; examine the role of the CFTC and FERC in establishing relevant standards for which risk management of FTRs should be governed; and examine the market management goals of a robust margining system.
- Evaluate whether a particular Confidence Interval of between 95% and 99% is recommended and may be more appropriate than the other choices given (1) the regulatory framework relating to PJM; (2) the industry best

practices in related financial markets for commodity derivatives; (3) the unique characteristics of Financial Transmission Rights; and (3) the objectives and structure of PJM;

- Prepare expert testimony in a regulatory proceeding before FERC.

Q3. Mr. Anderson, please briefly describe your qualifications.

- A. I have over thirty years of experience in the risk management profession as both a practitioner and as a professional advisor. For over a decade I have been CEO of the Committee of Chief Risk Officers, the energy industry's premier organization dedicated to advancement of best practices in risk management across all energy industry segments. In this role, I've gained personal knowledge of the internal practices at dozens of energy companies and have developed a deep knowledge of the modeling approaches, market structures and conditions, and trading practices that underpin effective risk management. As the head of business development for an international derivatives trading shop, and as the Chief Risk Officer for one of the largest trading entities in energy commodity markets, I have designed risk management strategies and provided risk oversight of industry-leading trading activities in the oil, natural gas, and power markets. As a consultant with the top-ranking firm for management consulting, I have provided strategic advice for some of the largest and most complex commodity trading teams in industry. Finally, as an expert witness for regulatory proceedings and corporate litigation cases involving mis-steps in the management of a commodity trading business, I bring knowledge of the consequences of poor choices in the application of risk management practices.

My BIO is included in Attachment F.

Q4. Mr. Wolkoff, please briefly describe your qualifications.

- A. I have had a lengthy career as an attorney and C-level executive at derivatives and securities exchanges, and as a lawyer and independent consultant working in the area of derivatives operations and regulations. I started my career as an Honors Program Trial Attorney with the CFTC, Division of Enforcement. Thereafter, from 1981 until 2003, I held several legal and managerial roles at the New York Mercantile Exchange ("NYMEX"), which included being the senior regulatory officer as a VP and Senior VP, the Executive Vice President and Chief Operating Officer, and the Acting President for a period of one year. I had extensive responsibilities and experience with the risk management policies and practices at NYMEX, including the setting of Initial Margin, the daily and intra-day settlement and variation margin system, and the circumstances under which initial margin levels were changed. I was also the Chairman and CEO of the American Stock

Exchange until its acquisition by the New York Stock Exchange, and was the CEO of ELX Futures, L.P. which was a futures exchange formed by a consortium of large banks to compete in the U.S. Treasury futures space.

My BIO is included in Attachment E.

Q5. Describe your previous experience with PJM as it relates to the GreenHat, Inc. matter.

- A. The two of us conducted an independent review of events surrounding the GreenHat default in the PJM FTR market. We submitted our report to the PJM Board, which in turn released it to the public, on March 26, 2019. Our report recommended a number of changes to the PJM risk management practices, particularly addressing oversight of the FTR markets. Several of our recommendations concerned the credit risk management policies (including Initial and Mark to Auction measurement of risk) in the PJM FTR market. Much of what is discussed in this affidavit is a continuation of efforts by PJM to improve its risk management policies in order to implement appropriate practices for this vitally important market, while at the same time strengthening risk management for the benefit of PJM members, who depend on PJM to run financially stable markets protecting the members, customers, and consumers - including ratepayers - from disruption or unexpected financial losses.

Q6. What is the purpose of your affidavit?

Our affidavit presents the results of our review of PJM's proposed enhancements to its method of determining a market participant's collateral requirement, which PJM refers to as the FTR Credit Requirement. Our affidavit supports changing PJM's model for calculating the FTR Credit Requirement from its existing model to an industry standard Initial Margin methodology utilizing a historical simulation model.

Q7. Why did PJM request you to review the new FTR Credit Requirement methodology?

PJM selected us to review the proposed FTR Credit Requirement enhancements to its credit policy because we have extensive experience and expertise with commodity derivatives markets and risk management policies. In addition, given our work in reviewing the GreenHat matter, we have developed a familiarity with the PJM FTR markets (all RTO and ISO markets operate on a somewhat different set of risk management policies) that would allow us to proceed in this review in an efficient and knowledgeable manner.

Q8. How do PJM’s proposed Credit Requirements fit within PJM’s core business?

PJM is a RTO that coordinates the operation of the electricity transmission system in the Mid-Atlantic U.S. and portions of the Mid-Western U.S. (in all or parts of 13 states and the District of Columbia). PJM employs a staff with specific engineering and technical expertise and other relevant skills necessary to administer wholesale electricity markets, oversee electric generator dispatch and transmission system operations, and ensure overall system reliability.

PJM is in the business of providing a reliable and uninterrupted flow of power across the interconnected electric grid in order to deliver power to end-use customers. Collateralizing a financial commodity market, is extremely important for any ISO/RTO in determining fair and reasonable prices, yet not at the core of expertise of an ISO/RTO. In contrast, the models supporting an effective set of policies to appropriately collateralize financial commodity derivatives positions are the core business of central counterparties (CCPs) in the cleared derivatives space for both listed futures contracts and options on futures, and for unlisted financial commodity derivatives. Thus it is important for the ISO/RTO to look to the practices of DCOs in the area of methodologies for collateralizing financial markets.

The CFTC and several independent financial derivatives industry organizations, specifically ISDA, IOSCO and BIS, have a particular focus on standards setting and developing and promoting best practices in risk management for financial derivatives. PJM has greatly improved its internal skills set for managing market risk, in keeping with its expert team to manage electric transmission systems risk. Nonetheless, PJM reached out to us for an unbiased, expert view of whether its proposed market risk management policies would be reasonable and appropriate for its FTR marketplace.

As the independent consultants who reviewed the circumstances surrounding the GreenHat default, we reviewed PJM’s risk management policies and procedures at that time for determining appropriate collateral for FTR transactions, and found that the procedures were lacking in targeted and reasonable protections for the marketplace as a whole. One of the recommendations we made in the report as a result of our review was to significantly improve the collateral/ margin policies.¹

¹ Anderson, Wolkoff, and Helfer, Report of the Independent Consultants on the Green Hat Default (Mar. 26, 2019) (“*Greenhat Report*”), available at <https://www.pjm.com/-/media/library/reports-notice/special-reports/2019/report-of-the-independent-consultants-on-the-greenhat-default.ashx?la=en>.

“A1) Use the mark to auction values established in the more frequent auctions (see recommendation F) as the basis for ‘variation margin,’ charging as a current debt the value erosion between the purchase price and the current market value as determined by the latest auction.

A1.1) This will help to capture the credit risk for all FTRs, not just near term FTRs, and reduce the current volatility of margining due to infrequent auctions.

A2) Retain the current 10¢/MWh minimum charge, in addition to purchase price, as a form of ‘original margin’¹⁵ until such time as more precise measurements become available to determine original margin.

PJM has now developed and is prepared to implement a significant revision to its credit policy for FTRs, and has asked us to examine the proposed new policy, and determine whether it is an appropriate and effective policy to protect the marketplace as a whole from the risk of default by market participants buying, selling and holding FTRs.

PJM's revised credit policy relies heavily on the methodology used to manage the risk of listed financial commodity derivatives as well as OTC derivatives (swaps), while at the same time making allowances for characteristics of those derivatives products and markets that are not well aligned with the characteristics of FTR contracts and the PJM markets.

Q9. Please explain the similarities between FTRs and commodity derivatives or “swaps.”

First, we might ask why the financial commodity derivatives world is the most appropriate risk management benchmark for managing the risks associated with FTR contracts given that such markets are not a perfect match with all the features of the FTR markets.

We believe that PJM is making an appropriate choice in looking toward the risk management (margin) policies of the financial commodity derivatives markets to shape its risk management policies, due to the material parallels between such markets and the FTR markets. FTR contracts and FTR markets, in our view, have many of the same market risks associated with them as regulated financial commodity derivatives, which are discussed in further detail in this paper. These similarities are an important reason why we rely on the risk management practices and policies governing the commodity derivative world.

Standardized financial commodity contracts are either commodity futures contracts, transacted on a regulated futures exchange, such as the CME, or transactions entered into over-the-counter between two contract counterparties as “swaps.” A primary attribute of a financial derivative is that its price depends on events, or derives from events that happen outside the four corners of the instrument. Similarly, an FTR is based on events that occur in the physical power markets, as illustrated below. Furthermore, one key purpose of any financial commodity derivative is to allow commercial companies that use commodities in the normal course of their business operations to “hedge,” or to shift, their commodity price risk to someone else who is willing to accept it. An FTR serves that purpose, also as illustrated below.

The holder of an FTR is not buying or selling electric energy, or any other physical commodity, when it buys, sells or holds an FTR. Instead, if you are an electric utility, you as a buyer of physical power are replacing a floating price risk component of the physical power (line congestion) purchase, over which you have no control, with a fixed payment component (congestion fees) that provides an offset. The cost of replacing floating price risk with fixed price certainty or vice versa is determined at competitive auctions which are managed by PJM as a market administrator. PJM, through PJM Settlement, acts as the central counterparty to every FTR transaction, whether with a buyer or a seller.

FTR contracts are standardized contracts - although having thousands of possible locational pricing differences. The final value of an FTR at settlement is a price consisting of the aggregate of price differentials along a particular transmission route in the Day Ahead Market. The difference in price between a source point where the power is generated, and a sink point where the power is delivered, is deemed to be a product of line congestion which is in addition to the cost of the delivered physical power. Load Serving Entities that provide power delivered to a certain node for their customers use FTR contracts as a means to hedge against the unknown and variable, or “floating,” cost of transmission (for which they have no control) along the path or paths on which they rely for delivering their power.

Financial market participants, sometimes called “speculators,” also participate in the FTR market in the hope of taking on price risk (the reverse of hedging) to realize a trading profit. Speculators provide liquidity for market participants, including commercial risk hedgers, allowing such hedgers to enter and exit the market (selling their floating commodity price risk) without suffering price slippage caused by wide bid-ask spreads due to few participants executing infrequent transactions. The purpose of this affidavit is not to advocate for any particular type of FTR market participant, but simply to set out the risk management parameters of all entities using the market and the financial risks attendant to such market participants transacting in FTRs.

III. THE PURPOSE OF INITIAL MARGIN

When the FTR is purchased, there can be from one month up to 36 months until the final cash flow of the FTR is determined -- depending on the tenor of the transaction. PJM has required that the holder of an FTR contract meet certain credit requirements based on several factors, but it has not historically used an Initial Margin calculation based on a historical simulation model.²

What an FTR along any given path is worth is a determination made by regular auctions administered by PJM, with members participating in a competition to obtain transmission line congestion rights at a fair market price. To protect the marketplace as a whole against the risk of loss if one market participant purchases FTRs, but then defaults, PJM determines the appropriate level of collateral to be paid, or “margin” that must be “posted to PJM” by an FTR purchaser before the FTR position is assigned to that purchaser.

As was the case with GreenHat, in the event an FTR market participant defaults, and the collateral or margin posted to PJM is not sufficient to cover the losses associated with liquidation of such market participant’s defaulted positions, the uncovered loss is socialized across the wider PJM membership whether or not the PJM members participated in the FTR auction or the FTR markets. Certain members of PJM are regulated entities serving end-use electric customers, and when

² PJM’s current credit policy for the FTR market is set forth in a publication by PJM Settlement, *see Credit Overview and Supplement to the PJM Credit Risk Management Policy Version 3.5*, PJM Settlement at PP. 30-33 (June 23, 2021) <https://www.pjm.com/-/media/documents/agreements/pjm-credit-overview.ashx> (last visited Dec. 9, 2021).

market losses are allocated to one of those entities, PJM is concerned that the loss may ultimately be borne by its end-use business and residential customers. An FTR market participant's default not only results in financial losses to the members, but it can also impact end-use customers and cause a loss of confidence in the PJM markets as a whole.

FTR transactions are deemed to be essential to the proper functioning of PJM's power markets, offering benefits to all because of the ability of commercial risk "hedgers" to mitigate their risks by engaging in FTR auctions and FTR market transactions. A disturbance to market confidence can undermine the well-being of the market by reducing liquidity, resulting in higher volatility and higher prices.

IV. IMPORTANT DIFFERENCES FROM COMMODITY FUTURES MARKETS

A risk management system that is continuously improving is advisable inasmuch as, while FTRs resemble certain other financial commodity derivatives products, such as listed commodity futures contracts and swaps, the FTR markets differ from other financial commodity derivatives markets in several noteworthy ways: lack of frequent pricing data in the FTR markets, and the lack of intermediation - the functions of which fall largely on PJM. These differences influence the design of the historical simulation model intended to be used for PJM's FTR markets.

While margin posted for listed commodity futures contracts is required by the CFTC to cover the risk of price moves over a minimum of one day at a 99% level of certainty (the "Confidence Interval"), listed commodity futures and options markets are continuous auction markets with an end of day settlement price. (*See* 17 C.F.R. §39.13 (g)(2)(A)). There are many opportunities each trading day for a Derivatives Clearing Organization to mark every open position to market and collect margin on the price movements since the last calculation of margin based on a prior price reference point. Most OTC swaps, particularly standardized swaps, have price references that are frequently accessible, if only once a day or every few days. The CFTC mandates that DCOs calculate Initial Margin for swaps at a 99% Confidence Interval for minimum periods, respectively, of one, five and ten days coverage depending on the underlying asset class and whether the swap is cleared or not. *See* 17 C.F.R. §39.13 (e)(2)(B) & (C); for uncleared swaps: 17 C.F.R. §23.154(a)(2)(i).

In contrast, FTRs are priced at the time of auction. Auctions occur at their greatest frequency monthly. They also occur quarterly during the planning year, and annually. As such, swap regulations about margin coverage become difficult to apply because the coverage period would be far in excess of one, five or ten days, and at a Confidence Interval of 99% the relative margin that would be required is quite a bit higher than it would be if the FTR priced daily or even weekly. Still, we do not believe that the organization and administration of the market should deter the market manager, PJM, in the long run from assessing the risk as it exists in the only measurements possible given the nature of pricing and repricing of FTRs in its market.

Q10. Describe a Derivatives Clearing Organization.

A. DCO is an entity registered with the CFTC that provides “clearing services” for exchange-listed commodity futures and options contracts, as well as for most standardized financial swaps. Clearing services in the financial markets, in brief, result in the novation of every contract sought to be cleared so that the DCO, rather than the original buyer and seller of the transaction, is the central credit counterparty, *i.e.* the buyer to every seller and the seller to every buyer. As a result of the novation, the buyer and seller are no longer concerned about the credit risk of each other inasmuch as the counterparty-to-counterparty credit risk becomes a risk of non-performance by the DCO, something that is highly remote. In addition to a series of protective rules and procedures, a DCO has available to it a series of backstop funding sources should the clearinghouse not be able to perform on each and every contract that it has cleared.

To provide market participants with the level of confidence to engage in the trading activity that a marketplace needs in order to have liquidity, counterparty credit risk must be removed or at least significantly mitigated. To protect the financial market system from a clearing member defaulting on its financial obligations to the DCO, each DCO is required to collect Initial Margin (sometimes called “Performance Bond”) from its clearing members on every contract submitted for clearing, and that was not offset on the same day it was initiated. In turn, DCOs also require their clearing members to collect from the members’ customers the required amount of Initial Margin. The CFTC prohibits members of a DCO from unsecured financing or lending money to a customer to pay for margin so that a clearing member’s capital is not impaired by the activity of any customer.³ If a customer defaults to the clearing member, only then must the clearing member finance the shortfall and liquidate any outstanding positions belonging to the defaulting customer.

