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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. ER24-99-001*
Responses to Deficiency Letter – Capacity Market Reforms to Accommodate the Energy Transition

Dear Secretary Bose:

PJM Interconnection, L.L.C. ("PJM") hereby responds to the letter of the Federal Energy Regulatory Commission's ("Commission") Office of Energy Market Regulation issued on November 17, 2023[1] seeking additional information concerning PJM's filing submitted on October 13, 2023, under section 205 of the Federal Power Act.[2] These responses concern PJM's October 13 Filing to update the risk modelling approach, utilize a "marginal" effective load carrying capability ("ELCC") approach for all Capacity Resources, enhanced intra-Delivery Year resource testing regime, improve the Locational Deliverability Area Reliability Requirement calculation, reduce the stop-loss limit, and better synchronize the Fixed Resource Requirement ("FRR") with Reliability Pricing Model

[1] *PJM Interconnection, L.L.C.*, Deficiency Letter, Docket No. ER24-99-000 (Nov. 17, 2023) ("Deficiency Letter").

[2] *PJM Interconnection, L.L.C.*, Capacity Market Reforms to Accommodate the Energy Transition While Maintaining Resource Adequacy of PJM Interconnection, L.L.C., Docket No. ER23-99-000 (Oct. 13, 2023) ("October 13 Filing").

("RPM"). These changes will help to strengthen the capacity market's ability to send market signals that incentivize resource adequacy in PJM.

PJM appreciates the opportunity to further clarify the proposed revisions to the Open Access Transmission Tariff ("Tariff") and the Reliability Assurance Agreement ("RAA").[3] In considering the additional answers below, PJM urges the Commission to accept the proposed enhancements expeditiously so that the benefits of this proposal can be applied beginning with the next Base Residual Auction (or "BRA") currently scheduled to commence in June of this year.

I. REQUESTED EFFECTIVE DATE AND ACTION DATE

PJM respectfully renews its request for an effective date of December 12, 2023, for the proposed revisions contained within this docket. Good cause exists to grant PJM's requested effective date. First, the Commission often retains the original requested effective date when a filing is made in good faith to cure a deficiency.[4] Second, the October 13 Filing provided the required notice as to the timing of the proposed deadlines associated with the proposed enhancements, and this filing gives notice of PJM's desire to retain that date in light of the deficiency letter. As such, no party will be prejudiced by adoption of the originally requested effective date. Third, adoption of the originally requested effective date will allow PJM to begin the transition from the existing capacity market rules in time for the next scheduled Base Residual Auction in June of 2024. Specifically, the deadline

[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 Dec. 1, 2023). Terms not otherwise defined herein shall have the same meaning as set forth in the RAA, the Tariff, and the Amended and Restated Operating Agreement of PJM Interconnection, L.L.C.

[4] *See, e.g.*, *PJM Interconnection, L.L.C.*, 182 FERC ¶ 61,073, at PP 1, 14 (2023) (granting requested effective date following supplemental filing in response to deficiency letter);*Midwest Indep. Transmission Sys. Operator. Inc*., 105 FERC ¶ 61,076 (2003) (same).

for resource owners to provide the binding notice of intent to offer is the requested effective date of this filing, December 12, 2023.[5] The December 12, 2023 deadline to submit a binding notice of intent to offer for the 2025/2026 Base Residual Auction is necessary to allow adequate time to model such Planned Generation Capacity Resources in the ELCC model and reserve requirement study. PJM must run this analysis and post the results in advance of the Base Residual Auction, and therefore, PJM must start the analysis before the end of each calendar year.

[5] While PJM's October 13 Filing indicated that the deadline to submit this binding notice of intent would be December 1, 2023, PJM is clarifying that this deadline should be December 12, 2023, based on Commission precedent. Specifically, the Commission has previously explained that deadlines before the effective date "are not effective or enforceable." *PJM Interconnection, L.L.C.*, 183 FERC ¶ 61,009, at P 38 (2023).

II. ANSWERS TO QUESTIONS IN DEFICIENCY NOTICE

A. DEFINITION OF INSTALLED CAPACITY

1. PJM proposes RAA revisions stating that "[t]he installed capacity of an Unlimited Resource and Variable Resource shall be determined in accordance with the PJM Manuals."[6] In its transmittal letter, PJM specifically references PJM Manual 21, section 1.2.1.[7]

    a. PJM Manual 21, section 1.2.1 does not appear to define the installed capacity of any Variable Resource[8] type other than run of river hydroelectric units without pooling capability.[9] However, PJM Manual 21, Appendix B defines various terms for wind and solar units such as "Capacity Value," "Net Maximum Capacity," etc.[10]

        i. Please identify the language in PJM Manual 21 that defines the installed capacity of Variable Resources as referenced in proposed RAA, Schedule 9.2, § G.

Answer:

The existing provisions of PJM Manual 21 provide the business rules for determining, among other things, the installed capacity ("ICAP") of generating facilities. More particularly, ICAP is defined in PJM Manual 21 as "the summer net capability of a generating unit as determined in accordance with PJM manual M-21, Rules and Procedures for Determination of Generation Capability and within the capacity interconnection right limits of the bus to which it is connected."[11]

Additionally, PJM Manual 21A "Determination of Accredited UCAP Using Effective Load Carrying Capability Analysis" was added as a new manual in 2021 to provide the business rules for determining the accredited capacity of current ELCC Resource types, including Variable Resources, and became effective with the 2023/2024 Delivery Year, superseding the rules in Appendix B of PJM Manual 21 for wind and solar units. PJM Manual 21A refers back to Manual 21 for its definition of ICAP, which it

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[6] Proposed RAA, Schedule 9.2, § G.

[7] Transmittal at 38, n.71.

[8] The PJM RAA defines a Variable Resource as "a Generation Capacity Resource with output that can vary as a function of its energy source, such as wind, solar, run of river hydroelectric power without storage, and landfill gas units without an alternate fuel source." PJM RAA, Article 1.

[9] *See* PJM, *Manual 21: Rules and Procedures for Determination of Generating Capability*, at 16 (Jul. 26, 2023), https://www.pjm.com/~/media/documents/manuals/m21.ashx (PJM Manual 21).

[10] PJM Manual 21, App. B (Jul. 26, 2023).

[11] PJM Manual 21, section 1.2.

references as the "summer net capability of a generating unit…", as well as the Capacity Interconnection Rights ("CIR") level of a resource.