When a market price of a commodity futures contract moves, the DCO collects, and requires its clearing members to collect, margin from the longs if the market price of the futures contract fell, or from the shorts if the market price went up. The amount of margin to be collected on an ongoing basis is based on a comparison of the current price to the price the previous time margin was calculated and collected. This process of re-valuing open positions at set times when new price information becomes available is called a “Mark to Market” process. Open positions can be Marked to Market several times a day for exchange traded commodity futures contracts, or once at the end of each day for most standardized OTC centrally cleared swaps.

A regulated DCO is required to apply at least a 99% CI to contracts that it clears, whether the contract is exchange traded or OTC. DCOs are required to use models to set their initial margin levels, and set a statistically derived Confidence Interval of 99% or better for the period it would take to have an orderly liquidation of cleared, or most uncleared, derivatives positions. *See* 17

³ *See* 17 C.F.R. §1.30, “A futures commission merchant may not loan funds on an unsecured basis to finance customers’ trading, nor may a futures commission merchant loan funds to customers secured by the customer accounts of such customers.”

C.F.R. §39.13 (g)(2)(iii) for listed contracts, which must be cleared, and for cleared swaps, and for uncleared swaps: 17 C.F.R. §23.154(a)(2)(i).

The minimum liquidation period that Initial Margin must cover is one day for listed contracts and most cleared swaps (while some less liquid cleared swaps must have a coverage period of not less than five days. *See* 17 C.F.R. §39.13 (g)(2)(ii). Major DCOs impose a 99% CI or greater for Initial Margin to cover a “Margin Period of Risk” of at least one day, but set at a level deemed appropriate for a particular product. *See e.g.* the policy followed by the CME Group, Inc. *Stability in Times of Stress: CME Clearing’s Anti-Procyclical Margining Regime*, CME Group, at 9 (May 2021), <https://www.cmegroup.com/clearing/files/stability-in-times-of-stress-cme-clearings-anti-procyclical-margining-regime.pdf>.

The higher the CI the market is required to achieve, the larger the amount of funds the model will calculate and the market participants will be required to post for Initial Margin. Similarly, the longer the duration of the expected Margin Period of Risk, during which Initial Margin is expected to provide coverage of any market price change as a defaulted market participant’s portfolio is liquidated, the larger the amount of required funds the model will calculate, and the market participants will be required to post, for Initial Margin. A combination of a high CI and long duration Margin Period of Risk will result in Initial Margin levels that can be considerably higher than if the DCO were protecting against price moves that might occur during a shorter Margin Period of Risk or with a lesser or lower CI percentage.

Figure 1. Confidence Intervals used by Derivatives Clearing Organizations and Other Market Risk Managers

Organization	Confidence Interval (%)	Link
Nodal	99.7	https://www.nodalclear.com/services/risk-management/margin-methodology
ICE	99	https://www.theice.com/clear-europe/risk-management
CFTC	99	https://www.ecfr.gov/current/title-17/chapter-I/part-39#p-39.13(g)
BCBS&IOSCO	99	https://www.bis.org.bcbs/publ/d475.pdf
ERCOT	99	http://www.ercot.com/mktinfo/crr

Q11. Please describe the governance of the market risk management practices of a DCO and PJM.

The CFTC’s Core Principles do not apply to PJM, which is not subject to the jurisdiction of the CFTC. In the RTO Exemption Order, pursuant to which the CFTC exempted PJM and other RTOs/ISOs and transactions in their markets, including FTRs, from the jurisdiction of the CFTC, the CFTC found that FERC Rule 35.47 requires risk management practices that are similar in many respects to the CFTC Core Principles for DCOs while recognizing that, for PJM and other RTOs,

compliance with FERC Rule 35.47 achieves risk management goals that are congruent with compliance with CFTC Core Principles for DCOs.⁴

V. PJM has complied with FERC Rule 35.47, but nonetheless such compliance did not avoid the Tower/Power Edge default in 2008 or the GreenHat default in 2018, which resulted in losses that were socialized to PJM members. Explain PJM's philosophy to look to derivatives market risk management practices.

PJM's current efforts to enhance its risk management practices to align more closely with the standards of the CFTC's Core Principle D for DCOs is a voluntary effort, not one that is mandated by regulation. PJM, as the market risk manager for all the PJM markets, with its concerns about protecting the PJM members from losses attributable to any FTR market participant default, continues to strive to avoid any such defaults in the future. PJM is proposing a stepped approach to implement its risk management enhancements for managing credit risk in the FTR market by beginning to apply margin procedures modeled on what the CFTC imposes on DCOs that clear financial commodity derivatives, including swaps.

PJM already performs several of the core functions of a DCO although it is not subject to the CFTC regulations that govern DCOs. PJM, in a manner similar to a DCO, is the buyer to every seller and the seller to every buyer in transactions on its markets, and thus the parties to a transaction always avoid the direct credit risk of having another individual market participant as the FTR contract counterparty. Instead, PJM Settlement, a wholly owned subsidiary of PJM, takes the opposite side of each transaction with a buyer or a seller, greatly mitigating if not eliminating the credit risk a market participant might otherwise experience of doing business with a single counterparty. PJM Settlement is backed financially by the members of PJM, each of whom have agreed pursuant to their membership agreement with PJM to accept a share of any market obligations or losses resulting from a member default.

Like a DCO, PJM determines the risk of adverse price moves from congestion for each available set of data points on the grid. Unlike a DCO, which accepts all trades in derivatives contracts that it has agreed to clear (futures contracts, options on futures contract or swaps submitted for clearing) and then collects Initial Margin, PJM requires the posting of margin with PJM Settlement before a member is allowed to participate in an FTR auction, and have an FTR transaction accepted by PJM.

Unlike a DCO, PJM is not an intermediated market. PJM Settlement accepts trades from principals, and there is not an intermediate level of a clearing member sitting between a DCO and its customer as exists in the listed futures and cleared swaps markets. DCOs have a clearing member to buffer the consequences which may arise from a clearing member's customer default. In fact, a customer may default, but its clearing member is responsible to satisfy the amount due to the DCO - even to the point of bankruptcy - before any obligations are absorbed by the DCO and the market losses

⁴ See the RTO Exemption Order at 19884.

assigned to other members of the DCO. Clearing members of a DCO are incented to manage risk by the fear of clearing a customer that may not meet its financial obligations in order to preserve their commercial success, if not their commercial existence. The absence of this extra layer of market intermediation places a burden on PJM to treat membership admission to PJM as a clearing member would treat accepting a client (“Know Your Customer”). *The absence of such market intermediation places a unique burden on PJM that DCOs do not face.* This situation is why our GreenHat report recommendations addressed numerous risk management practices beyond collateral management.⁵

Q12. What are the origins of the CFTC’s margin requirements for swaps?

For listed commodity futures contracts and options on futures contracts, which are traded at commodity exchanges and cleared by DCOs, the DCOs have long (more than 30 years) used models to calculate margin requirements, with a standard Confidence Interval of 99% and with a holding or coverage period of one to two days. The models that DCOs initially developed were Historical Simulation Models, like the one that PJM is implementing for its FTR markets. DCOs have found that models based on data about how the markets have reacted to events in the past can be a reliable predictor of future events, at least within the range of possibilities of events that have happened in the past.

With the advent of listed options on futures contracts in the early 1980s, the DCOs changed the model for margin calculations for those products having a corresponding options contract from a Historical Simulation Model to a Volatility Model. DCOs found that the options trading market can be an even better predictor of future events than HSIM models, and consequently models that rely on forward-looking options trades were extremely accurate predictors of future price moves. The past is not as good a predictor of the future, and historical simulations anticipate possible repetition of past events, but new market conditions are not predicted as well as with a volatility model. DCOs clear a number of futures contracts without corresponding options contracts (e.g. Palladium Futures and Propane Futures), and for those products, DCOs use a Historical Simulation model.⁶

Following the financial crisis of 2008-2009, two important international regulators - IOSCO and BIS - recommended that financial commodity swaps, like exchange-listed futures contracts and options on such futures contracts, should be subject to a margin model similar to the listed world with a Confidence Interval of at least 99% and a coverage period determined by the estimated liquidation period required for a particular product. *See Capital requirements for bank exposures to central counterparties*, Basel Committee on Banking supervision (April 2014), <https://www.bis.org/publ/bcbs282.pdf> (last visited Dec. 9, 2021); and *Margin requirements for non-centrally cleared derivatives*, Basel Committee on Banking Supervision and Board of the

⁵ See Q13 of this paper.

⁶ Nodal and ICE Clear are either utilizing or in the process of transitioning to HSIM VaR based models to calculate initial margin for electricity-related futures contracts and swaps. *See* Bloczynski Affidavit at 10.

International Organization of Securities Commissions (Feb. 2013), <https://www.iosco.org/library/pubdocs/pdf/IOSCOPD403.pdf>.

To the extent swaps were one of the causes of the financial crisis, international oversight organizations and regulators wanted to apply industry standard best practices to what had been a largely unregulated market governed solely by agreements entered into between two private counterparties to a trade. In November, 2011 the CFTC adopted rules governing required margin practices by DCOs for cleared swaps, *see* 17 C.F.R. § 39.13; and in January 2016 margin rules for swap dealers and major swap participants entering into uncleared swaps, *see*, 17 C.F.R. § 23.154. The CFTC's Regulations set forth requirements similar to those proposed at the time by BIS and IOSCO (approved as final standards after the CFTC adopted its regulations). Margin for swaps was to be model-based, have a Confidence Interval of 99%, and a liquidation period/coverage period of one, two, five and ten days depending on the swap asset class and whether cleared or uncleared.

VI. THE STRENGTHS AND WEAKNESSES

It is our view that, while there are some weaknesses in PJM's proposed initial implementation of a historical simulation model methodology to enhance its FTR Credit Requirement, the strengths materially outweigh the weaknesses. Indeed, the currently proposed HSIM model is a significant step forward in risk management practices.

On the side of weaknesses,

1) The historical simulation model approach does assume that history will repeat itself, from a risk perspective. Of course, this is not always true in energy markets. In particular in the FTR markets, we can certainly assume with confidence that events may occur in the future which have yet to be seen.

2) In the case of FTRs we know the PJM markets are intrinsically linked to the physical market flow of electric energy on the transmission grid. Asset resources available at nodes and the transmission resources available between nodes can change unexpectedly or "by design," as constraints are eased with infrastructure upgrades. As a consequence of design changes, it is intuitive that, for those affected FTR paths, older market data may be less representative of price behaviors in the future. However, PJM has provided information showing that the number of such major infrastructure upgrades is quite limited from year-to-year. Furthermore, because IM calculation, and changes thereto, reflect the net effect of all historical changes to a market participant's portfolio's value, it is not clear without further study, whether or not infrastructure changes at specific physical locations will have a material impact on a market participant's overall portfolio IM calculations.

3) The PJM FTR data set is a rich historical database, yet it is still not statistically ideal in terms of input for the model. First, some proxy prices are used in a backfilling process if a node or a path does not have the entire history of auction prices since 2008. Second, the statistical properties of the data set for an FTR portfolio must be adjusted for small sample size, and in order to make that adjustment, data are assumed to be normally distributed. This data blending and extrapolation risks introducing an error component into the model's output. KPMG's model validation study⁷ has determined through backtesting that the error component is small and controlled. It is recommended that, once sufficient data is developed and input into the model over time, the statistical assumptions should be dropped, and the confidence interval instead measured directly from the distribution derived from actual historical data.

On the side of strengths,

1) Analyzing and applying historical data to current portfolios is a particularly effective approach to gain insights into how FTR markets have reacted to the complex and inter-related driving factors that come to bear on prices. The ability to capture these complex factors and their net effect on auction prices is a valuable aspect of the historical simulation approach.

2) During their relatively short history, PJM's FTR markets have seen a number of events that were, at the time, unexpected. For example, the impact of extreme winter storm events,⁸ the COVID-19 pandemic, and cyber-attack crises⁹ provide colorful examples of how often the unexpected seems to happen in our country's regional energy markets. Therefore, for a portfolio of FTR transactions, the market price impact of unexpected market stress events of the past may well be captured in the associated historical data. The impact of recent winter storm events¹⁰ and cyber-attack crises provide colorful examples of how readily the unexpected happens in our country's regional energy markets.

These strengths mitigate to some degree the weakness mentioned in 1) above.

3) There is a great deal of energy industry experience with historical simulation modelling, which provides a rich set of technical resources to draw from. These resources support best practices for backtesting and approaches to incremental improvements in a model's ability over time to more accurately forecast the risks of FTR portfolios.

4) Most importantly, the historical modeling approach provides explainable, verifiable results. These results can be readily supported and understood as a fair, just, consistent and reasonable basis for Initial Margin calculation. By contrast, the more formulaic methods used at PJM in the past have been shown to have critical flaws. Further, other well-known modeling methods, such

⁷ Model Validation Report, KPMG, January 21, 2021.

⁸ The Polar Vortex events in January 2014 and December 2016, and winter storm Uri in February of 2021.

⁹ The cyber attack on Colonial Pipeline in May of 2021.

¹⁰ The Polar Vortex events in January 2014 and December 2016 winter storm Uri in February of 2021, and cyber attack on Colonial Pipeline in May of 2021, just to name a few.

as the parametric or the Monte Carlo approaches, require underlying assumptions which can be challenging to explain or to build consensus for.

Q13: Please explain the fit between this change proposal and your recommendations from the GreenHat report.

In our March 2019 “Report of the Independent Consultants on the GreenHat Default”, commissioned by the PJM Board, we studied the situation that PJM faced surrounding the costly default of one of the largest participants in the FTR markets. Based on our findings, we made thirty-six challenging recommendations for PJM to pursue as it strived to advance their overall risk management practices.

As of the time of this writing, PJM has addressed all of the recommendations, and successfully implemented some 90% of them. The Initial Margin topic of this affidavit was included as just one of our recommendations, reflecting another important consideration worth considering herein.

Though a major step forward for margining practices, the HSIM model implementation that we are advocating here is certainly not an end-all for risk management practice advancement at PJM. We believe it is important to consider the HSIM model implementation as part of a wider process of risk management practice developments at PJM. We recognize the important advancements that PJM’s risk function, established after our report, has made in other risk management subject areas. These broad subject areas where we made specific recommendations include:

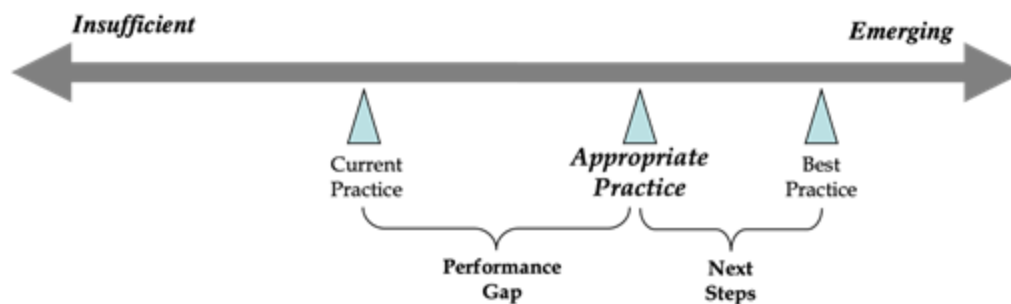
- A) Advance Credit/Collateral Best Practices into the Tariff
 - a. (HSIM model implementation fits here)
- B) Clarify the Role of PJM as Manager of Risk in its Financial Markets
- C) Build a Customer Awareness Beyond Market Procedures & Rules
- D) Implement Technical Practices for Participant Risk Management
- E) Bring On-board and Develop New Expertise in Risk Management

As mentioned, all of these areas have been addressed by PJM in some form since our 2019 report was published. A discussion with the PJM CRO confirmed that the process of advancement is ongoing. A number of real-world examples have proven that the role of the CRO and the risk function at PJM is a valuable asset protecting market participants from defaults and markets from disruptions. At PJM, the HSIM model implementation is an important step forward for that continuing process.

VII. ABOUT “BEST” PRACTICES

A company’s risk assessment and risk management practices must continually advance as the company’s enterprise of businesses change, markets change, and technology changes. Furthermore, risk management practices span a wide range of specific challenges that the risk professionals must address. The risk professional leading a process of continual improvement needs to be able to benchmark specific current practices with the range of alternative practices available. This practice benchmarking process usually involves the use of the term “best” practice. Often confusing to decision makers, “best” is highly dependent on the situation at hand and the objective purpose of the specific practice under study. To help clarify things, the CCRO has recommended the use of the practice benchmarking terms illustrated below:

Figure: Nomenclature for Benchmarking Risk Management Practices



The illustration helps to clarify important concepts related to best practices.

“Best” practices are industry-leading methods deployed at those companies where the most material and complex risks, for the most material and complex products, must be addressed.

“Appropriate” practice refers to a methodology that is appropriate to achieve effectiveness balanced with the level and complexity of risks at hand for a given company. “Best” practices then are also “appropriate” (and widely implemented) by those industry leading companies facing large and complex risks. Those companies with less material risks or less complex risks under consideration may find their “appropriate” practices somewhere to the left of “best”.

The challenge for any company is to evaluate where “current” practices lie versus “appropriate” practices that are needed for effective management of the risks the company faces. If to the left of appropriate, then an unfavorable “practice gap” exists which must be closed to avoid unfavorable outcomes.

The historical simulation methodology proposed by PJM that we have been asked to evaluate here, represents an important closure of a “performance gap” which we observed at the time of our GreenHat study at PJM in 2019. Hence we refer to the HSIM model proposed as an “appropriate” practice for PJM’s FTR markets at this time.

It is very important to recognize that again, with time if left unattended, current risk management practices may fall behind appropriate. This could again result in a performance gap, which will have to be addressed to keep up with appropriate practices for PJM's FTR markets.

We have found full acknowledgement and understanding of these concepts in PJM's CRO and risk function staff.

PJM's proposed enhancements to its FTR Credit Requirements are a commendable step in the ongoing process of advancing its ability to manage the risks of its FTR market for the benefit of the marketplace and the PJM members as a whole. By using Initial Margin calculated using an HSIM model, as the primary tools to establish an effective and reliable scheme of collateral management, PJM presents a risk management system for the FTR markets with important similarities to risk management systems that have been used successfully over many years by risk managers in the listed and OTC financial commodity derivatives and swaps markets.

Q14 Why Should PJM Continue to Enhance its Risk Management Practices to be More Like the Industry Best Practices used by a DCO?

PJM, through its subsidiary PJM Settlement, performs a pre-trade and post-trade role in qualifying new entrants seeking to participate in its FTR markets as meeting current credit standards, and serving as the counterparty to every FTR transaction with the ultimate responsibility to assure financial performance (by using the funding commitments from its non-defaulting PJM members). With respect to FTR transactions specifically, the product for which PJM is performing these central counterparty functions, they are the substantive equivalent to a cleared commodity derivative even though they are not regulated in the same manner.

DCOs have a nearly unblemished record of managing the financial risks of cleared commodity derivatives markets. There have been a few exceptions, including MF Global¹¹, however even that \$1.6 billion default by a clearing member did not result in losses to the market clearinghouse or its other clearing members. It did take time to close out the defaulted MF Global positions, and the financial loss to the markets was limited to wiping out the capital of MF Global.¹²

Given the success that DCOs have had over a long period of time in managing market risks by providing clearing services for commodity derivatives, DCO practices and procedures make an excellent guidepost for how similar risks in the FTR markets can be better managed by PJM, which shares many of the functions and market risk management responsibilities of a DCO. As such, the

¹¹ See *The MF Global Bankruptcy, Missing Customer Funds, and Proposals for Reform*, Rena S. Miller (Aug. 1, 2013) <https://sgp.fas.org/crs/misc/R42091.pdf>.

¹² See *MF Global Customers Will Recover All They Lost*, Ben Protess (Nov. 5, 2013) <https://dealbook.nytimes.com/2013/11/05/mf-global-customers-will-recover-all-they-lost/> (last visited Dec. 16, 2021),

DCO model of risk management, in particular use of an initial margin regime patterned after those used by risk managers in CFTC-regulated and cleared commodity futures and swaps markets, is the kind of system of risk management to which PJM should aspire.¹³

Q15: How do the margin policies proposed by PJM compare to the CFTC’s rules for DCOs contained in Core Principle D on Risk Management, and describe the reason for any material differences?

In the discussion surrounding the granting of the RTO Exemption Order from CFTC jurisdiction, the CFTC found that compliance by the RTOs with FERC Rule 35.47 relating to credit requirements and risk management was similar to compliance with Core Principles applied to a DCO, including Core Principle D (codified in 17 CFR §39.13), and the similarities satisfied the CFTC's concerns about exempting the RTOs from CFTC regulation of their markets.

The CFTC Exemption Order exempting FTRs from CFTC jurisdiction can be found at <https://www.cftc.gov/sites/default/files/idc/groups/public/@lrfederalregister/documents/file/2013-07634a.pdf>.

Notwithstanding the absence of a regulatory requirement for PJM to satisfy CFTC Core Principle D, PJM is continually evaluating and reviewing its risk management policies related to collateral in the context of Core Principle D as having established an industry “Best Practice.”

Core Principle D sets forth standards for collateral (for the sake of this discussion, synonymous with margin), of commodity derivatives of various types and categories. The CFTC requires that a DCO’s determination of Initial Margin requirements be a) model-based, not ad hoc, and that the model must b) satisfy at least a 99% Confidence Interval in all cases, and c) be calculated for a coverage period of one, two, five or ten days, depending on the type of commodity derivative product.

In comparing PJM’s new proposal with Core Principle D, the following are key points we wish to highlight:

First, PJM intends to use a historical simulation model, which would meet the requirement that a margin methodology be model based.

Second, PJM captures a much longer liquidation period or Margin Period of Risk (auction cycles or two months) than the minimum requirement of Core Principle D. We believe this is appropriate, given the unique nature of FTR markets. The period required to liquidate a portfolio of FTRs into relatively infrequent monthly auctions will necessarily be significantly longer than liquidation periods applicable to other cleared or uncleared commodity derivative markets with much more frequent opportunity for pricing/repricing portfolios and unwinding transactions.

¹³ See “About best practices” under Q13 of this paper.

Third, PJM intends to initially rely on a Confidence Interval of 97%, with the intent of moving to the higher 99% prescribed by the CFTC for DCOs within a reasonable period of time. In part, this decision to increase the Confidence Interval in steps is due to the longer liquidation period (Margin Period of Risk) and the margin costs to FTR market participants associated with covering risk for such a lengthy time period. It is also in part because PJM is prudently avoiding any disruption of the orderly functioning of the FTR markets that might be expected by imposing a sudden increase in margin levels that may shock the market system and possibly force some market participants to unwind FTR positions or to decide not to continue participation in the FTR auctions and FTR markets entirely. It is not in the public interest to have a potentially-avoidable market disruption in the PJM FTR market.

At the same time, PJM has told us they are committed to implementing a 99% Confidence Interval in the future once the additional working capital requirements required to post margin at the 97% CI flow through the market, and additional market data points are input and additional backtesting of the HSIM margin model is performed. The Confidence Interval of 99% may be referred to as an aspiration toward industry best practices. PJM also recognizes that it is not in the public interest for the FTR market to be exposed to another default resulting in losses to PJM members because of an extended delay in moving the FTR Credit Requirements to a 99% Confidence Interval.

We are supportive of using a 97% Confidence Interval as an appropriate practice at this time. We see this as an initial step toward industry best practices while avoiding market disruptions that could be caused by the transition from the old collateral system to the new Initial Margin regime, with a 99% Confidence Interval, in one step. However, for the reasons stated above, we concur with PJM's expressed and appropriate intent to move diligently and on a reasonable timeframe to a 99% Confidence Interval.

Q16: Please elaborate on PJM's use of the historical simulation model.

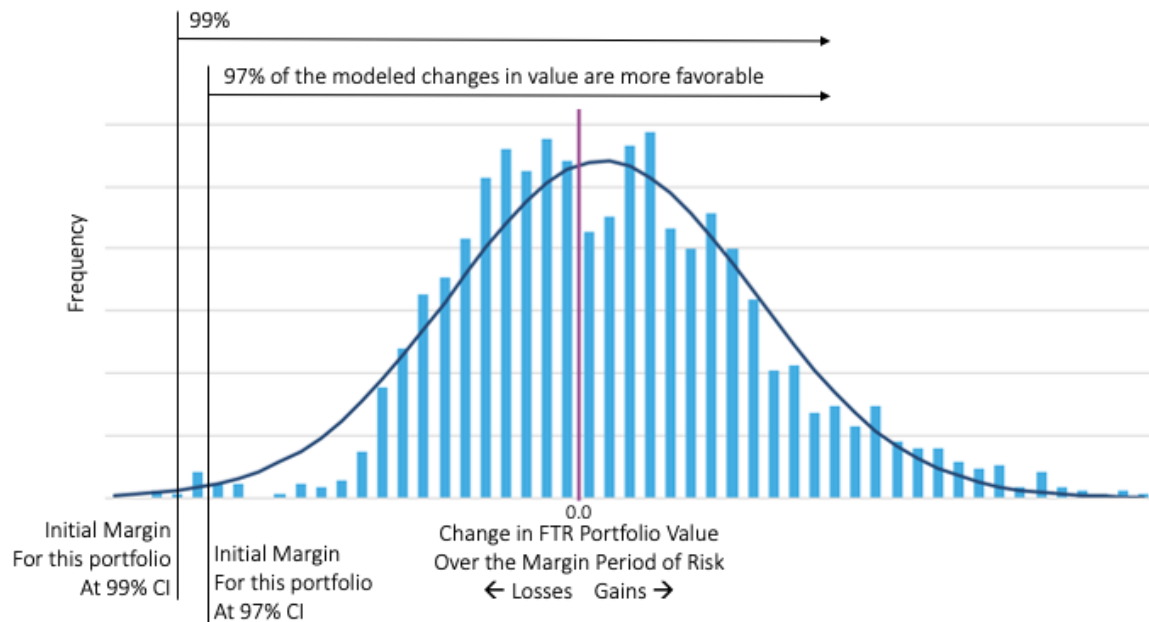
For a given portfolio of FTR positions, the historical simulation method of modeling risk studies historically observed price data in order to estimate potential future financial outcomes for a given portfolio of FTRs. The data inputs to PJM's model are the actual FTR positions in a given market participant's portfolio, and the entire data set of historical auction prices available at each node in the PJM markets since inception of the PJM FTR markets in 2008. Using statistical analysis techniques, the model can estimate financial outcomes for any individual market participant's portfolio of FTR positions based on how those positions would have fared under historically observed price changes.

In addition to the Confidence Interval, a time interval over which market price changes will be measured and applied in the model must be specified. This time period corresponds to the time estimated to be required for a controlled liquidation of the defaulted portfolio into the market. This

is typically referred to as the model’s specified “liquidation period”, or a “Margin Period of Risk”. PJM has provided in its model for two auction periods as the Margin Period of Risk.¹⁴

The method quantifies a potential dollar amount loss in value which corresponds to a certain level of statistical confidence (the Confidence Interval). So, a desired confidence interval must be specified by the user of the model. For example, PJM is proposing to use a Confidence Interval of 97%. This means that PJM expects that, in 97% of HSIM model-derived outcomes, the financial loss in value on the given portfolio of FTR positions will be less than the quantified dollar amount.

Figure: Illustrative Distribution of Hypothetical FTR Portfolio Outcomes



Given those inputs, the potential dollar amount loss output by the model is used by PJM to set an “Initial Margin” (IM) dollar amount for each participant’s portfolio of FTRs. In this example, PJM expects to find that 97% of the time, any portfolio’s loss during a possible liquidation period or Margin Period of Risk in the future will be less than that portfolio’s Initial Margin held by PJM.

¹⁴ Tariff, Attachment K-Appendix, section 7.3.9.

Q17. Please describe the practical difference between the use of a 97% Confidence Interval level and a 99% Confidence Interval level when used to calculate Initial Margin – both in terms of the aggregate amount of margin that would need to be posted by FTR market participants, and in terms of the risk management benefits for the PJM markets, and consequently for PJM members, taken as a whole.

“Confidence Interval” describes the extent to which the range of possible outcomes is captured by a process. Political polls use a Confidence Interval of + or - some percent to take into account the size of the poll, the possibility of respondents not being forthcoming and other variables. In other words, there is a known risk that the poll may not be accurate in representing actual future outcome.

In the current context of setting an Initial Margin rate, a Confidence Interval is placed on the loss portion of a distribution of potential portfolio value changes. Therefore the effect of moving to a confidence interval further-out (e.g. from 97% to 99%) on the distribution’s tail depends on the shape of that portfolio’s distribution.

VIII. THE PRACTICAL IMPACT OF 97% VS 99%

Though at first glance, 97% vs 99% may seem trivial in difference, in fact there are significant gains to margin effectiveness for market risk management at 99%.

PJM’s analysis¹⁵ has estimated that (using 1Q 2021 data as an example) a 99% confidence interval calls for about 50% more collateral to be posted by FTR market participants in aggregate than a 97% CI. Yet, based on that information, we find the higher CI reduced by 36% the incidence of scenarios with uncovered liquidation losses. Further, the analysis showed that when such uncovered liquidation losses occurred, the potential shortfall dollar amounts in the uncovered loss scenarios (with the shortfall dollar amounts being those which are socialized to all PJM members, whether or not they are active participants in the FTR markets) were three times greater in the 97% tail than in the 99% tail. Because these material uncovered losses are shared among all PJM members, and PJM is concerned that many integrated utilities and LSEs among PJM members must, either directly or indirectly, pass their share of such uncovered market losses on to electric ratepayers, the “practical impact” of using the lower Confidence level (reducing FTR market participants’ margin cost requirements) is to increase the potential for inadequate margin coverage and uncovered liquidation losses -- reducing market risk management effectiveness and increasing the potential that PJM members, and their customers, will be forced to absorb possibly significant, market losses.

By design, a 97% CI in the FTR Credit Requirements will allow for potentially more inadequate margin scenarios which may result in more uncovered losses to the PJM markets as a whole and to the PJM members, including those that do not actively participate in the FTR markets. The model-generated scenarios contemplate events captured in historical market data. Unfortunately,

¹⁵ PJM presentation 10/14/2021.

in the PJM markets that are inextricably tied to the physical power markets, the 3% tail which is uncovered may include an extreme weather event like a polar vortex or a Winter Storm Uri event which foreseeably could re-occur. Such extreme but foreseeable events can result in significant commodity derivatives market price swings, which may cause FTR market defaults, which may generate disproportionately large losses which PJM's members do not have the resources to bear. By missing 3% of the outlying events of the past using a 97% CI when setting a protective Initial Margin level, the 97% CI choice knowingly exposes the FTR markets to foreseeable price moves that are not covered by the level of required Initial Margin. Even while the market proceeds without any defaults, the PJM markets as a whole and members of PJM (including non-participants in the FTR market) are effectively providing credit support to FTR market participants by agreeing to backstop losses resulting from a failure in FTR market margin policy.

Moreover, as discussed in the “weaknesses...” section of the answer to Q12, history is not necessarily a good predictor of the future, particularly in the markets for energy commodities and derivatives. Other physical market events which might have a correspondingly significant effect on commodity derivatives markets like PJM might include a physical- or cyber-security event affecting the grid. Even if, hopefully, the likelihood of such an event is small, there is nonetheless a credible risk of future events driving stressful market changes that are more extreme or more frequent than any captured in historical data, and such events could significantly change the loss tail of the portfolio's distribution. Such an unfavorable potential distribution change truly brings focus on the need to move with reasonable speed toward the highest confidence interval applied by market risk managers like DCOs in commodity derivatives markets with more history of market function than is available for the PJM FTR markets.