The current provisions in Manual 21 and Manual 21A do not currently provide further detail on the ICAP rating of Variable Resources, as they generally do for other generation resource types, and instead focus on the determination of Effective Nameplate Capacity and other factors used to derive the Accredited UCAP of Variable Resources today. As part of this broader proposal and contingent upon Commission approval, PJM will update its manuals to provide a more precise definition of ICAP for Variable Resources. Specifically, the ICAP for Variable Resources, as noted in the response for (ii) below, will be set equal to the Effective Nameplate Capacity of the resource, not to exceed the greater of the CIRs of such resource, or the transitional system capability as limited by the transitional resource megawatt ("MW") ceiling, awarded for the applicable Delivery Year.

Defining the calculation of ICAP for Variable Resources in PJM Manuals 21 and 21A is consistent with where the current definition of ICAP resides for most other generation resource types.

ii. Please explain how PJM will define installed capacity for each of the Variable Resource Effective Load Carrying Capability (ELCC) Classes defined in proposed RAA, Schedule 9.2, section B.

Answer:

PJM will define installed capacity, or ICAP, for each of the Variable Resource ELCC Classes defined in RAA, Schedule 9.2, section B as the Effective Nameplate Capacity of the resource, not to exceed the greater of the CIRs of the resource, or the transitional system capability as limited by the transitional resource MW ceiling, awarded for the applicable Delivery Year.

This definition is consistent with the broader definition of installed capacity, or ICAP, of generating units as defined in Manual 21, which is limited to the CIRs of the resource at the bus to which it is connected.

For reference, CIRs are defined in the Tariff as "the rights to input generation as a Generation Capacity Resource into the Transmission System at the Point of Interconnection where the generating facilities connect to the Transmission System." CIRs distinguish Generation Capacity Resources from Energy Resources and are granted when an interconnecting generating facility has been studied to be deliverable.

iii. PJM proposes to define the installed capacity of a Combination Resource "based on the lesser of the Maximum Facility Output or the sum of the equivalent Effective Nameplate Capacity values of the resource's constituent components considered on a stand-alone basis."[12]

1. Please explain whether the installed capacity of a stand-alone Variable Resource is equivalent to its Effective Nameplate Capacity.

Answer:

The installed capacity of a stand-alone Variable Resource will be determined as described in the response provided in 1(a)(ii) above.

[12] Proposed RAA, Schedule 9.2, § G.

2. If the two terms (installed capacity and Effective Nameplate Capacity) are not equivalent, please support the proposal to define the installed capacity of a standalone Variable Resource on a different basis than the installed capacity of a Combination Resource with a Variable Resource component.

Answer:

The two terms are not equivalent. The notable difference between the two terms is that installed capacity, or ICAP, is limited by the CIRs (or transitional system capability, if applicable) of the resource, while the Effective Nameplate Capacity of a Variable Resource is set equal to the Maximum Facility Output, which is not limited by the CIRs.

However, the proposal does not intend to define the installed capacity values of standalone Variable Resources on a different basis than Combination Resources with a Variable Resource component. In both instances, the ICAP shall be limited to the CIRs (or transitional system capability, if applicable) consistent with the ICAP provisions described in Manual 21 that are referenced in Manual 21A today.

The ICAP of a Combination Resource is based on and determined by first taking the lesser of the Maximum Facility Output or the sum of the equivalent Effective Nameplate Capacity values of the resource's constituent components considered on a stand-alone basis, as described in the current RAA Schedule 9.1 language and the proposed RAA Schedule 9.2 language. That value is then capped such that the ICAP does not exceed the CIRs of the Combination Resource (or transitional system capability, if applicable). It is appropriate to apply the CIR limit after summing the equivalent Effective Nameplate Capacity values of the components given the CIRs may only be specified in the interconnection agreement for the entire Combination Resource rather than individually for each of the constituent components. Alternatively, if the CIRs are delineated for each component, the CIRs of the Combination Resource is equal to the sum of the individual components' CIRs, and again, would set an upper limit on the ICAP rating of the Combination Resource.

As a numerical example, assume a Combination Resource has a Maximum Facility Output of 150 MW, CIRs of 100 MW, and consists of a Variable Resource component that has an Effective Nameplate Capacity of 100 MW, and a Limited Duration Resource component that has an Effective Nameplate Capacity of 50 MW. In this instance, the CIRs of the Combination Resource will limit the ICAP rating to 100 MW.

b. PJM Manual 21, section 1.2.1 defines the installed capacity of Unlimited Resources as their generating capability under summer conditions.[13] However, PJM also refers to installed capacity in the context of winter conditions.[14]

i. Please clarify how PJM will define the installed capacity of an Unlimited Resource.

Answer:

The installed capacity, or ICAP, of an Unlimited Resource will continue to be determined on a Delivery Year basis and calculated consistent with the existing provisions of PJM Manual 21, section 1.2 that are based on summer net capability and limited by the CIRs of the resource[15].

For context, under the annual market design, the Accredited UCAP and Accredited UCAP Factor used to convert the ICAP of an Unlimited Resource to its Accredited UCAP is also determined and set on an annual basis, where the determination of such values will reflect resource outages and unavailability modeled in the ELCC analysis across different seasons and weather conditions.

The Commission correctly recognizes that installed capacity is referenced in the context of winter conditions as well, particularly with regard to the Generation Resource Rating Test described in the Tariff, Attachment DD, section 7 and further described in PJM Manuals 21 and 18. Specifically, where Unlimited Resources take on a capacity commitment, they are required to test in each season to demonstrate that they are capable of providing the "megawatt amount of installed capacity the Market Seller committed.[16]" This test is completed today for both the summer and winter season for Unlimited

[13] *See, e.g.*, PJM Manual 21 at 14 ("Steam units with only once through or multipass cooling must have their ICAP determined by adjusting for cooling body (intake) water temperature *under summer conditions*." (emphasis added)); *see also id.* § 1.2 ("The ICAP is equivalent to . . . the Summer Net Capability defined in section 2.2 of this document.").

[14] Transmittal at 83 ("PJM believes that the best way to assess both summer and winter capability is by requiring physical demonstrations of this capability in each season. . . . This is appropriate because the purpose of the capacity capability test is to verify that committed Generation Capacity Resources are capable of generating up to their committed megawatt amount of installed capacity.")

[15] To be clear, PJM has not proposed a change to this within its instant filing that retains an annual market construct with which the level of CIRs and ICAP of an Unlimited Resource are effectively annual and do not vary across different periods of the year. However, the concept of differentiating CIRs and ICAP across seasons or periods of the year for Unlimited Resources will be a consideration when further discussing a seasonal or sub-annual market construct with stakeholders, which PJM plans to pursue next year.