Regulated DCOs do not accept the same level of risk of uncovered losses when these tail events happen, and are required by regulation to manage and mitigate the risks by using a Confidence Interval of 99%. As stated elsewhere, we view a 97% Confidence Interval at PJM as a stepping stone to avoid market disruption with the clear understanding that PJM intends to move to a 99% Confidence Interval within a reasonable amount of time.

Q18. Should PJM be able to change the Confidence Interval level and under what circumstances?

Any model for determining an appropriate Confidence Interval level will require change over time, or it may not be predictive of conditions as they arrive in real-time. Model results are not static as they show changes in the expected range of prices at different times. A two month forward looking range of prices at a 97% or 99% Confidence Interval may well differ if the next two months are April and May rather than December and January. PJM may need to modify its Confidence Interval

levels as a means of increasing credit requirements on outstanding or open FTR positions to account for changes in the model's forecast of possible price moves over the near future.¹⁶

In addition to changing Confidence Interval levels because of a seasonality effect on a possible range of prices, PJM may also find that conditions on the ground, and their impact on price moves, is far different from what had been predicted. Given the lengthy period between auctions, PJM may have to wait one or two months to have sufficient price data to see that its model is not effectively capturing price risk as expected at the Confidence Interval in effect.

Collecting Mark to Auction margin to account for a market loss, which is the mark to market of outstanding or open positions based upon the most recent available price information from actual auction results, does not substitute for having an appropriate Confidence Interval level. A Mark to Auction process is intended to recover the erosion in value from auction-to-auction of the Initial Margin amount that was initially posted. If the model predicts a larger range of possible prices, or prices at the auction show greater price movement than predicted, restoring Initial Margin to the level it was set at in the past may not capture the market risk as it exists today. Only a change to Initial Margin will reflect the change in price risk from time to time.

Therefore, as part of our review, we believe that PJM must have the authority to change Initial Margin requirements as its model requires, or as conditions in real time show such a change to be necessary to retain coverage of price risk at the Confidence Interval.

Q19. Please describe the key components of PJM's current FTR Credit Requirement calculation.

The existing calculation is based on five (5) factors: (1) Monthly Path Requirement; (2) Individual FTR Requirement; (3) Un-Diversified Adder and (4) add 10 cent per MWh volumetric minimum charge and; (5) subtracts ARR credits. *See* Tariff, Attachment Q, section VI.C.2.

¹⁶ The publication "CME Clearing Performance Bond Practices," states that "CME Clearing recalculates performance bond [or "Initial Margin"] requirements at least once daily for clearing member and customer portfolios, but twice daily in most cases (e.g., for exchange-traded derivatives)...CME Clearing endeavors to make preemptive incremental changes to its performance bond requirements in response to volatility, where possible." *CME Clearing Performance Bond Practices*, CME Group (July 16, 2020), <https://www.cmegroup.com/education/articles-and-reports/cme-clearing-performance-bond-practices.html> (last visited Dec. 9, 2021).

Notwithstanding its commitment to frequent measurements of appropriate Initial Margin requirements, changes to Initial Margin tend to be periodic, not daily or even weekly or monthly.

Q20: Please describe the drawbacks of the current formulaic model?

PJM's proposal would replace the current formulaic model, in order to advance risk management practices. We see material drawbacks to the current formulaic model, which are overcome by the new proposal.

1) The current formulaic model uses only a limited historical "look-back" range of three years as the basis for establishing required FTR Credit Requirement. This is a narrow historical frame of reference from which to infer possible price moves in the future, particularly considering infrequent extreme weather events, which may now be becoming more frequent if climate change predictions hold true.

2) In addition, the formulaic model accords much greater weight to the most recent year during the historical look-back period than the previous 2 years. Whether a nearby year is more representative of the future than two or three years ago may seem arguable. However, we have not seen any analyses providing quantitative support for the assumption of this particular weighting. Whatever the weighting chosen, the use of weighting is a simplifying assumption, which is undesirable in any case when constructing a model. Thus, the current model is incorporating a simplifying assumption that could lead to both risk evaluation and margin collection errors.

3) The un-diversified adder, an adder for portfolios that are deemed to present heightened risk from being undiversified, introduces another simplifying assumption with potentially significant impact. Subsequent to calculating a tentative cleared solution for an FTR auction (or auction round), PJM determines the FTR Portfolio Auction Value for each customer account of a Market Participant, including the tentative cleared solution. FTR Portfolio Auction Values, calculated on a monthly basis, are the sum across all FTRs, of the FTR price times the FTR volume in MW. Any customer accounts with FTR Portfolio Auction Values that are negative in one or more months shall be deemed "FTR Flow Undiversified." For customer accounts that are FTR Flow Undiversified in a month, PJM increases the FTR Credit Requirement by an amount equal to three times the absolute value of the FTR Portfolio Auction Value in that month, including the tentative cleared solution. This adder attempts to capture an intuitive feature of a portfolio's make up, yet must make a gross oversimplification in order to fit the formulaic approach. Again, the current model may be incorporating a simplifying assumption that could lead to risk evaluation and margin collection errors.

Q21. Please describe the key components of PJM's proposed FTR Credit Requirement calculation?

- The new calculation will be performed on a portfolio basis for each FTR Market Participant based on

- the Initial Margin calculated using the new historical simulation model, using the previously approved two-month Margin Period of Risk, and at a Confidence Interval of 97%.
- The Initial Margin is then adjusted by:
 - Auction Revenue Right (“ARR”) Credits
 - Mark-to-Auction Value,
 - Add the 10 cent per MWh minimum volumetric charge, and
 - Any realized gains and/or losses.

Altogether, these components significantly enhance PJM’s market risk management practices by implementing the concepts of Initial Margin, as well as adjusting the Initial Margin calculation based on a high Confidence Interval.

Q22: Please describe the benefits of the enhancements to the FTR Credit Requirement.

The proposed enhancements to the FTR Credit Requirements are a significant step forward in aligning PJM’s market risk management practices with industry best practices represented by DCOs. The proposed enhancements remove many of the simplifying assumptions of the current formulaic model, accommodate the market’s ARR and FTR auction structure, and introduce new modeling capabilities for PJM to better understand the potential risks of FTR portfolios large and small.

- The development and use of the historical simulation model affords PJM’s risk management function with an important new tool for insights into the risks in FTR markets.
- The historical simulation model will strengthen with time. PJM’s ongoing addition of data points with each FTR auction and validation through backtesting of the model will assure continued accuracy as markets evolve and more data is acquired.
- The proposed requirement uses the maximum available historical price record as the best way to predict the future. It does not arbitrarily assign greater weight to the market effects of some events over others because such events occurred more recently.
- When new auctions occur, open FTR portfolio positions will be marked to current auction prices, and Initial Margin adjusted, to recover any erosion of value against the Initial Margin levels indicated at a prior auction time.
- The application of any ARR credits incorporates an appropriate allowance for the important role of asset-driven FTR market participants.

- A 10 cent per MWh minimum volumetric charge provides a significant cushion against potential market behaviors that are unanticipated and unlike the historical data used in the historical simulation model.

Q23. As a result of your evaluation, please state whether you recommend any changes to the PJM's proposed FTR Credit Calculation

Initially, no. In our opinion, the historical simulation model detailed in the Model Validation Report is appropriate, and reasonable. It is our belief that the enhancements to the FTR Credit Requirements is a material improvement over the status quo for market risk management at PJM.

The initial 97% Confidence Interval proposal is a prudent step forward to avoid collateral shock and market disruption. It is important to give the market participants time to adjust to the new model and the new FTR Credit Requirements for Initial Margin. We expect some participants will need time to modify their FTR portfolios, to secure additional capital or lines of credit, or to increase working capital available for posting as margin. Such financial choices are critical to an ongoing business – whether an LSE, another type of asset-driven FTR market participant, or a financial entity or other liquidity provider, and such financial choices should be made in an orderly, planned manner.

It is our recommendation that PJM ultimately move to a Confidence Interval of 99% within a reasonable period of time, and it is our understanding that PJM intends to do so.

The experience of DCOs, and the regulations concerning use of models, a Margin Period of Risk that reflects the products and markets for which margin is being posted/collected, and a 97% Confidence Interval, shows that PJM is evolving its market risk management practices toward industry best practices, making the FTR Credit Requirement a more effective tool to measure risk and limit the potential fallout from a default by an FTR market participant. At the same time, a 99% Confidence Interval as the basis for determining the Initial Margin is an industry best practice for DCOs, and as such should be the goal for PJM as the market risk manager for an analogous commodity derivatives market like FTRs.

Q24. Do you recommend any other changes to the FTR Credit Requirement calculation?

At this time no, with the caveat that keeping risk management practices up to date and in line with developing industry best practices is a continuing effort:

- 1) As recommended, the historical simulation model should be validated with backtesting and appropriate adjustments made as part of an on-going planned process of risk management.

- 2) PJM should regularly review and update its risk management framework.
- 3) Also as recommended, as more price data is accumulated with time, PJM should evaluate the appropriateness of the Confidence Interval.

Q25. Please summarize your affidavit regarding PJM's adoption of a historical simulation model, with the previously approved Margin Period of Risk of two months, and 97% Confidence Interval.

The rationale behind implementing PJM's Initial Margin methodology using an HSIM model with a 97% Confidence Interval is well-supported for the following reasons:

- (1) Historical simulation models are used by DCOs to generate initial margin requirements in CFTC-regulated markets for electricity-related futures contracts, including Nodal and ICE Clear, and for other listed derivatives contracts, as well as by risk managers for major market participants in many over the counter energy commodity and swaps markets.
- (2) Due to certain unique attributes of PJM's FTR market structure and practice, margin requirements for participation in PJM FTR markets established using the HSIM model at a 99% Confidence Interval, if implemented in one step rather than gradually, could have unintended consequences for the PJM FTR markets due to the significant difference in margin required using a Confidence Interval of 99% rather than 97%. Some participants could be forced to reduce their participation and/or liquidate some positions in PJM's FTR markets if the initial margin requirements exceed a market participant's working capital available for margin purposes, and market disruptions could occur as a result.
- (2) The 97% Confidence Interval will be implemented as a first step, with a clear understanding that PJM intends to move to a Confidence Interval of 99% within a reasonable period of time.
- (3) PJM's experience gained with the historical simulation model during this interim period will allow additional data points to be included into the backtesting of the HSIM model for validation of effectiveness and creating opportunities for any appropriate further enhancements to the FTR Credit Requirement methodology prior to moving to the 99% Confidence Interval.

We have relied on the Model Validation Report to conclude that PJM's historical simulation model is the most appropriate industry standard model available to measure market risk in the absence of a forward looking and liquid options market for FTR products. The two-auction Margin Period of Risk (previously approved by FERC) and a high Confidence Interval is warranted and will be in keeping with the industry best practices of the regulated cleared derivatives markets.

We believe a 97% Confidence Interval is an acceptable step toward an industry best practice 99% Confidence Interval to avoid possible collateral shock and disruption in the FTR markets that are critical to PJM's market structure. It is important to give the current and potential FTR market participants time to adjust to and gain confidence in the new Initial Margin approach. We expect some current FTR market participants will need time to modify their portfolios, secure additional capital or lines of credit, or to increase working capital available for posting as margin. Such financial choices are critical to a business as a going concern, and should be done in an orderly, planned manner.

Given a reasonable period of time, market participants should be able to adjust to the target 99% Confidence Interval in an orderly fashion or by raising incremental capital, if needed, or adjusting operations to take into account the margin requirements of PJM's FTR market. At that point, PJM will be able to enhance its market risk management policies further, and protect the PJM markets, its PJM members and their electric customers with even more confidence against unexpected financial losses.

Our recommendation of the interim 97% Confidence Interval at this time is with the clear understanding that PJM will implement a 99% Confidence Interval within a reasonable period of time.

This concludes our affidavit.

**UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION**

PJM Interconnection, L.L.C.

)
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Docket No. ER22-____-000

VERIFICATION

Pursuant to 28 U.S.C. § 1746 (2000), I state under penalty of perjury that I am the Neal Wolkoff referred to in the foregoing “Affidavit of Neal Wolkoff and Robert Anderson on Behalf of PJM Interconnection, L.L.C.,” 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 this 17th day of December, 2021.

/s/ Neal Wolkoff

NEAL WOLKOFF

**UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION**

PJM Interconnection, L.L.C.

)
)
)

Docket No. ER22-____-000

VERIFICATION

Pursuant to 28 U.S.C. § 1746 (2000), I state under penalty of perjury that I am the Robert Anderson referred to in the foregoing “Affidavit of Neal Wolkoff and Robert Anderson on Behalf of PJM Interconnection, L.L.C.,” 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 this 17th day of December, 2021.

/s/ Robert Anderson

ROBERT ANDERSON

Attachment E

Resume of Neal Wolkoff

BIO - Neal L. Wolkoff

Neal Wolkoff is an independent attorney and consultant on matters relating to derivatives and securities market regulation, policies and operations.

Mr. Wolkoff served as the Chairman and Chief Executive Officer of the American Stock Exchange (Amex) until negotiating and closing its merger with the NYSE. Prior to the Amex, for over 20 years, Mr. Wolkoff held senior level officer positions including Acting President, and EVP and Chief Operating Officer at the New York Mercantile Exchange (NYMEX), the leading marketplace for energy and precious metals trading. He has also been the Chief Executive Officer of ELX Futures, L.P., an all-electronic futures exchange founded by major dealer banks and trading firms. Mr. Wolkoff started his career as an Honors Program Trial Attorney in the Division of Enforcement of the Commodity Futures Trading Commission.

Mr. Wolkoff currently sits as the nonexecutive chairman of the board of OTC Markets Group “OTCM”, a public company that operates the OTC equities markets. He is also an independent director on the board, and member of the Audit Committee, of World Gold Trust Services, and World Gold Council U.S., respectively the sponsors of the exchange traded funds “GLD” and “GLDM.”

He has appeared at three trials to testify as an expert witness, and has been an expert litigation consultant in a number of matters.

He has often been quoted on market matters in the press. Mr. Wolkoff has written opinion pieces for the Financial Times, New York Times, and The Wall Street Journal, and has been featured on the cover of Forbes Magazine while at the Amex. In 2011 he co-authored a peer-reviewed scholarly article published in the Boston University Review of Banking and Financial Law on the "*History of Regulation of Clearing in the Futures and Securities Markets and Its Impact on Competition.*"

Mr. Wolkoff received a B.A. from the College of Columbia University and a J.D. from Boston University School of Law, and is a member of the Bar of the State of New York, and the U.S. District Court, SDNY.

Attachment F

Resume of Robert Anderson

Robert M. Anderson

**Executive Director, *Committee of Chief Risk Officers* (CCRO)
Independent Consultant and Subject Expert**



As Executive Director of the CCRO, Bob is the Committee's principal spokesperson, lead strategist and chief administrator. He represents the Committee before regulators and industry. The Committee of Chief Risk Officers is a corporation of member companies from across the energy industry from upstream to retail. The CCRO is dedicated to the development and advancement of a broad range of best practices in the fields of risk and compliance.

With 15 years in this role as CCRO lead, Bob has developed relationships with risk professionals from across the industry and hosted over seventy live and virtual events, creating constructive growth opportunities for all. Through active involvement and leadership, Bob has developed deep expertise and knowledge into the latest practices and technologies for the practical conduct of risk management and compliance in the energy industry.

Prior to becoming the lead at the CCRO, Bob had more than two decades of energy trading and risk management experience. Bob was the Chief Risk Officer for the **El Paso Corporation**, a consultant with **McKinsey & Company**, and a lead at the energy derivatives trading & marketing group at **BP Oil Company**.

Bob is also an **independent consultant**, providing services that help companies advance risk management practices and performance goals. In this role, Bob has wide ranging experience:

- [Publishing an expert analysis](#) of gaps in ISO internal risk practices that contributed to a major default in one ISO's financial power transmission market
- Benchmarking the risk-adjusted performance of a large trading business
- Advising a CEO regarding organizational change to implement a new risk function and create a culture of risk-awareness
- Acting as CEO for a start-up initiative introducing an innovative approach to energy market transparency.

Bob also provides expert witness services for corporate litigation in the areas of risk management, corporate governance, and business development.

Bob has received much public acknowledgement for his contributions to the field of risk management, including the "Famous Fifty" hall of fame award and years of industry speaking engagements.

Bob's educational background includes an MBA from Duke's Fuqua School of Business and a BE in Mechanical Engineering from Vanderbilt University.

Contact Bob at: bob.anderson@ccro.org

Attachment G

Affidavit and Exhibits of Dr. Alex Eydeland
on Behalf of PJM Interconnection, L.L.C.

**UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION**

)	
PJM Interconnection, L.L.C.)	Docket No. ER22-____
)	

**AFFIDAVIT OF
DR. ALEX EYDELAND
ON BEHALF OF PJM INTERCONNECTION, L.L.C.**

1 **1. PERSONAL AND PROFESSIONAL QUALIFICATIONS**

2 **Q 1.1 PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.**

3 A. My name is Dr. Alexander Eydeland.

4 Address: 25 Central Park West, #5S, NY, NY 10023

5 **Q 1.2 BY WHOM AND IN WHAT CAPACITY ARE YOU EMPLOYED?**

6 A. I am employed by PJM as a consultant.

7 **Q 1.3 PLEASE DESCRIBE YOUR PROFESSIONAL EXPERIENCE.**

8 A. I have more than twenty-five years of experience in energy markets including
9 twelve years as a Managing Director at Morgan Stanley in charge of global
10 commodities strategies and analytic modeling, and seven years as a Head of
11 Research at Mirant Corp. I have also consulted for a number of energy companies,
12 did quantitative research projects for various Wall Street firms, and worked as a
13 mathematics professor at the University of Massachusetts at Amherst. I am a
14 coauthor of the book "Energy and Power Risk Management." My papers on risk
15 management have appeared in a number of major publications, and I have lectured
16 extensively throughout the United States, Europe, and Japan.

1 **Q 1.4 PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND.**

2 A. I hold a Ph.D. degree in Mathematics from Courant Institute of Mathematical
3 Sciences.

4 **2. PURPOSE AND SUMMARY OF AFFIDAVIT**

5 **Q 2.1 WHAT IS THE PURPOSE OF YOUR AFFIDAVIT?**

6 A. My affidavit is offered to (1) discuss initial margin methodology and provide
7 background on the use of models to calculate initial margin; (2) discuss PJM's
8 adoption of an historical simulation (HSIM) model; and (3) discuss the concept of
9 confidence interval (CI); and (4) describe the extensive back-testing of the PJM
10 HSIM model.

11 **3. BACKGROUND ON INITIAL MARGIN METHODOLOGY**

12 **Q 3.1 DESCRIBE INITIAL MARGIN.**

13 A. As further explained in Exhibit A attached hereto,¹ initial margin is the amount of
14 collateral needed to cover the replacement cost of unwinding a market participant's
15 portfolio in the case of default. Replacement cost is the cost incurred during the
16 liquidation period. The liquidation period is the time-period between the last
17 variation margin posting and the complete portfolio closeout time. Initial margin is
18 posted by a trading participant as collateral to protect against the financial
19 consequences of default. It typically represents the potential losses that would be
20 incurred by a central counter-party, like PJMSettlement, Inc., should a participant

¹ Exhibit A: PJM Financial Market Reform Project Desktop Review of Methodologies for Initial Margin Calculation (July 2019).

1 default. It is calculated with a high degree of statistical likelihood across a
2 participant's portfolio.²

3 **Q 3.2 PLEASE SUMMARIZE THE RESULTS OF THE ACADEMIC**
4 **LITERATURE REVIEW ON THE USE OF MODELS TO CALCULATE**
5 **INITIAL MARGIN EXPOSURE.**

6 A. As more fully described in Exhibit A attached hereto, there have been many studies
7 that have analyzed the potential exposure of central counter parties. Models that
8 have been developed can be generally categorized into three (3) main categories:
9 (1) statistical models, which assume simple underlying dynamics that derive the
10 probability for the initial margin to be exceeded within a given time horizon:
11 (2) optimization models, which calculate margin in a manner that balances the
12 resilience of central clearing parties against costs to their members; and (3) options
13 pricing based models, which explore the fact that the exposure profile of a central
14 clearing party is approximately equivalent to a combination of “call and put”
15 options because a central clearing party can strategically default if a contract loses
16 more value than the posted initial margin.³

17 **Q 3.3 WHAT THEORIES HAVE BEEN CONSIDERED FOR CALCULATING**
18 **INITIAL MARGIN?**

19 A. As further described in Exhibit A, theories of calculating margin include the
20 Extreme Value Theory (Longin 1999, Broussard 2001), the Standard Portfolio

² Exhibit A at 2.

³ *Id.* at 3.

1 Analysis of Risk methodology (Kupiec 1994), the Value at Risk (VaR) based IM
2 system (Barone-Adesi et. al 2002) and the optimal liquidation strategy based on
3 auctioning parts of a portfolio (Cont and Avellaneda 2013).⁴ As relevant here, the
4 VaR approach has been found well-suited to assessing the risk that losses on
5 complex portfolios will exceed the specified margin level.

6 **Q 3.4 PLEASE DESCRIBE THE TWO PRINCIPAL APPROACHES TO INITIAL**
7 **MARGIN CALCULATION.**

8 A. The two main approaches to initial margin calculation include the historical
9 simulation (HSIM) approach and the Monte Carlo (MC) approach. The HSIM
10 approach can be categorized as a VaR-based methodology that is widely accepted
11 in different markets for calculating initial margin and other capital requirements.
12 HSIM model uses Financial Transmission Right (FTR) auction historical data to
13 assess the impact of market moves on a given Market Participant's portfolio. The
14 portfolio is subjected to historically recorded FTR price movements over a
15 specified time period called the margin period of risk. The impact of these price
16 movements is used to generate a distribution of the portfolio value changes. That
17 distribution is then used to calculate the maximum loss corresponding to a fixed
18 confidence level. The loss value determines the initial margin.

19 The MC approach is based on generating a range of locational margin
20 pricing (LMP) sets using economic software and a set of stochastic primary drivers
21 (load, generation, transmission, fuel prices, etc.). This approach utilizes knowledge

⁴ *Id.*

1 of the statistical properties of these primary drivers to calculate changes to Market
2 Participants' portfolio values under each simulated scenario, and based on this
3 forward looking central counter party risk.⁵

4 **Q 3.5 WHAT ARE THE APPROPRIATE METHODOLOGY GUIDELINES IN**
5 **SELECTING A METHOD TO CALCULATE INITIAL MARGIN?**

6 A. There are four (4) factors that are objectives of the method selected. These include:
7 (1) margin levels should reflect the risk; (2) margin calculation methodologies
8 should be transparent and relatively simple; (3) margin calculation methodologies
9 should be replicable by counterparties to reduce dispute burdens; and (4) margin
10 methodologies should take into consideration market liquidity.⁶ These types of
11 methodologies are generally referred to as VaR or risk-based methodologies. These
12 methodologies are widely accepted in different markets for calculating initial
13 margin and for other capital requirements.⁷

14 **Q 3.6 WHAT ARE THE ADVANTAGES AND DISADVANTAGES OF THE MC**
15 **METHOD?**

16 A. The advantages of the MC method include broader flexibility and better risk
17 determination. Disadvantages of the MC method include dependence on a choice

⁵ *Id.* at 2, 7.

⁶ *Id.* at 4.

⁷ *Id.* at 5.

1 of proprietary software, the potential for dispute if results are not easily understood
2 and the high data requirements of its use.⁸

3 **Q 3.7 WHAT ARE THE ADVANTAGES AND DISADVANTAGES OF THE HSIM**
4 **METHOD?**

5 A. Advantages of the HSIM approach include that it is a standard risk-based approach
6 used in a majority of markets, it is easy to implement, it is a transparent process
7 with a low probability of dispute, and there is no need to determine correlations
8 between paths as they are included in the historical data.⁹ Disadvantages include
9 that HSIM is based on historical price behavior, requires substantial historical data,
10 and may generate unfeasible scenarios.¹⁰

11 **Q 3.8 WHAT ARE THE ADVANTAGES OF THE HSIM MODEL OVER THE MC**
12 **MODEL APPROACH?**

13 A. One of the strongest arguments in favor of HSIM methodology is that it produces
14 joint distribution of price movements without requiring such inputs as correlation
15 matrix or covariance matrix. Indeed, the correlation coefficients are frequently used
16 in the alternative simulation methods as a step to determine the joint distribution of
17 risk factors underlying the portfolio values. However, often the calculation of the
18 correlation coefficients in a stable way is challenging, and their use in the
19 simulation methodology is questionable, as it implies that the methodology restricts

⁸ *Id.* at 8.

⁹ *Id.* at 6.

¹⁰ *Id.* at 7.

1 itself to a narrow, and potentially inadequate, family of joint distributions of risk
2 factors. The HSIM approach is free from this intermediate step and uses historical
3 data directly to determine the joint distribution of underlying risk factors (FTR
4 prices in our case) without any assumptions or constraints on the choice of this
5 distribution. The HSIM method does not require correlations because, by
6 construction, price movements for each scenario are taken from the same period in
7 the past ensuring correct joint behavior. HSIM has proved to be a reasonable
8 methodology to be considered for computing initial margin.¹¹

9 **Q 3.9 WHAT OTHER FACTORS WERE CONSIDERED IN CHOOSING**
10 **BETWEEN THE HSIM AND MC METHODS?**

11 A. PJM used back-testing, in part, to choose between the different methodologies.
12 Back-testing is a standard method for validating a particular trading or risk
13 management methodology.¹²

14 **Q 3.10 PLEASE DESCRIBE THE PROCEDURE FOR BACK-TESTING INITIAL**
15 **MARGIN CALCULATION METHODOLOGY.**

16 A. As further described in Exhibit A, back-testing involves a series of steps used to
17 determine whether the methodology objectives described above are achieved by
18 comparing results to a known default occurrence. This back-testing procedure was

¹¹ Exhibit B: PJM Report: Results of Risk Model Quantitative Analysis (September 24-25, 2019), at 17.

¹² Exhibit A at 6.

1 used to help PJM choose the most appropriate initial margin calculation
2 methodology.¹³

3 **Q 3.11 UPON ASSESSMENT OF PJM’S FTR MARKET, WHY WAS PJM’S**
4 **IMPLEMENTATION OF AN HSIM MODEL APPROPRIATE?**

5 A. The HSIM method uses real data. It can capture unexpected “tail” events and
6 correlations that would not necessarily be predicted by a theoretical model. The
7 methodology allows one to model a complex joint behavior of various risk factors
8 that impact portfolio values, making the HSIM method a very effective tool in
9 evaluating and managing risk. PJM’s implementation of the HSIM model will help
10 prevent under-collateralization in the PJM markets. Under-collateralization makes
11 markets more vulnerable to defaults, for which PJM Members bear the burden.

12 **Q 3.12 DESCRIBE THE INITIAL MARGIN COMPONENT OF THE**
13 **CALCULATON AND WHAT IT REPRESENTS.**

14 A. The FTR auction historical price data, from 2008 up to the most recent auction, is
15 used to generate the distribution of a participant’s portfolio value changes over the
16 margin period of risk. The distribution is then used to determine the initial margin,
17 defined as the maximum loss corresponding to a prescribed confidence level, i.e.,
18 the simulated portfolio losses are not expected, with a given degree of confidence,
19 to exceed the initial margin.

¹³ *Id.*

Q 3.13 DOES THE PJM MODEL INCORPORATE A WEIGHTING COMPONENT?

A. Yes. When the initial margin is computed for the Balance of Planning Period (BOPP), first the initial margins are calculated independently for each month of the BOPP. Then, these monthly initial margins are aggregated into one BOPP margin. The aggregation can be done under two extreme assumptions. First extreme: the monthly losses are completely uncorrelated. In this case the aggregated BOPP initial margin is the square root of sum of squares of individual monthly initial margins (“square root of sum of squares”). Second extreme: the monthly losses are perfectly correlated. Then the aggregated BOPP initial margin is the sum of the monthly initial margins. The current methodology defines the BOPP initial margin as a point between these two extremes. The BOPP initial margin is a weighted sum of these two extreme values. The weights are determined to achieve an optimal balance between the collateral costs to the participants and the attainment of the risk management goals, such as, in particular, a successful passing of the back-test. Currently, the weights are fixed to be 80% for the square root of sum of squares and 20% for the sum of monthly initial margin. The choice of current weights is supported by the back-test results. Different weights were tested, and 80%/20% was the one that satisfied the target failure rate at the lowest collateral cost. In the future the weights may be changed as a result of the regular annual back-testing that incorporates new auction results, or as a result of increased market volatility.

1 **Q 3.14 WHAT IS THE PURPOSE OF THE WEIGHTING COMPONENT OF THE**
2 **MODEL?**

3 A. As described above, PJM used two approaches to aggregate monthly initial margin
4 values into the balance of planning period, the summation approach and the square
5 root sum approach. PJM used a blended approach to aggregate the monthly initial
6 margin values into the single BOPP initial margin. This blending formula is
7 designed to bring the back-testing results into the desired range. The choice of
8 methods is driven by the goal to have as small a perturbation of square sum of
9 squares formula as possible.¹⁴

10 **4. CONFIDENCE INTERVAL**

11 **Q 4.1 HOW DOES THE CHOICE OF THE CI IN THE PROPOSED**
12 **METHODOLOGY IMPACT THE MARKET PARTICIPANTS' SHARED**
13 **BURDEN IN CASE OF DEFAULT?**

14 A. The higher the CI, the lower the expected burden to participants in the case of
15 default, while a lower confidence level poses a higher risk to participants.

16 **Q 4.2 DOES THE NUMERICAL VALUE ASSOCIATED WITH THE CI**
17 **MATTER?**

18 A. Yes. As mentioned above, a higher CI poses a lower risk to participants and a lower
19 CI poses a higher risk.

¹⁴ Exhibit C: PJM Initial margin and FTR Credit Requirements, Alex Eydeland & Bridgid Cummings, Financial Risk Mitigation Senior Task Force (September 29, 2020), at 7.

1 **5. BACK-TESTING OF THE PROPOSED MODEL**

2 **Q 5.1 WAS THE PROPOSED MODEL SUBJECTED TO BACK-TESTING?**

3 A. Yes. The model was back-tested using available historical data.

4 **Q 5.2 WHAT IS THE PURPOSE OF BACK-TESTING THE MODEL?**

5 A. The purpose of back-testing is to validate the model and to verify that in practice
6 the model performance is consistent with its theoretically expected characteristics,
7 i.e., that in practice the model behaves as is expected in theory. Back-testing the
8 model is a standard method for validating a particular trading or risk management
9 methodology.¹⁵

10 **Q 5.3 WHAT WERE THE RESULTS OF THE BACK-TESTING?**

11 A. The principal objective of the back-testing was to analyze if the initial margin
12 collected after any past auction during the test period for a given participant's
13 portfolio was sufficient to cover potential portfolio losses over the margin period
14 of risk, should the participant default after this auction. If the initial margin was not
15 sufficient, this outcome was counted as a failure. Likewise, a failure rate is the
16 percentage of times initial margin was less than an actual loss. The back-testing
17 results are considered to be satisfactory if the total failure rate is in agreement with
18 the model CI. In the performed back-testing, the failure rate did not exceed 3%,
19 which is consistent with the model CI = 97%, and it did not exceed 1% for CI =
20 99%. These results allow us to conclude that back-testing supports the model
21 methodology.