[16] *See* Tariff, Attachment DD, section 7 ("If none of the tests during a testing period *certify full delivery of the megawatt amount of installed capacity the Market Seller committed, or Locational UCAP Seller sold, for such Delivery Year*, the Market Seller or Locational UCAP Seller shall be assessed a daily Generation Resource Rating Test Failure Charge for each day from the first day of the Summer or Winter Season in which such resource failed the rating test . . . ." (emphasis added)).

Resources, as detailed in PJM Manual 18, section 8.5[17], where the net capability test for the winter season shall consider actual site conditions at the time of the test and is corrected to PJM peak winter conditions, as further detailed in PJM Manual 21 section 2.3 "Winter Net Corrected Test Capability", and a resource may be subject to a Generation Resource Rating Test Failure Charge for one or both seasons if they fail to demonstrate that their resource is capable of fully delivering the megawatt amount of installed capacity committed on such resource.

The proposed change to the winter test is to remove the existing provisions in PJM Manuals 21 and 18 that allow a winter capability test to be satisfied by adjusting the most recent summer capability test to reflect performance during winter conditions, and instead require that an actual, physical test be performed on resources during the winter season to demonstrate their capability to perform up to the installed capacity committed on such resource in the season.

It is within that context that installed capacity under winter conditions is referenced. The purpose of the winter capability test is not to establish or demonstrate some additional capability that an Unlimited Resource may have beyond its rated ICAP or CIRs, for which it is considered a Capacity Resource, but rather to demonstrate that the resource is capable of performing up to the level for which it has been committed for capacity in the winter season.

[17] *See* Capacity Market & Demand Response Operations, *PJM Manual 18: PJM Capacity Market*, PJM Interconnection, L.L.C., section 8.5 (Nov. 15, 2023), https://www.pjm.com/-/media/documents/manuals/m18.ashx ("In accordance with M-21, a Net Capability Test must be performed during both the Summer and the Winter testing periods.").

ii. PJM proposes to calculate the Generation Resource Rating Test Failure Charge on a Generation Capacity Resource based in part on "the installed capacity committed for such day of the Delivery Year,"[18] and assess the charge "for each day of the Delivery Year in which the seasonal rating test for such resource fails to certify full delivery of the megawatt amount of installed capacity committed for such day."[19] Please explain how PJM will determine the amount of installed capacity committed on a given day for an Unlimited Resource, and to what extent this value varies over the year on a seasonal basis.

Answer:

The amount of installed capacity committed on a given day for an Unlimited Resource will be equal to the committed unforced capacity, or UCAP, on the resource for such day divided by the resource's Accredited UCAP Factor.

Committed ICAP = Committed UCAP / Accredited UCAP Factor.

This is consistent with the conversion between committed UCAP and committed ICAP today for Unlimited Resources, with the exception that (1 – the resource's EFORd) is used today in place of the proposed Accredited UCAP Factor. The Accredited UCAP Factor, by definition, is the ratio of a resource's Accredited UCAP to ICAP. The committed UCAP in the formula can vary by season or day, and is a function of the amount of UCAP that has cleared an RPM auction, been committed in an FRR Plan[20], sold in a Locational UCAP bilateral transaction, or used in a replacement transaction for such resource.

The amount of installed capacity committed on a given day is not a new term for Unlimited Resources. PJM's Capacity Exchange System provides capacity resource positions, including capacity commitments, for market sellers to view on a daily basis in both ICAP and UCAP terms. There are also a number of instances in the current PJM Manuals and governing documents that use the level of committed installed capacity, including PJM Manual 18 section 8.3, which defines the Total Unit ICAP Commitment Average (TUICA)[21] that is currently used for summer and winter rating tests and equal to the average committed ICAP on a unit in the Delivery Year. As a part of its proposal, PJM

[18] Proposed OATT, Attach. DD, § 7.1(b).

[19] *Id.* § 7.1(a).

[20] To be clear, capacity commitments submitted in an FRR Plan specify a megawatt quantity of ICAP to be committed, and the equivalent level of committed capacity in UCAP terms is calculated; today, that equivalent UCAP is based on the final EFORd of the resource, and under the proposal, based on the Accredited UCAP Factor.

[21] *See* PJM Manual 18, section 8.3 ("Since the RPM Resource Commitments or FRR Capacity Plan Commitments on a unit can vary daily during the delivery year, a Total Unit ICAP Commitment Amount (TUICA) is calculated for each unit and used as the basis for assessing the performance of a unit for summer/winter capability tests.").

will update the Manuals to describe the calculation of committed ICAP which will now be based on the Accredited UCAP Factor.

To provide a numerical example of the commitments varying throughout the Delivery Year, assume a generating unit rated at 100 MW ICAP is accredited with 80 MW UCAP, and therefore has an Accredited UCAP Factor of 80%. The unit partially clears in the RPM auctions for 60 MW of UCAP and during the Delivery Year, the unit bilaterally sells and commits the remaining 20 MW UCAP for 3 months of the year. During the 9 months of the Delivery Year that the unit has a 60 MW UCAP commitment, the equivalent committed ICAP is equal to 75 MW [60 MW UCAP / 80%]. During the remaining 3 months of the Delivery Year that the unit is fully committed for the 80 MW UCAP, the equivalent committed ICAP is equal to 100 MW ICAP [80 MW UCAP / 80%]. The 75 MW of committed ICAP for 9 months of the Delivery Year and 100 MW of committed ICAP for the remaining 3 months of the Delivery Year in this example reflect "the installed capacity committed for such day of the Delivery Year" during those months that will be used in the rating test.

c. PJM proposes to calculate the Accredited Unforced Capacity (UCAP) of an Unlimited Resource as the product of its "(i) installed capacity; (ii) the applicable ELCC Class Rating; and (iii) the ELCC Resource Performance Adjustment."[22] PJM also proposes to define the Accredited UCAP Factor for all Generation Capacity Resources as "the ratio of the resource's Accredited UCAP to the resource's installed capacity."[23] Further, PJM proposes to calculate the Forecast Pool Requirement based in part on the Pool-wide Average Accredited UCAP Factor, which PJM proposes to define as "the ratio of the total Accredited UCAP to the total installed capacity of all resources."[24]

i. Please clarify how PJM will define the installed capacity of Variable Resources and Unlimited Resources for the purposes of these formulas.

Answer:

In each of the referenced formulas, the installed capacity (ICAP) of Variable Resources and Unlimited Resources will be determined consistent with the responses above (1)(a)(ii) for Variable Resources and 1(b)(i) for Unlimited Resources).