¹⁵ Exhibit A at 6.

1 As further described in Exhibit B, PJM also back-tested results for 10,724
2 zonal path prices. The number of failures was 139 indicating a failure rate of .013.
3 This .013 failure shows the HSIM is a reasonable method for computing initial
4 margin. PJM also back-tested the model against the known results of GreenHat's
5 long-term portfolio. PJM's analysis revealed that beginning in 2018, the initial
6 margin requirements for GreenHat long-term portfolio was approximately \$80
7 million. This figure combined with other collateral requirements required by
8 GreenHat, indicated the HSIM model is operating as intended.¹⁶

9 **Q 5.4 DID PJM PERFORM ADDITIONAL BACK-TESTING?**

10 A. Yes. PJM performed additional back-testing and shared results with the Financial
11 Risk Mitigation Senior Task Force on September 20, 2020. This subsequent back-
12 testing confirmed previous results and additionally determined that (1) there was
13 no concentration of failures within a particular subset of participants; (2) when
14 failures occur, no single participant stands out and failures are evenly distributed;
15 and (3) the failures are not clustered within a small group of participants.¹⁷

16 **Q 5.5 WAS THE MODEL INDEPENDENTLY VALIDATED?**

17 A. Yes. The PJM Model was submitted to and validated by the consulting firm of
18 KPMG. KPMG validated that the model operated as intended and that the results
19 of the model were as expected.

¹⁶ Exhibit B at 16.

¹⁷ Exhibit C at 9.

1 **Q 5.6 DOES THIS COMPLETE YOUR AFFIDAVIT?**

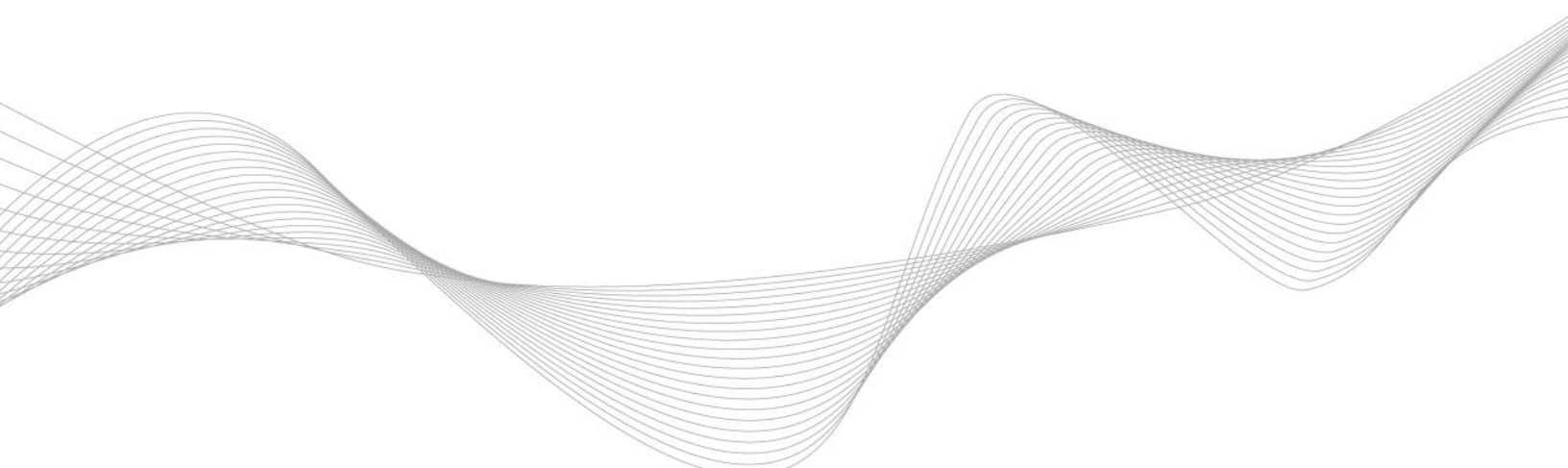
2 A. Yes, it does.

Exhibit A



Financial Market Reform Project Desktop Review of Methodologies for Initial Margin Calculation

July 2019



1 Purpose

This paper examines the pros and cons of potential approaches for the calculation of initial margin for participant FTR portfolios, and recommends two options to proceed forward with for development of proof-of-concept models and associated back-testing.

2 Summary

Margin is the amount of **financial** collateral deposited by a market participant with the Central Counter-Party (CCP) to collateralize trade exposures introduced by the participant. Margins are the CCP's first line of defense in the event of the market participant's default, to satisfy the financial obligations of that participant. The margins are designed to cover the market risk of a market participant's portfolio with high level of confidence. There are two principal forms of margin: Variation Margin (VM) and Initial Margin (IM).

Initial Margin is the main focus of this paper. IM is the amount of collateral needed to cover the 'replacement cost' of unwinding a market participant's portfolio in the case of default. These are the costs incurred during the liquidation period – the time period between the last VM posting and the complete portfolio closeout time.

In this paper we describe two principal approaches to IM calculation: Historical Simulation (HS) approach and Monte-Carlo (MC) approach. In the Historical Simulation method, past auction price volatilities are used to calculate the CCP's exposures during the liquidation period.

The Monte-Carlo approach is based on generating a range of LMP sets using economic dispatch software (PROMOD, PLEXOS, etc.) and a set of stochastic primary drivers: load, generation, transmission, fuel prices, etc. This approach would utilize knowledge of the statistical properties of these primary drivers to calculate changes to market participants' portfolio values under each simulated scenario, and based on this, forward looking CCP risk.

In this paper both methods are described, together with the methodology for their validation.

3 Initial Margin

Initial Margin (IM) is a good-faith deposit, posted by a trading participant as collateral to protect against the financial consequences of default. It typically represents the potential losses that would be incurred by the counter-party – or frequently, as in this case, the Central Counter-Party (CCP) – should the participant default, calculated to a high degree of statistical likelihood, across the participant's entire portfolio. In order to do this, it must cover the time period between when the position was incurred or variation margin (VM) last levied (whichever is the latter), and when it could be liquidated or taken to final settlement (whichever is the sooner) in the event of default. This time period is called the Market Period of Risk (MPOR), and is also known as "liquidation period".

The correct calculation and levying of IM is an essential – but not the sole – defense in protecting the market from the failure of any of its individual participants.

4 Review of the Academic Literature¹

Early models quantifying potential exposure of Central Counter-Parties (CCPs) can be divided into three main categories:

- **Statistical Models:** assume simple underlying dynamics, such as geometric Brownian motion, and derive the probability for the IM to be exceeded within a given time horizon. For instance, Figlewski (1984) calculated the probability of a margin call given a certain percentage of Variation Margin (VM) and Initial Margin (IM).
- **Optimization Models:** calculate margins in a way that balances the resilience of CCPs and costs to their members. For example, Fenn and Kupiec (1993) and Baer et al (1996) built models along these lines by minimizing the total sum of margin, settlement and failure costs.
- **Option Pricing-Based Models:** explore the fact that the exposure profile of a CCP is approximately equivalent to a combination of call and put options because a GCM can strategically default if the contract loses more value than the posted IM. (This is largely a theoretical possibility.) Day and Lewis (1999) used this framework and estimated prudent margin levels for specific instruments.

When designing its defenses, a CCP has to analyze losses conditional on exceeding margins. By its very nature, extreme-value theory (EVT) can be used for this purpose; it has been exploited by several researchers (see, for example, Longin 1999; Broussard 2001). While the use of EVT to set up margins for a single contract is straightforward, it is much more difficult to do this at a portfolio level. Accordingly, CCPs tend not to use EVT directly, relying instead on the intuitive Standard Portfolio Analysis of risk (SPAN) methodology and its variations (see Kupiec 1994). In practice, SPAN has severe limitations when applied to complex portfolios. The value-at-risk-based (VaR-based) IM system, which is better suited for such a task, was discussed by Barone-Adesi et. al. (2002).

More recently, some fundamental topics related to the clearing process have come into focus. For instance, Duffie and Zhu (2011) questioned the premise that central clearing of OTC derivatives can substantially reduce counterparty risk. They argued that some of the expected benefits are lost due to the fragmentation of clearing services, since there is no allowance for interoperability across asset classes and/or CCPs. They argued that the benefit of multilateral netting among many clearing participants across a single class of derivatives over bilateral netting between counterparties across assets depends on the specifics of the clearing process and could be absent in practice.

Arnsdorf (2012) showed that a clearing GCM's CCP risk is given by a sum of exposures to each of the other clearing members, which arises because of the implicit default insurance that each member has provided in the form of mutualized, loss sharing collateral. He calculated the exposures of GCMs by explicitly modelling the capital structure of a CCP as well as the loss distributions of the individual member portfolios. Arnsdorf assumed that all GCMs are equivalent, which is not the case in practice.

Cont and Avellaneda (2013) developed an optimal liquidation strategy for a defaulted GCM portfolio that is based on auctioning parts of the portfolio, unwinding other parts and selling the rest on the market. They modelled an auction with limits on how many positions can be liquidated on a given day due to liquidity considerations, and determined an optimal sale strategy to minimize market risk by using linear programming.

¹ This synopsis and more can be found in the paper by A. Lipton, "Systemic Risk in Central Counterparty Clearing House Networks", *Margin in Derivatives Trading*, Ch. 16, Risk, 2018.

Cumming and Noss (2013) assessed the adequacy of CCPs' default resources and concluded that the best way to model a CCP's exposure to a single GCM in excess of its IM and DF contribution is to use EVT. They drew a simple analogy between the risk faced by a CCP's default fund and that borne by a mezzanine tranche of a collateralized debt obligation (CDO) and used an established framework to model codependency of defaults based on a gamma distribution. Their model is a useful step towards building a proper top-down statistical framework for evaluating the risk of a CCP's member exposures.

Ghamami (2015) introduced a risk measurement framework that coherently specifies all layers of the default waterfall resources of typical derivatives CCPs, and produced a risk sensitive definition of the CCP risk capital.

Berlinger et al (2017) analyzed the effects of different margin strategies on the loss distribution of a CCP during different crises and found that anti-cyclical margin strategies might be optimal not only for regulators aiming to reduce systemic risk, but also for CCPs focusing on their micro-level financial stability.

Menkveld (2017) emphasized the fact that CCP risk management does not account for risks associated with crowded positions. He proposed an exposure measure based on tail risk in trader portfolios, which identifies and measures crowded risk and assigns it to traders according to the polluter-pays principle.

Lipton (2018) analyzed the pros and cons of moving trade execution, clearing and settlement to blockchain and concluded that the advantages of such a move are not as clear-cut as its proponents claim. Still, by using permissioned private ledger(s), costs can potentially be cut and the speed of clearing and settlement somewhat increased while the number of failures can be reduced.

5 Methodology Guidelines and Requirements

Objectives:

- Margin levels should correctly reflect the risk
- Margin calculation methodologies should be transparent and relatively simple
- Margin calculation methodologies should be replicable by counterparties to reduce dispute burdens
- Margin methodologies should take into consideration market liquidity and concentration

Guidelines from other markets:

- The BCBS-IOSCO guidelines (BCBS-IOSCO, 2015) define the IM requirement as an amount that "covers potential future exposure for the expected time between the last Variation Margin (VM) exchange and the liquidation of positions on the default of a counterparty". It is further specified that the calculation of this potential future exposure "should reflect an extreme but plausible estimate of an increase in the value of the instrument that is consistent with a one-tailed 99% confidence interval over a 10-day horizon, based on historical data that incorporates a period of significant financial stress".

Note. The 10-day horizon in the guidelines above is the suggested length of the liquidation period for the markets trading frequently. The liquidation period for the FTR market will be substantially larger. We will also investigate the choice of confidence interval in the context of FTRs.

Methodologies similar to the one outlined in the above guidelines are called VaR-based methodologies (or, risk-based methodologies) and are widely accepted in different markets for calculating IM and for other capital requirements. We note that after choosing the target percentile, the collateral (capital) required for insurance against default or other adverse market events can be computed in several ways. It can be just the value corresponding to this percentile (VaR), or it can be the expected value of losses exceeding VaR. This expected value, called *expected shortfall* (ES), has recently become more and more frequently used in regulatory guidelines for capital requirements. For example, it is universally used for calculating regulatory capital under FRTB IMA guidelines.

Regardless of the choice of the capital calculation, one step is common – calculating the change (over the MPOR) in the MTA value corresponding to the target percentile. That step, in turn, requires determination of the distribution of these MTA value changes. More precisely, at time t (time of current auction) we need to determine the distribution of the random variable

$$d_t = MTA_{t+MPOR} - MTA_t \#(1)$$

Two principle ways of generating this distribution will be described in this paper – a method based on historical simulations, and one based on Monte-Carlo simulations.

6 Historical Simulation Approach

In this approach we use the historical time series for auction prices for all auction times preceding the current time t .

6.1 Simple Historical Simulation

Using historical time series of auction prices, we compute the changes of portfolio MTA values over the MPOR for all times τ , $\tau \leq t$, in our time series:

$$D_\tau = MTA_\tau - MTA_{\tau-MPOR}$$

- Sort D_τ and find the one corresponding to target percentile.
- Compute IM using VaR or ES approach.

6.2 Historical Simulation with Scaling: FHS (filtered historical simulations)

In this method we scale by the ratio of current volatility and long-term volatility to account for *procyclicality*.

6.3 Using Stress Period

In this method we use changes over the worst historical period (worst year, two years ...) to get more conservative values of IM.

6.4 Liquidity Adjustment

Liquidity is taken into account by introducing liquidity horizons (LH) for each path and product, and by scaling historical changes by a factor proportional to \sqrt{LH} . The meaning of LH is that for certain paths/products the time to unwind is greater than for others.

LH values are typically the same for a specified group. We assign the lowest LH to the most liquid paths and higher values to the less liquid paths. Determining LH groupings and values will be one of our principal tasks.

6.5 Market Concentration Adjustment

Another objective of this project is to determine how to account for a concentrated trading position, i.e., a position that constitutes a large percentage of the total market exposure to the underlying product.

6.6 Generating Historical Time Series

Generating reliable historical time series is a key step for the success of HS methodology. This step requires proper concatenating, cleaning and analysis of various data streams as well as potential bootstrapping and proxying.

6.7 Validation of the Methodology: Back-Testing

Back-testing is a standard method for validating a particular trading or risk management methodology. We will also use it to choose between different IM methodologies under consideration.

For a given IM methodology the back-testing procedure works as follows.

- We fix a particular time t in the past and calculate IM using historical data for times preceding t .
- We then assume that default happens at time t and it takes a time period equal to MPOR to unwind the position.
- We then compare the loss during MPOR with the computed IM.
- We repeat this test for a number of times t and compute a percentage of times IM was less than actual loss.
- We check if this frequency is consistent with target risk percentile fixed in IM calculation methodology.

The comparison of these statistics for different methodologies also will allow us to choose a better IM methodology.

In addition to the procedure above we will include back-testing of a known default occurrence. Our goal is to analyze the performance of the IM algorithm during that time.

6.8 Final Thoughts about Historical Simulations Approach

Pros

- Standard risk-based approach used in majority of markets.
- Easy to implement.
- Transparent; low probability of dispute.
- No need to determine correlations between paths as there are built in the historical data.

Cons

- The method is based on historical price behavior; assumes stationarity; does not take into account present and future systemic changes.
- Requires substantial historical data which may not be available.
- May generate unfeasible scenarios.

7 Monte-Carlo (MC) Simulation Approach

In this section we describe an alternative approach to simulating CCP exposure to a market participant over the MPOR. The main idea underlying this approach is that the congestion component of the LMP price at any node is a function of fundamental drivers, such as nodal loads, generation and transmission constraints, fuel prices, etc. Once the values of these fundamental drivers are specified, we can run an optimization program, such as PROMOD, PLEXOS, etc., to determine economic dispatch solution and LMP prices at every node x , and particularly its congestion component (CLMP)

$$c^x = \Phi(L^y, \dots, G^z, \dots, T^b, \dots U) \# (2)$$

where L^y denotes the load at a node y , G^z denotes generation constraints at the node z , T^b is the transmission constraint at the branch b and U is the vector of fuel prices.

The consequence of our ability to generate CLMPs as a function of primary drivers is that for any given path we can generate the distribution of CLMP price differentials for that path by generating the distribution of the primary drivers over the MPOR. The benefit of this approach is that the statistical properties of primary drivers (loads, fuel prices) are stable and their distribution can be reliably validated. Having the distribution of the path prices over MPOR will allow us to simulate the distribution of a market participant's portfolio values, which ultimately will lead us to the calculation of the IM.

We suggest two approaches to generation of the distribution of the primary drivers.

7.1 Using Historical Data to Generate Distributions of Primary Drivers

Let t denote the current date. We need to generate the distribution of the future primary drivers, say loads, for the month $t + MPOR$. We will produce this distribution by applying historical load changes over the same period to the expected load for the month $t + MPOR$. After the distribution for loads is constructed, we generate the distribution of FTR prices

Again, the advantage of the historical approach is that the distributions used in this approach are not parametric and we don't need to determine correlations between these drivers at different locations. Moreover, compared to the historical price simulation methodology the advantage of this approach is that statistical characteristics of primary drivers are much more stable than those of the prices, and thus, historical distribution of these drivers are more stable and reliable.

7.2 Using MC Simulations to Generate Distributions of Primary Drivers

In this approach we use pure MC simulations to generate joint distribution of LMP primary drivers. This approach allows us to generate as many scenarios as our hardware and efficiency of our software will allow us, thus, giving us an increased degree of confidence that we will cover most of the adverse future scenarios. In addition to scenarios on loads, generation and fuel prices we can also consider scenarios

impacting grid topology. We should note here that even the pure MC simulations involve the usage of the historical data. We need it to determine parameters of the joint distribution, particularly, the correlation between different drivers.

7.3 Validation of the Methodology: Back-Testing

The back-testing methodology for MC approach is the same as the one proposed for HS methodology (see Section 6.7).

7.4 Add-Ons

Additional modifications, such as liquidity adjustments and concentration adjustments, will be considered for implementation as part of the MC approach, in the same way they are considered for the HS method (see Sections 6.4, 6.5).

7.5 Final Thoughts about MC Simulations Approach

Pros

- More flexibility; broader set of scenarios.
- Better risk determination; can better capture fat tails of loss distribution as we can analyze scenarios that HS cannot.

Cons

- Dependence on a choice of proprietary software.
- Potential for dispute if results are not easily understood (Solution: need to find a transparent way to communicate the process).
- More computationally intense; data requirements are high.

Exhibit B

Report: Results of Risk Model Quantitative Analysis Initial Margin Part 1: Historical Simulation Approach

Alex Eydeland

Financial Risk Mitigation Senior Task Force

September 25, 2019

- This paper examines the implementation of a Historical Simulation (HS) methodology for Initial Margin (IM) calculation via the development of proof-of-concept models and associated back-testing.
- The full paper is available here: <https://www.pjm.com/-/media/committees-groups/task-forces/frmstf/20190925/20190925-item-07-results-of-risk-model-quantitative-analysis.ashx>

- Margin is the amount of **financial** collateral deposited by a market participant with the Central Counter-Party (CCP) to collateralize trade exposures introduced by the participant. There are two principal forms of margin: **Variation Margin (VM)** and **Initial Margin (IM)**.
- **Variation Margin (VM)** has been described in the Variation Margin and Post-Auction Settlement Discussion Paper. Key features of any variation margin methodology:
 - At the time of the variation margin posting the combined value of the participant's portfolio and the cash in the variation margin account is never negative. In other words, if the CCP unwinds the participant's portfolio precisely at the moment of variation margin posting, there will be no losses to the CCP.
 - Variation Margin is a **forward-looking quantity**. Its value is connected to the Mark-to-Auction value of the participant's portfolio, which in turn is determined by the participants' expectation of future conditions affecting LMPs, including expectations of future demand, generation, fuel prices, outages and changes in grid topology.

- **Initial Margin (IM)** provides further protection in case the market participant is not able to post Variation Margin, hence triggering default.
- **IM** is a good-faith deposit, posted by a trading participant as collateral to protect against the financial consequences of default. It reflects potential losses that would be incurred by the participant's counter-party (in our case, by CCP) should the participant default, calculated to a high degree of statistical likelihood, across the participant's entire portfolio.
- **IM** must cover the period between the time when the position was incurred or variation margin (VM) last levied, and the time when the position could be liquidated or taken to final settlement (whichever is sooner) in the event of default. This time period is called the **Margin Period of Risk (MPOR)**, and is also known as "liquidation period".
- **IM** is computed at the time of every auction and, if necessary, more frequently.

- Monthly auctions.
 - For each planning year there are 12 monthly auctions from May to April of the next year at times $t_{May}^{mo}, \dots, t_{April}^{mo}$.
- Annual auctions.
 - For each planning year there are 4 rounds of annual auctions at times $t_1^{An}, \dots, t_4^{An}$.
- Long Term Auctions.
 - For each planning year YYYY/YYYY+1 there are three rounds of auctions for the long term FTR contracts covering planning years: YYYY+1/YYYY+2, YYYY+2/YYYY+3, YYYY+3/YYYY+4.
 - The times of these rounds are denoted $t_1^{LT}, t_2^{LT}, t_3^{LT}$.

- Cleared prices per auction or auction round:
 - $P(t_i^{mo}, MMYYYY)$: $MMYYYY$ – month and year of *monthly* FTR contract
 - $P(t_i^{An}, YYYY^{An})$: $YYYY^{An}$ –contract year of the *annual* contract
 - $P(t_i^{LT}, YYYY_1^{LT}), P(t_i^{LT}, YYYY_2^{LT}), P(t_i^{LT}, YYYY_3^{LT})$:
 $YYYY_1^{LT}, YYYY_2^{LT}, YYYY_3^{LT}$ are three years of the *long term* contract.
- **Example 1.** FTR contracts bid in the AUG 2018 monthly auction on 07/16/2018 will include Aug2018, Sep2018, Oct2018, Nov2018, Dec2018, Jan2019, Feb2019, Mar2019, Apr2019, May2019.
- **Example 2.** The four rounds of the 18/19 Annual auction run during April of 2018 will clear the price of the annual FTR contract for the 2018/2019 planning year.
- **Example 3.** The three rounds of the 19/22 Long Term auction (Jun, Sep, Dec) of 2018 will clear the prices of the long term FTR contracts for the planning years 2019/2020, 2020/2021, 2021/2022.

- To unify the notation all prices described above can be denoted as

$$P_{\mu}(t_i, T_k; \tau)$$

- μ is the index of a particular path;
- t_i is the auction date of the auction i ;
- T_k is the beginning of the FTR period, $t_i < T_k$;
- τ is the length of the FTR period (e.g., 1 month, 1 year);
- $P_{\mu}(t_i, T_k; \tau)$ is the price for the path μ cleared during the auction i at time t_i ; the price is for the contract that starts at T_k and has duration τ .
- $t_i \leq T_k$ where $t_i < T_k$ is the case of auction cleared prices, while $t_i = T_k$ means the settled price.
 - Example.** If t_i is 07/16/2018, T_k is 12/01/2018, $\tau = 1 \text{ month}$, then $P_{\mu}(t_i, T_k; \tau)$ denotes the FTR price for the path μ cleared during July 2018 monthly auction for the December 2018 contract.

- Period duration $\tau = 1 \text{ month}$.
- Historical data for HS method: 2006 - 2019. For each planning year since 2006/2007 we have path prices $P_{\mu}(t_i, T_k; 1m)$.
- $t_i < T_k$. To increase the data set $t_i = T_k$ is allowed. In this case the “auction price” is the settled price for the month i .
- Assume that participant's portfolio Π includes paths $\{\mu_1, \mu_2, \dots, \mu_m\}$. The HS method requires to construct many scenarios of how current auction prices for these paths will change over the specified MPOR (**margin period of risk**, a.k.a **liquidation period**). MPOR can be 2,3, or more months.

- How to compute the scenarios?
 - Choose a planning year in the past
 - Choose a contract month T_k in that planning year
 - Choose an auction month i and corresponding auction time t_i . The choice of the auction month is constrained by the requirement that $t_{i+MPOR} \leq T_k$.
 - Compute the changes for each path over MPOR:

$$D_{\mu}^{scen} = P_{\mu}(t_{i+MPOR}, T_k; 1m) - P_{\mu}(t_i, T_k; 1m), \quad scen = 1, 2, \dots$$
 - Create as many scenarios as possible by varying planning years and contracts
 - Apply these historical price moves to current auction prices to generate forward distribution of auction prices – each scenario corresponds to a set of potential auction prices at the end of MPOR over all paths in the portfolio.

- **The main question:**

Assuming that we need to liquidate the market participant's portfolio Π by the end of the MPOR, what would be our exposure with a high degree of confidence?

In other words, we need to state that with high probability our losses will not exceed δ during the liquidation period. Then, requesting the participant to post IM that is greater than or equal to δ , we ensure that we are protected with high degree of confidence in case the participant defaults and we need to liquidate by the end of MPOR.

To determine this critical loss level we will compute portfolio values for all price scenarios; then compute corresponding deviations of these values from the current portfolio value; rank these deviations and, finally, find the level such that percentage of scenarios with losses below this level does not exceed a small number (say, 1%).

- For all price scenarios compute

$$\Delta\Pi^{scen} = \Pi(scenario_prices) - \Pi(current_prices)$$

- Find δ such that

$$\Pr(\Delta\Pi^{scen} < \delta) = 1\%$$

- **Initial Margin.** Once we determined that 99% of portfolio deviations over MPOR are above δ , the *initial margin (IM)* is defined as follows:

$$IM = Const \cdot \delta$$

where *Const* is a pre-fixed scaling factor, greater than or equal to 1.

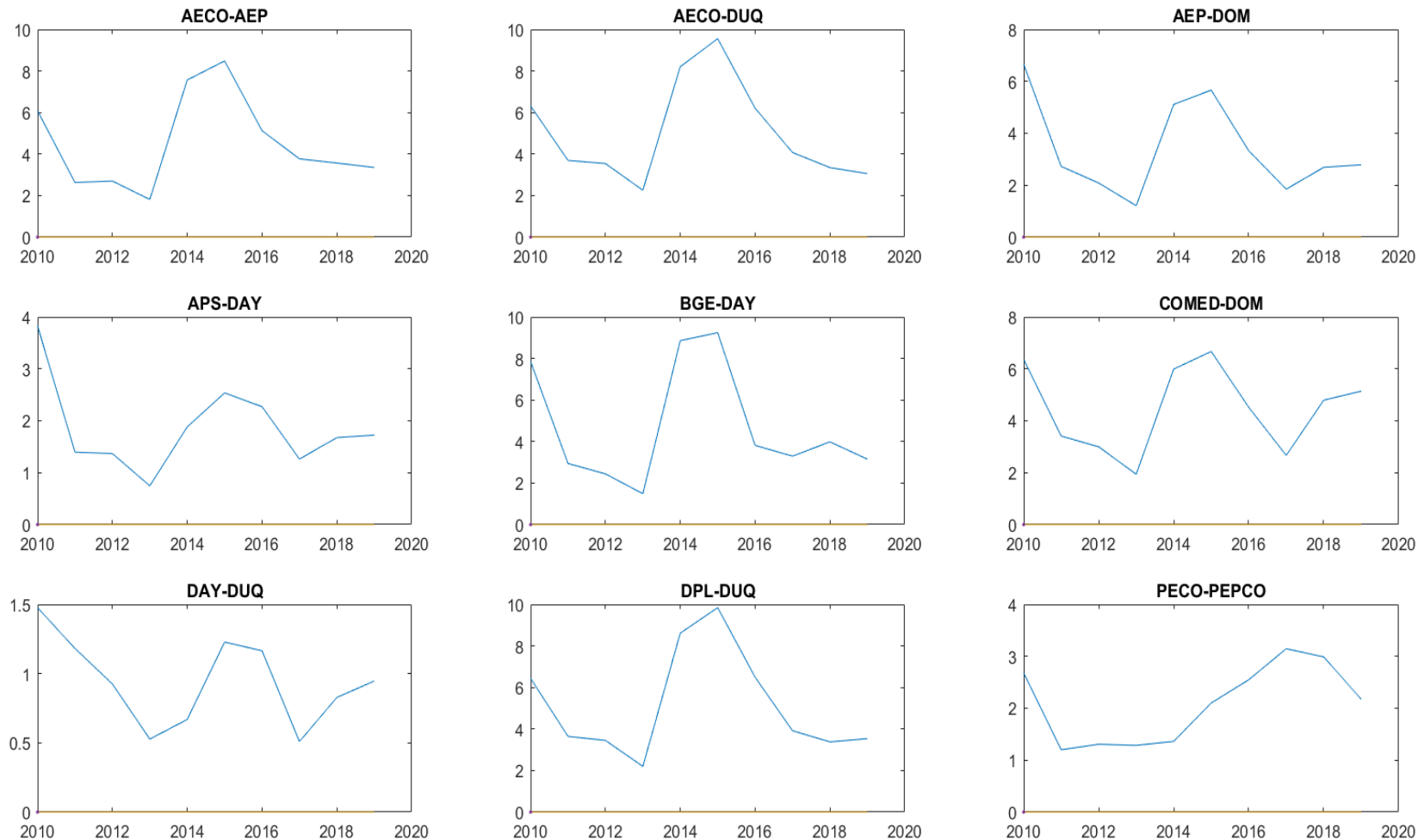
- **Annual Contract.** As we enter a given planning year, we determine the IM for the remaining balance of the corresponding Annual contract by splitting it into the monthly contracts and determining IM the same way we did it for monthly contracts.
- **Long Term Contract.** Similar methodology as in the case of monthly contracts with the following modifications:
 - $\tau = 1yr$ and not $1m$
 - t_i is the time of a particular round of LT auction
 - *MPOR* is now 6-9 months.

- **conYYYY, conMM** - year and month of the contract under consideration;
- **inAucYYYY, inAucMM** – year and month of the auction when we enter the contract;
- **inPromptNum** – the distance in months from the in-auction month to the contract month;
- **outAucYYYY, outAucMM** – year and month of the auction when we exit the contract (including the possibility of getting settled prices in the contract month);
- **outPromptNum** – the distance in months from the out-auction month to the contract month;
- **MPOR** – margin period of risk, the period between in-auction and out-auction;
- **PriceIn, PriceOut, Diff** – respectively, the price of the contract cleared in the in-auction, the price of the contract cleared in the out-auction and the difference between those prices.

conYYYY	conMM	inAucYYYY	inAucMM	inPromptNum	outAucYYYY	outAucMM	outPromptNum	MPOR	PriceIn	PriceOut	Diff
2017	5	2017	2	3	2017	5	0	3	1.4508	1.9109	0.46017

- The analysis of price distributions, as well as all back tests, except the last one, will be performed on zonal paths, due to the fact that the historical data for zonal prices is more reliable and readily available.
- Ultimately, we intend to perform similar analysis on all paths relevant to participants' portfolios.
- In this presentation, most of the analysis and test results are given in a reduced form. The full set of results can be found in the paper in the Appendix.
- First question: was there a systemic change in price volatility? For example, was there steady increase or decrease in volatility?