[22] Proposed RAA, Schedule 9.2, § D(1)(c).

[23] *Id*. at Schedule 9.2, § E.

[24] *Id.* at Schedule 4.1, § C.

B. CAPACITY RESOURCE TESTING

2. PJM proposes to "require the generator capacity capability test to be conducted in both the summer and winter seasons during the Delivery Year for any Generation Capacity Resource, excluding Variable Resources, that is committed through the RPM Auctions or in an FRR Plan."[25]

    a. Please identify the proposed tariff revisions in OATT, Attachment DD, section 7.1(a) that effectuate the requirement that the generator capacity capability test be conducted in both the summer and winter seasons.

Answer:

The proposed revisions in Tariff, Attachment DD, section 7.1(a) do not include a change to effectuate the requirement that an actual, physical test be conducted in each season. Under the existing rules detailed in Tariff, Attachment DD, section 7.1(a), and as discussed in response to question 1(b)(i) above, committed Generation Capacity Resources have their capability assessed in both the summer and winter season. However, there are explicit provisions in the PJM Manuals that allow the winter test to be satisfied by adjusting the most recent summer capability test to winter conditions.[26] Updating the Manual provision regarding the adjustment of summer capability tests to winter conditions does not require changes to the aforementioned Tariff language. As a result, contingent upon acceptance of this filing, PJM would remove the current provisions that allow a winter test to be satisfied by adjusting the most recent summer capability test to winter conditions in the manuals. Such an update would effectively require the generator capacity capability test to be conducted in both the summer and winter seasons during Delivery Year for any Generation Capacity Resource that is committed through the RPM Auctions or in an FRR Plan.

The current and proposed Tariff revisions support the requirement for seasonal testing, where the current provisions refer to "tests during a testing period" to certify full delivery of the committed installed capacity, and that such charge shall be assessed "for each day from the first day of the Summer or Winter Season in which such resource failed the rating test."[27] The current Tariff provisions also refer to a resource's "test during the relevant testing period" in the formula to determine if a charge shall be assessed.[28] Furthermore, the proposed Tariff language explicitly refers to a seasonal rating test

[25] Transmittal at 83 (citing proposed OATT, Att. DD, § 7.1(a)).

[26] *See* PJM Manual 21, section 2.3 ("Winter capability verification tests can be satisfied by correcting the most recent summer capability verification tests to winter conditions."); PJM Manual 18, section 8.5 ("Alternatively, data collected during the summer verification window may be used to satisfy winter test requirements after adjustment to appropriate ambient winter conditions.").

[27] Tariff, Attachment DD, section 7.1(a).

[28] Tariff, Attachment DD, section 7.1(b).

requirement, noting that effective with the 2025/2026 Delivery Year, the charge "shall be evaluated and assessed for each day of the Delivery Year in which the *seasonal rating test* for such resource fails to certify…"

Notwithstanding the foregoing, should the Commission deem necessary, PJM consents to a compliance directive that would more explicitly require a physical testing requirement in both the summer and winter seasons in Tariff, Attachment DD, section 7.1(a).

3. PJM proposes to exempt Variable Resources from the Generation Resource Rating Test Failure Charge, because "the varying nature of the resource's capability as a function of its energy source, along with the fact that the capacity accreditation of these resources largely relies upon such Variable Resource's historical output rather than a claimed installed capacity level that may be committed."[29] PJM also proposes a new, separate, Generation Capacity Operational Test to determine whether a resource can synchronize to the grid within the start-up times specified in the schedule that PJM tests the unit on and operates for its minimum run time.[30] PJM states that its "selection of resources for operational testing and the timing of such tests will be based on a number of factors, including the period of time since a unit last operated, the system conditions under which the unit has recently operated, the expected system conditions during the operational test, and the recent performance of units with respect to successfully starting and operating within the specified parameters."[31]

    a. Please clarify whether PJM is proposing to apply the Generation Capacity Operational Test to Variable Resources. Please identify the proposed tariff revisions that define the applicability of this test.

Answer:

PJM is not proposing to apply the Generation Capacity Operational Test to Variable Resources. The purpose of the test is to confirm that dispatchable resources, especially those that have not operated recently, can do so upon PJM request and according to their operating parameters. Variable Resource performance is already demonstrated on an on-going basis through normal operations. Therefore, it would not be necessary to apply the Generation Capacity Operational Test to Variable Resources.

PJM intends to provide for this exemption to the operational test in the PJM Manuals, subject to Commission approval of the proposal, consistent with the placement of the current provisions in the PJM Manuals that provide an exemption for Variable Resources for seasonal capability testing.[32]

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[29] *Id.* at 83 n.218; *see* proposed OATT, Att. DD, § 7.1(a)).

[30] *Id.* at 85-87; proposed OATT, Att. DD, § 7A.

[31] *Id.* at 85-86 (citing proposed OATT, Att. DD, § 7A(a)).

[32] *See* PJM Manual 18, section 8.5 ("A Variable Resource is exempted from the summer/winter capability testing requirement and will not be assessed any Generation Resource Rating Test Failure Charges."); *see also* Resource Adequacy Planning Department, *PJM Manual 21A: Determination of Accredited UCAP Using Effective Load Carrying Capability Analysis*, PJM Interconnection, L.L.C., section 7 (July 26, 2023), https://www.pjm.com/-/media/documents/manuals/m21a.ashx ("Testing" has that "Variable Resources and Variable Resource components of a Combination Resource are exempt from the Capability Verification Testing requirement.").

Notwithstanding, PJM would also be amenable to specifying this exemption as a part of the proposed language in the Tariff, Attachment DD, section 7A, consistent with the proposed clarification that was added in section 7.1(a) for the seasonal capability testing.

C. CAPACITY ACCREDITATION AND ELCC

4. PJM proposes to define a Gas Combined Cycle Dual Fuel Class and a Gas Combustion Turbine Dual Fuel Class as:[33]

> [A]n ELCC Class consisting of Unlimited Resources of the [corresponding] technology type that is primarily fueled by natural gas, and that attests that it has the capability to start and operate independently on an alternate, onsite fuel source up to its maximum capacity level during the winter season of the applicable Delivery Year in which it is providing capacity, and capable of operating on the alternate fuel for two 16-hour periods over two consecutive days at its maximum capacity level.[34]

   a. Please describe what mechanisms PJM will use to enforce each of these proposed requirements.

It is the responsibility of the generation owner to provide truthful and accurate information on their resource to PJM, including in this attestation in meeting the dual fuel requirements. Any intentional misrepresentation of the unit's existing or planned capability could be subject to Commission referral and enforcement. For this attestation, PJM will require generation resource owners to describe how they currently, or plan to, meet the requirements to be included in the Combined Cycle or Combustion Turbine dual fuel ELCC class.

Such an attestation is similar to the process that PJM utilizes in the context of the Minimum Offer Price Rule where Capacity Market Sellers are required to certify whether the underlying resource is expected to receive Conditioned State Support and whether the Capacity Market Seller intends to exercise buyer-side market power.[35] To further strengthen this requirement, PJM intends to include in the Manual language (subject to the filing being approved) the obligation on generation owners to notify PJM of any material change in their resource that would impact whether or not they meet the dual fuel criteria. Additionally, PJM also intends to include language in the PJM Manuals that PJM may request additional information from owners at the time of the attestation and/or going into the delivery year to confirm their eligibility for the dual fuel class. For instance, PJM may question resources that have historically not been able to meet this and are now claiming they can without further investment/operational changes.

To the extent a resource that is the subject of such attestation does not mark their energy market schedule on the alternative fuel as available for the required time, or are called upon but fail to operate on the alternative fuel due to reasons that would have

[33] *Id.* at 39-41.

[34] Proposed RAA, Article 1.

[35] *See* Tariff, Attachment DD, section 5.14(h-2)(1).

prevented the owner from qualifying as dual fuel, the Market Monitor and/or PJM could refer the relevant Capacity Market Seller of such resource to the Commission's Office of Enforcement for potentially misrepresenting the capability of their resource.

5. PJM proposes to evaluate a resource's ELCC Resource Performance Adjustment based on the resource's modeled hourly output on days since June 1, 2012.[36] Please explain how PJM will model hourly output for resources that:

    a. Enter commercial operation after June 1, 2012;

Answer:

PJM will identify the ELCC Class that each resource belongs to prior to conducting each annual ELCC analysis. If the resource does not have a full performance history back to June 1, 2012, for each hour with missing data, the following applies by resource type:

For Unlimited Resources:

The putative forced outage history of the resource will be calculated as total megawatts forced out from resources in the same ELCC Class that were in commercial operation divided by total installed capacity from resources in the same ELCC Class that were in commercial operation[37]. Subsequently, to derive the megawatts forced out of the resource in a given hour in a given scenario, the sample-from-bins approach will be performed.

The putative ambient derate history of the resource will be calculated as total megawatts on an ambient derate from resources in the same ELCC Class that were in commercial operation divided by total installed capacity from resources in the same ELCC Class that were in commercial operation. Subsequently, to derive the megawatts derated due to ambient conditions of the resource in a given hour in a given scenario, the sample-from-bins approach will be performed.

The putative planned/maintenance outage requirement of the resource will be calculated in weeks per year as the weighted average of the annual planned/maintenance outage requirement using the performance data of the resource and the annual average planned/maintenance outage requirement of resources in the same ELCC Class. The weights will correspond to the share of data coming from the resource and the share of data coming from the resources in the same ELCC Class. Subsequently, the planned/maintenance outages of the resource will be scheduled using a heuristic that seeks

[36] Transmittal at 51; Proposed RAA, Schedule 9.2, § D(2).

[37] In the event that a resource belongs to an ELCC Class with no or very few existing units, PJM may use units with similar operational characteristics in a similar ELCC class to derive the putative unavailability. If no similar ELCC class is identified, PJM may use units with similar operational characteristics in the Unlimited Resources category, or may rely upon external sources to derive the putative unavailability. This applies to forced outages, ambient derates and planned/maintenance outage requirement.

to levelize reserves throughout the year in each load scenario as described in the Rocha-Garrido affidavit.[38]

For Variable Resources:

The putative unavailability is derived from an hourly backcast, which uses geographical location and plant characteristics as inputs.

For Limited Duration Resources:

The putative output in the model is based on storage characteristics and a dispatch heuristic. In general, the hourly output for Limited Duration Resources is not based on specific historical performance so a full or partial performance history is not significantly relevant. The maximum output for resources in this ELCC Class, however, is derated by EFORd. Units without a full history back to June 1, 2012 use an EFORd calculated using the individual unit's forced outage data and forced outage data of all units in the relevant ELCC Class[39] (in a manner similar to the planned/maintenance outage requirement calculation described above for Unlimited Resources).

[38] October 13 Filing, Attachment E, Affidavit of Dr. Patricio Rocha-Garrido ¶ 27.

[39] In the case that the resource belongs to an ELCC Class that has no or very few existing units, PJM will use units with similar operational characteristics in a similar duration ELCC class to derive the EFORd. If no similar duration ELCC class is identified, PJM may rely upon external sources to derive an EFORd for the resource.

b. Made a major change to plant design affecting their ELCC Class (for instance adding dual-fuel capability) after June 1, 2012; or

Answer:

If for a portion of the historical time period starting on June 1, 2012, the resource belonged to a different ELCC Class, the performance data for that portion of the historical record will not be used. In other words, only the historical data that is representative of the current ELCC Class the resource belongs to will be utilized. The putative output for the hours with missing data will be derived as described in the previous answer for Unlimited Resources.

c. Made other resource improvements that affect performance (e.g., fuel contract changes, weatherization, etc.) after June 1, 2012.

Answer:

If a resource makes an improvement that does not trigger a change in ELCC Class, no adjustments to the historical performance data prior to the resource improvement date will be performed. In other words, the improvements would impact historical data *after* the resource makes any such improvement, while all historical data available for that resource would continue to be used.

6. PJM's proposed RAA, Schedule 9.2, section I states that:

> The output of Combination Resources shall be capped in any hour at: (i) the Combination Resource's Capacity Interconnection Rights during the months of June through October and the following May of the Delivery Year, and (ii) the Combination Resource's assessed deliverability, as defined in the PJM Manuals, during the months of November through April of the Delivery Year.[40]
>
> PJM's proposed RAA, Schedule 9.2, section H states that:
>
> Variable Resource actual output shall be adjusted in the ELCC analysis to reflect historical curtailments, and output shall be capped in any hour at: (i) the greater of the Variable Resource's Capacity Interconnection Rights, or the transitional system capability as limited by the transitional resource MW ceiling as defined in the PJM Manuals, awarded for the applicable Delivery Year, during the months of June through October and the following May of the Delivery Year, and (ii) the Variable Resource's assessed deliverability, as defined in the PJM Manuals, during the months of November through April of the Delivery Year.[41]

a. Please support the use of different caps for the modeled outputs of a Combination Resource and a Variable Resource during the months of May through October.