- No manifested systemic change in volatility (to be continuously monitored)



- Standard deviation, first percentile, and kurtosis of the zonal path FTR price distributions. $MPOR = 2$.

PATH	STD	1%	Kurtosis
AECO-AEP	4.19	-10.19	102.3
AEP-BGE	4.56	-12.09	121.66
APS-DOM	2.23	-5.92	60.11
DOM-DUQ	4.02	-11.64	42.47
PENELEC-PEPCO	3.28	-8.21	97.12

- Volatility decays for farther contracts. Standard deviation for each FTR contract is calculated for the distribution corresponding to MPOR=2

PATHS	Auction month + 2	Auction month + 3	Auction month + 5	Auction month + 7	All
AECO-AEP	8.50	2.92	2.50	2.19	4.19
AEP-DPL	8.79	3.08	2.46	2.24	4.33
DOM-DUQ	7.81	3.07	2.36	2.42	4.02
PECO-PEPCO	3.77	1.78	1.27	1.17	2.02
PENELEC-EKPC	4.28	1.67	1.06	0.60	2.00

- Back-testing is a standard method for validating a particular trading or risk management methodology. The back-testing procedure works as follows:
 - Fix a particular time t in the past and calculate IM using historical data for times preceding t .
 - Assume that a default happens at time t and it takes a time period equal to MPOR to unwind the position.
 - Compare the loss during MPOR with the computed IM.
 - Repeat this test for a number of times t and compute a percentage of times IM was less than actual loss.
 - Check if this frequency is consistent with target risk percentile fixed in IM calculation methodology.

- Back-testing results for zonal path prices. MPOR = 2, inPromptNum = 3

PATH	# TESTS	# FAILS
AECO-AEP	62	0
AECO-APS	62	0
AECO-BGE	62	0
AECO-COMED	62	0
AECO-DAY	62	0
AECO-DOM	62	1
AECO-DPL	62	2

- Total Number of Tests = 10724**
- Total Number of Fails = 139**
- Fails/Total = .013**

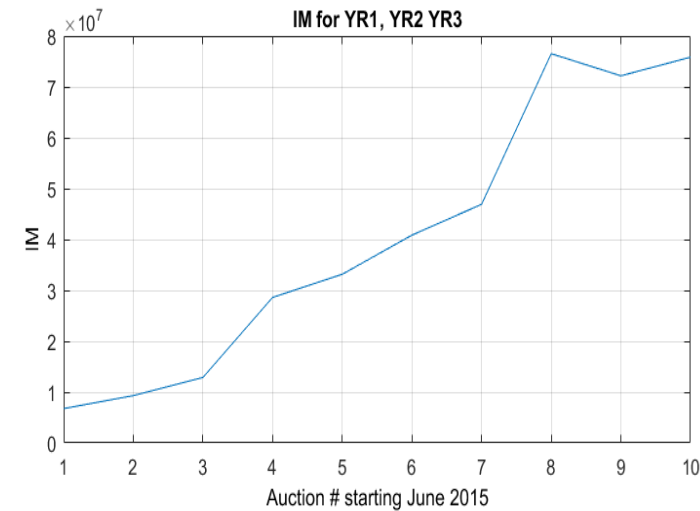
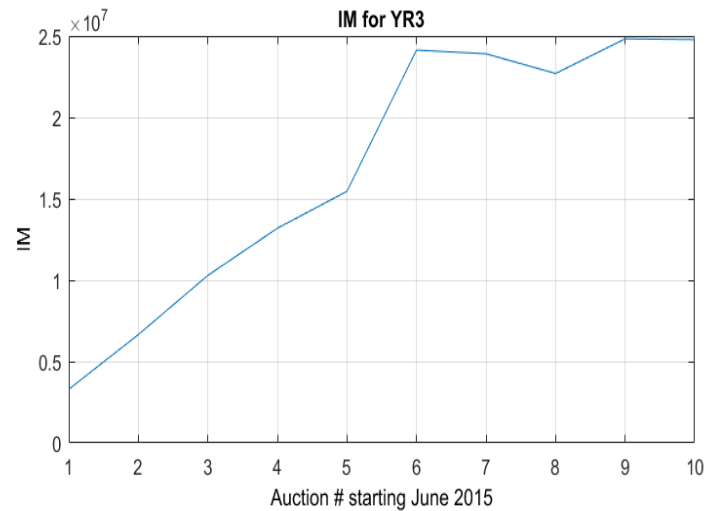
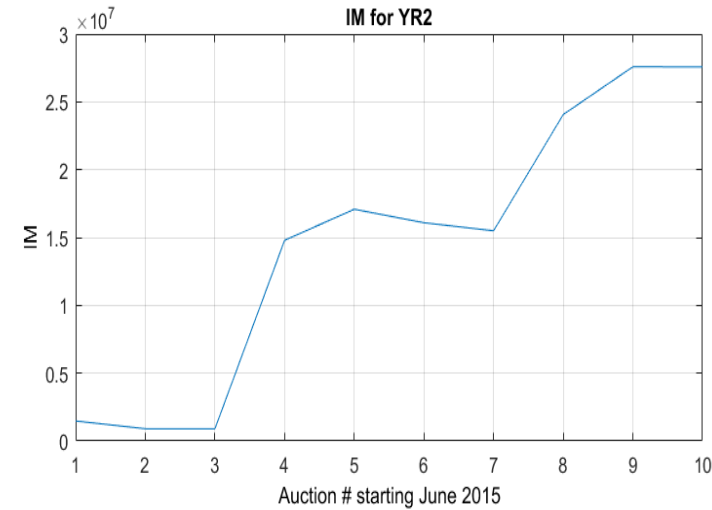
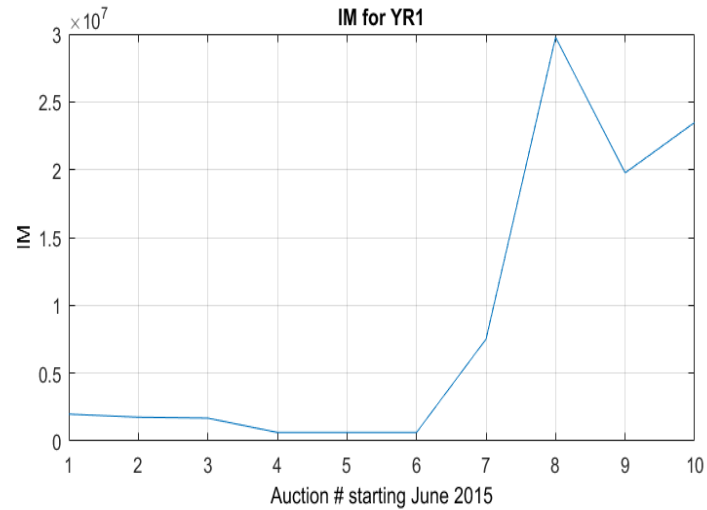
- **Const** = 125%

MPOR	inPromptNum	numFails/numScenarios
2	2	0.0092
2	3	0.0053
2	4	0.0043
2	5	0.0034
2	6	0.0029
2	7	0.0026
3	3	0.0041
3	4	0.0042
3	5	0.0038
3	6	0.0035
3	7	0.0032

- **Const** = 100%

MPOR	inPromptNum	numFails/numScenarios
2	2	0.0226
2	3	0.0130
2	4	0.0106
2	5	0.0085
2	6	0.0073
2	7	0.0065
3	3	0.0106
3	4	0.0113
3	5	0.0103
3	6	0.0096
3	7	0.0090

GreenHat Portfolio: IM for LT portfolio for auctions starting June 2015



- The concepts underlying the approach are common and preferred by regulators and market governing bodies. See, for example, Standard Initial Margin Model for Non-cleared Derivatives, ISDA, 2013
- Although called Historical Simulations, the method uses historical data only to determine the distribution around the forward prices and *not* the forward prices themselves. The forward prices, which at any auction reflect participants' expectations of future settled FTR prices, are determined at the auction time and, ideally, incorporate all information participants have about the future, including topology changes, outages, fuel prices, etc.
- Changes in participants' expectations result in changes in auction prices, changes in Mark-to-Auction portfolio values, and, finally, changes in VM which is levied to protect CCP against adverse movements of portfolio values.
- Initial Margin provides an additional protection against participant's default.

- IM is computed after we construct distributions of potential movements of all forward contract prices over relatively short period of time, MPOR. These distributions are constructed using historical price movements.
- **Summary.** VM is needed to neutralize portfolio losses due to changes in forward expectations, while IM is needed to protect (with a high degree of confidence) against losses during the period of liquidation caused by default. Calculation of IM never requires predicting of forward prices.
- Key benefit of HS approach – it produces a joint distribution of price movements without requiring correlation or covariance inputs.

- More work required:
 - *Adjustment for liquidity.* More analysis is needed to determine how adjust IM in case of illiquid paths.
 - *Choice of MPOR and other parameters for IM calculation.* We need to do more back testing of different portfolios to establish a definitive choice of these parameters.

- At the initial stage HS has proved to be a reasonable methodology to be considered for computing IM.
- HS can also be a simple and reliable back-up method in production or for testing purposes.
- HS can also be used to improve effectiveness of other methodologies, such as Monte Carlo simulations, resulting is some kind of hybrid method.

Exhibit C

Initial Margin and FTR Credit Requirements

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September 29, 2020

- Previously we reviewed initial backtesting results
- Today we will be covering
 - Additional Backtesting Results
 - Initial Margin Proposal
 - Considerations for FTR Credit Requirements

Additional Backtesting Results

Demonstrate that the IM methodology historically behaves as expected.

- Fix FTR portfolios at a particular time in the past, called the **measurement date**
- Calculate IM using historical data prior to the measurement date
- Calculate the actual move of the fixed portfolio over the time period equal to the liquidation period (i.e. 1 Auction Period, 2 Auction Periods, or to Settlement)
- Compare the actual move during the liquidation period with the computed IM
- Repeat this test for various measurement dates
- Compute the **failure rate** which is the percentage of times IM was less than an actual loss

Verify that the failure rate is consistent with target risk percentile fixed in IM calculation methodology.

- Assuming a targeted 99% Confidence Interval, results expected to fall within a 1% failure rate.
- Expected results:
 - Failure rates will fall between 0.5% and 1.5%, whereby
 - ~ 0.5% implies more conservative IM estimations, and
 - ~1.5% implies less conservative estimations

Previously, two approaches to aggregate the Monthly IM values into the BOPP IM were discussed.

Liquidation Period	Failure Rate Sum of monthly IM	Failure Rate Square root sum of squares
To Settlement	0.37%	2.79%
1	0.31%	1.78%
2	0.28%	1.86%

The summation approach is a more conservative approach to the calculation in that the value is less than the expected 1% and the square root sum of squares is the less conservative approach since it is greater than the expected 1%. Both aggregation methods result in failure rates outside of the failure rate boundaries of 0.5% and 1.5%.

Utilize a blended approach to aggregate the Monthly IM values into the BOPP IM

$$IM_{Balance\ of\ PP} = .1 \cdot \sum IM_{Monthly} + .9 \cdot \sqrt{\sum IM_{Monthly}^2}$$

- This “blending” formula is designed to bring the backtesting results into the desired range.
- The choice of coefficients is driven by the goal to have as small a perturbation of square root sum of squares formula (case of non-correlated moves) as possible, but not smaller.

Liquidation Period	Failure Rate
To Settlement	1.24%
1	0.74%
2	0.65%

In case of a failure, what is the average loss above the IM

- The **expected shortfall** indicates the percentage difference between the IM and the loss above the IM when there was a failure

IM Range (million USD)	Liquidation Period = "to settle" Shortfall (% of IM)	Liquidation Period = 1 Shortfall (% of IM)	Liquidation Period = 2 Shortfall (% of IM)
0-1	150	49	52
1-3	23	26	43
3-10	22	49	13
10 and above	36	40	37

Distribution of failures among participants

- There is no concentration of failures within a particular subset of participants
- When failures occur, no single participant stands out and failures are evenly distributed
 - Participants with 1-2 “fails” are the biggest subset of the total number of failing participants.
- The failures are not clustered within a small group of participants

- The historical back testing has demonstrated that the methodology proposed for computing IM has been performing as expected and is in agreement with the underlying assumptions.
- The methodology passes the back test for every choice of the liquidation period.
- Backtesting showed that the methodology does not underestimate the IM.
- It also showed that it does not overestimate the IM. Lowering the IM by 10% increases the failure rate by ~50%, bringing it out of targeted range.

Proposal for Initial Margin

- Our proposal is to choose **liquidation period = 2** as the input into the IM calculation procedure.
 - We need one period to detect a default and at least one period to take the liquidation measures.
 - Back testing for liquidation period = 2 showed good results for the failure rate, expected shortfall and failure distribution by participants.
 - A liquidation period of 2 aligns with the liquidation process to unwind a portfolio in a prudent manner

Considerations for FTR Credit Requirements

Current FTR Credit Requirements



- Path Specific Requirement
 - Replace with Initial Margin Methodology, using a Liquidation Period=2
 - Captures exposure of portfolio using best practices
- Undiversified Adder
 - Remove from the calculation
 - Not correlated to risk
- Per-MWh
 - Continue to consider as part of calculation, if works with summation methodology
 - Can serve to maintain a minimum requirement

- ARR Credits
 - Used as an offset to FTR Credit Requirements
 - Assumed to be guaranteed revenue

Period	Monthly Requirement	ARR Credits	Net of ARR Credits and Monthly Requirement	Final Monthly Requirement
SEP 2020	\$464,200	\$637,106	-\$172,906	\$0
OCT 2020	\$639,571	\$657,232	-\$17,661	\$0
....
APR 2020	\$409,637	\$636,859	-\$227,222	\$0
MAY 2020	\$711,428	\$658,397	\$53,031	\$53,031

- Final settlement of ARRs are reassigned on a daily basis
 - Based on a proportional basis within a zone, as load shifts from one LSE to another within a transmission zone (PJM Manual 6, Section 4.6)
- At the time of default, load served by the defaulting party is shifted to the EDC pursuant to the provisions of the Tariff, section 7.3 and OA, section 15.1.5.

- Given this load shift, the ARRs are also reassigned
- After the default, these ARR revenues will no longer be available in the defaulting party's invoice to offset the potential charges of unwinding the portfolio
- Considering ARR credits to be available at the time of default is counter to the settlement process following a default

Should ARR credits be considered as part of an offset to the collateral requirements

- Realized Gains and Losses
 - The gains or losses are a result of selling FTR(s) in an auction
 - Does not include bilateral transactions
 - At time of settlement, the gains will be considered a payment and the losses will be a charge to the participant
 - Recognizing these in the collateral requirements is in line with the actual settlement of these types of FTR transactions

Recognizing these in the collateral requirements is in line with the actual settlement of these types of FTR transactions

- Mark to Auction
 - The calculation will remain as the difference between the original cleared price and most recent auction price multiplied by the MW quantity
 - However, it will be updated to determine MTA based on remaining open positions (i.e. will no longer include realized gains and losses)
 - Today, the MTA is only utilized if the most recent auction prices are indicating a portfolio experiencing a loss, the amount of which is added to the base margin

Net MTA appropriately on both sides, in line with best practices

- Finalize approach to calculating a Total Credit Requirement for FTR positions
- Quantify impacts to Member Portfolios

**UNITED STATES OF AMERICA
BEFORE THE
FEDERAL ENERGY REGULATORY COMMISSION**

PJM Interconnection, L.L.C.

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Docket No. ER22-____-000

VERIFICATION

Pursuant to 28 U.S.C. § 1746 (2000), I state under penalty of perjury that I am the Dr. Alex Eydeland referred to in the foregoing “Affidavit of Dr. Alex Eydeland on Behalf of PJM Interconnection, L.L.C.,” 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 this 21 day of December, 2021.



ALEX EYDELAND