Answer:

PJM is not proposing to change the current output cap for Combination Resources or Variable Resources that was previously approved by the Commission.[42] To that end, the output of Combination Resources and Variable Resources will be capped in any hour at the greater of the Variable Resource's CIRs or the transitional system capability (as limited by the transitional resource MW ceiling) during the months of May through October.

In drafting the proposed RAA, Schedule 9.2 language as part of this filing, the transitional system capability concept was inadvertently omitted from the description of the capping for Combination Resources in RAA, Schedule 9.2, section I. To correct this omission, the Commission should direct PJM on compliance to add the transitional system

[40] Proposed RAA, Schedule 9.2, § I.

[41] *Id.* at Schedule 9.2, § H.

[42] *PJM Interconnection, L.L.C.*, 183 FERC ¶ 61,009 (2023).

capability concept back to the cap on modeled outputs of a Combination Resource in RAA, Schedule 9.2, section I.

7. The Affidavit of Dr. Patricio Rocha-Garrido (Garrido Affidavit) provides indicative 2024/2025 ELCC Class Ratings for several ELCC Classes and ELCC Resources that PJM will model on a resource-specific basis.[43] However, the affidavit does not provide separate indicative ELCC Class Ratings for PJM's proposed Gas Combined Cycle Dual Fuel Class and Gas Combustion Turbine Dual Fuel Class.

    a. Please provide indicative 2024/2025 ELCC Class Ratings for the Gas Combined Cycle Dual Fuel Class and the Gas Combustion Turbine Dual Fuel Class. Please also clarify whether the indicative ELCC Class Ratings provided in your filing for the "Gas CC" and "Gas CT" classes reflect the ELCC Class Rating of only gas resources without dual-fuel capability or a blended ELCC Class Rating of both dual-fuel and gas-only resources.

Answer:

In response to this request, PJM is providing preliminary ELCC Class Ratings for 2025/2026 as opposed to 2024/2025[44]. The 2025/2026 values will be more reflective of the class ratings that, subject to approval of the filing, will be used for the 2025/2026 BRA. PJM recently published these values to provide stakeholders additional transparency into the impact of these proposed changes. To be clear, the values provided below represent *preliminary* values that are subject to change based on factors including the inclusion of additional historic outage and output information in future updates and which resource owners attest to having dual fuel capability.

[43] Garrido Aff. ¶ 48.

[44] These preliminary 2025/26 BRA ELCC Class Ratings reflect updated assumptions/inputs, as well as changes to the methodology consistent with what was filed with the Commission relative to the preliminary values that were estimated during the stakeholder process and referenced in the Garrido affidavit.

ELCC Class	Preliminary 2025/26 BRA Class Rating	Status Quo 2025/2026 BRA Class Rating
Onshore Wind	21%	10%
Offshore Wind	39%	21%
Fixed-Tilt Solar	15%	30%
Tracking Solar	25%	50%
Intermittent Landfill Gas	56%	61%
Intermittent Hydropower	41%	34%
4-hr Storage	76%	80%
6-hr Storage	85%	96%
8-hr Storage	89%	100%
10-hr Storage	92%	100%
Solar 4-hr Storage Hybrid Closed Loop *^	44%	70%
Solar 4-hr Storage Hybrid Open Loop *^	44%	70%
Hydro with Non-Pumped Storage^	94%	94%
Demand Resource (“DR”)	95%	109%
Nuclear	96%	99%
Coal	86%	87%
Gas Combined Cycle **	87%	96%
Gas Combined Cycle Dual Fuel **	88%	96%
Gas Combustion Turbine **	74%	90%
Gas Combustion Turbine Dual Fuel **	90%	90%
Diesel Utility	91%	91%
Steam	78%	87%

* For the two hybrid classes, solar nameplate is assumed to be 100% of the hybrid’s Maximum Facility Output (“MFO”) and the ICAP of the 4-hr storage component is assumed to be 25% of the hybrid’s MFO

^ The values for these classes are only illustrative as the units in these classes receive unit-specific accredited UCAP values

** Preliminary values provided for non-dual fuel and dual fuel Gas Combined Cycle and Gas Combustion Turbine classes may change based on the dual fuel attestations provided by generation owners.

In the table, Gas Combined Cycle and Gas Combustion Turbine refer to natural gas-fired, single fuel resources.

In the Rocha-Garrido affidavit, Gas Combined Cycle and Gas Combustion Turbine values correspond to a blended ELCC Class Rating of both dual-fuel and single fuel resources natural gas-fired resources.

b. For each ELCC Class identified in the Garrido Affidavit, and for the Gas Combined Cycle Dual Fuel Class and Gas Combustion Turbine Dual Fuel Class, please provide the equivalent accreditation factors that apply under PJM's current tariff (e.g., (1 minus class-average Equivalent Demand Forced Outage Rate (EFORd)), ELCC Class Rating, etc.).

Answer:

Please see table above, column Status Quo 2025/2026 BRA Class Rating. The large decreases (i.e. more than ten percentage points) are for classes whose correlated unavailability consistently coincides with periods of loss of load risk in the model. Specifically, the solar classes, the storage classes, the solar-storage hybrid classes, and some of the gas classes experience unavailability during high-risk winter period (and roughly, 50% of the Portfolio expected unserved energy ("EUE") in the proposed model is in the winter period). In the case of the storage classes, the unavailability is caused by winter events that are longer than those in summer due to flatter load shapes and also, in some cases, due to multi-day risk events, which do not allow for the recharging of the storage. This correlated unavailability-driven winter risk is currently not properly reflected in the accreditation of solar or storage (which is based on an average ELCC approach that mostly shows the loss of load risk in summer) nor in the EFORd used to accredit gas resources.

The large increases for onshore and offshore wind are driven by the previously noted greater winter risk in the proposed model. Wind output is higher during peak risk periods in winter compared to those in summer (and, as noted earlier, the current ELCC model shows most of the risk in the summer season).

Lastly, the Demand Resource ("DR") class shows a significant drop in its accreditation level because of two reasons: (i) the DR accreditation level is a function of the Forecast Pool Requirement ("FPR") (currently the FPR is about 109%) and the FPR under the proposed accreditation and risk modeling reforms will decrease as illustrated in the Rocha-Garrido affidavit to values around 100%; and (ii) the current DR performance window in the winter period does not cover hours that show loss of load risk in the model.

8. PJM's proposed RAA, Schedule 9.2, section H describes the resource mix considered in the marginal ELCC analysis as follows:

> The quantity of deployed resources studied in the analysis shall be based on resource deployment forecasts and, where applicable, on available information based on Sell Offers submitted in RPM Auctions or Fixed Resource Requirement plans for the applicable Delivery Year, and, where applicable, information provided to the Office of the Interconnection regarding intent to offer in an RPM Auction, pursuant to the requirements in the Tariff, Attachment DD, section 5.5.
>
> The model inputs, including the set of ELCC Resources that are expected to offer in a given RPM Auction, or otherwise provide capacity, in the Delivery Year, shall be scaled to meet the annual reliability criteria of the Office of the Interconnection. The resulting expected unserved energy constitutes the Portfolio [Expected Unserved Energy (EUE)] for the Delivery Year.[45]

PJM explains that the Portfolio EUE forms the baseline for determining marginal ELCC Class Ratings.[46]

a. While PJM's proposed RAA language states that "the set of *ELCC Resources* . . . shall be scaled to meet the annual reliability criteria," the Garrido Affidavit states that "PJM is proposing to iteratively adjust the *load scenarios* until the [Loss of Load Expectation (LOLE)] criterion of 0.1 days per year is achieved" to determine the Solved Load and corresponding Portfolio EUE.[47] Please clarify whether PJM will scale the resource mix, the load, or both to determine the Portfolio EUE corresponding to the LOLE criterion of 0.1 days per year.

Answer:

PJM will scale the load so that it is adjusted relative to supply to reach the Loss of Load Expectation ("LOLE") criterion of 0.1 days per year. This approach is correctly described in Dr. Garrido's affidavit. PJM acknowledges that the proposed RAA language

[45] Proposed RAA, Schedule 9.2, § H.

[46] Transmittal at 48-49.

[47] Garrido Aff. ¶ 34 (emphasis added).

in this respect should be clarified and is including an updated Tariff sheet that reflects the intended language, as shown below:[48]

> The model inputs, specifically the load scenarios~~including the set of ELCC Resources that are expected to offer in a given RPM Auction, or otherwise provide capacity, in the Delivery Year~~, shall be scaled to meet the annual reliability criteria of the Office of the Interconnection.

[48] The blacklines show the only difference from the October 13 Filing and the updated tariff record for RAA, Schedule 9.2 that is included in this response. To the extent deemed necessary, PJM requests a waiver of the Commission's 60-days' notice requirement to allow for the proposed revisions in this docket to become effective on December 12, 2023 (i.e., 11 days after the date of this filing). The Commission may allow changes to take effect without requiring the sixty days' notice for good cause. *Consol. Edison Co. of N.Y., Inc. v. FERC*, 347 F.3d 964, 969 (D.C. Cir. 2003) (quoting 16 U.S.C. § 824d(d)). Here, good cause exists for the Commission to allow for the proposed changes to become effective December 12, 2023 given that this clarification is consistent with the original intent of PJM's October 13 Filing. Additionally, the December 12, 2023 deadline to submit a binding notice of intent to offer for the 2025/2026 Base Residual Auction (which is part of this proposal in Docket No. ER24-99-000) is necessary to allow adequate time to model such Planned Generation Capacity Resources in the ELCC model and reserve requirement study. PJM must run this analysis and post the results in advance of the Base Residual Auction, and therefore, PJM must start the analysis by the end of each calendar year.

b. Please explain how differences between the resource mix and load *assumed* for the Portfolio EUE calculation, and the *actual cleared* resource mix and forecasted load affect: (1) resources' ELCC Class Ratings, and (2) PJM's compliance with the LOLE criterion of 0.1 days per year.

Answer:

To clarify, the load forecast is the same when determining the Portfolio EUE calculation for a given auction (e.g. BRA) and when clearing such auction. Therefore, load forecast changes do not impact ELCC Class Ratings or LOLE. On the other hand, the assumed resource mix when determining the Portfolio EUE calculation for a given auction can be different from the actual cleared resource mix in such auction. The rest of the response tackles the impact of this difference in resource mix.

A resource adequacy study performed in advance of a future delivery year (such as the studies PJM performs to calculate parameters for an auction three years ahead) requires the development of a number of potential scenarios for load and resource performance and the estimation of an associated probability for each of those scenarios. PJM uses the best information on inputs available at the time of performing studies (e.g, most recent load forecast, a resource mix forecast developed with external information as well as internal information including the proposed notices of intent). The model uses these inputs to estimate loss of load risk patterns, and based on these risk patterns, the accreditation that resources receive and the total amount of UCAP targeted to be procured in RPM. Deviations between the resource mix used as input assumption and the resource mix that clears the auction can impact the loss of load risk patterns, and therefore the model outputs. The larger the deviation, the more likely it is that there are differences between the estimated Accredited UCAP values and the actual Accredited UCAP values implied by the cleared resource mix. In an effort to reduce such differences, PJM has proposed as part of this docket to require a Notice of Intent for planning resources so that at the time of running the ELCC/Reserve Requirement Study ("RRS") model PJM knows the resources that will be offering in the auction and therefore, have a chance of clearing in the auction.

To illustrate the potential differences in ELCC Class Ratings due to differences in assumed resource mix and actual cleared resource mix, PJM performed a sensitivity analysis that consisted of reducing the Solar Tracking class deployment level by 2,000 MW nameplate and the 4-hour Storage class deployment level by 300 MW of installed capacity relative to the deployment levels used in the calculation of the Preliminary ELCC Class Ratings for 2025/26. (These decreases in deployment levels were chosen arbitrarily to illustrate an important difference relative to the deployment levels used in the calculation of the Preliminary ELCC Class Ratings). The results are presented in the table below. The Preliminary ELCC Class Ratings for 2025/26 are in the second column from left to right while the Class Ratings resulting from the sensitivity run are in the third column. While there are differences in ELCC class ratings, especially for the Solar Tracking class and the Hybrid classes that include a Solar Tracking component, the differences are all 3% or less and, in most cases, 2% or less (see Difference column in table below). Moreover, any

annual or seasonal accreditation approach that relies on an assumed resource mix and expected loss of load risk patterns is susceptible to these differences in accreditation results. In the specific case of the sensitivity run, the Class Rating differences are driven by loss of load risk being shifted from the winter season to the summer season as the deployment levels of solar in the sensitivity run are lower. Directionally, classes that are negatively impacted by more risk in the winter see an increase in their rating (e.g., solar, storage, solar-storage hybrids, DR, gas) while those that are positively impacted by more risk in the winter see a decrease in their ratings (e.g, onshore wind, offshore wind).

ELCC Class	Preliminary 2025/26 BRA Class Rating	2025/26 BRA Class Rating - Sensitivity	Difference
Onshore Wind	21%	20%	-1%
Offshore Wind	39%	37%	-2%
Fixed-Tilt Solar	15%	17%	2%
Tracking Solar	25%	28%	3%
Landfill	56%	57%	1%
Hydro Intermittent	41%	40%	-1%
4-hr Storage	76%	78%	2%
6-hr Storage	85%	87%	2%
8-hr Storage	89%	91%	2%
10-hr Storage	92%	94%	2%
Solar 4-hr Storage Hybrid Closed Loop *^	44%	47%	3%
Solar 4-hr Storage Hybrid Open Loop *^	44%	47%	3%
Hydro NPS^	94%	95%	1%
DR	95%	97%	2%
Nuclear	96%	96%	0%
Coal	86%	87%	1%
Gas Combined Cycle **	87%	88%	1%
Gas Combined Cycle Dual Fuel **	88%	89%	1%
Gas Combustion Turbine **	74%	76%	2%
Gas Combustion Turbine Dual Fuel **	90%	90%	0%
Diesel Utility	91%	91%	0%
Steam	78%	79%	1%

Regarding "compliance with the LOLE criterion of 0.1 days per year" due to differences in assumed resource mix and actual cleared resource mix, note that the LOLE criterion of 0.1 days per year is used to simply establish a target amount of UCAP for each

RPM auction. Therefore, there are no issues regarding compliance with a requirement. However, if the question refers to differences in implied reliability levels arising from the differences in accreditation discussed above, there can be some differences. Take for example the case where the assumed resource mix for 2025/26 produces the Preliminary 2025/26 BRA Class Ratings in the table above but what actually clears in the auction is the resource mix that produces the values in column 2025/26 BRA Class Rating – Sensitivity in the table above. The table below summarizes that scenario:

	With Assumed Resource Mix	**With Cleared Resource Mix**
Total Accredited UCAP	169,542 MW	170,588 MW
FPR	1.01595	1.02287
Reliability Requirement (assuming forecasted peak load of 167,701 MW)	170,274 MW	171,434 MW
Share of Reliability Requirement Satisfied with Total UCAP	99.57%	99.51%
Missing UCAP to meet Reliability Requirement	732 MW	847 MW

Using the ELCC Class Ratings derived with the assumed resource mix to accredit the resources in the cleared resource mix results in a Total Accredited UCAP of cleared resources of 169,542 MW. Using the ELCC Class Ratings derived with the cleared resource mix produces a slightly higher Total Accredited UCAP value of 170,588 MW. Because the ELCC Class Ratings derived with the cleared resource mix tend to be a bit higher than those derived with the assumed resource mix, the FPR and Reliability Requirement values are also slightly higher (the FPR values were derived using a Capacity Benefit of Ties equal to zero in both cases for illustrative purposes). From the penultimate row of the table, it can be observed that the difference created by using the parameters derived with the assumed resource mix instead of those derived with the cleared resource mix is small. Under the assumed resource mix parameters, PJM would conclude that with the cleared resource mix 99.57% of the Reliability Requirement is satisfied while under the cleared resource mix parameters the conclusion is that 99.51% of the Reliability Requirement is being satisfied. In terms of missing MW of UCAP to meet the Reliability Requirement, PJM would conclude that 732 MW are missing if using the assumed resource mix parameters while in reality the value is 115 MW higher (i.e., 847 MW). The difference therefore in the example above corresponds to 115 MW or 0.06% of the reliability requirement which is minor and has a rather negligible impact on LOLE. In fact, understating the procured capacity by approximately 115 MW UCAP around 1-day-in-10 year reserve levels increases LOLE by roughly 0.003 days/year.

Lastly, in addition to the three-year ahead Base Residual Auction, PJM conducts Incremental Auctions ("IAs") in the intervening years and re-accredits resources in updated versions of the annual ELCC/RRS analysis that include the cleared resource set from prior auctions as part of the assumed resource set. Therefore, the differences in the Accredited UCAP and risk patterns that originate from differences between the assumed resource set

used in the initial ELCC/RSS runs for the BRA, and the final set of values that are reflective of the actual resources available for the Delivery Year, are minimized to the extent practicable.

D. RESOURCE ADEQUACY RISK MODELING AND FORECAST POOL REQUIREMENT

9. The Garrido Affidavit presents illustrative results of PJM's proposed Reserve Requirement Study/ELCC model for the 2024/2025 Delivery Year. The illustrative analysis found that, with a total installed capacity of 194,017 MW: Solved Load is 164,452 MW, Installed Reserve Margin (IRM) is 17.98%, total Accredited UCAP is 159,971 MW, Forecast Pool Requirement without considering the Capacity Benefit of Ties is 0.9727, and Forecast Pool Requirement considering the Capacity Benefit of Ties is 0.9604.[49] The Garrido Affidavit explains that the Reliability Requirement for the capacity auction is based on the product of the Forecast Pool Requirement and the annual forecasted peak load for a future Delivery Year.[50]

    a. Considering the fact that a Forecast Pool Requirement value less than one corresponds to a Reliability Requirement less than the annual forecasted peak load,[51] please explain to what extent a Forecast Pool Requirement value less than one may result in PJM procuring less capacity than PJM's forecasted peak load.

Answer:

The FPR has traditionally represented the percent of UCAP reserves relative to the forecasted peak load needed to meet the 1-day-in-10 years LOLE criteria. Note that the decision to express the value relative to the forecasted peak load is based simply on practical considerations. Under the current accreditation framework, the FPR usually has had a value of 1.09.

Under a marginal accreditation framework, the accredited UCAP values and therefore the total UCAP needed to meet the 1-day-in-10-years LOLE criteria is representative of the hours of risk in the system considering the balance of both supply and demand. This is not the case under an average ELCC framework as the FPR is by design meant to be representative of demand uncertainty only. Consider, for instance, that in the illustrative results for 2024/2025 included in the Rocha-Garrido affidavit, more than 50% (53%) of the EUE originates in hours that have gross load levels less than the forecasted peak load. This means that an important share of the loss of load risk is driven by supply performance issues (because the load is not necessarily at peak levels in those hours). Therefore, the accreditation that the resources with performance issues during loss of load hours receive will be reflective of their poor performance on those hours, notwithstanding

[49] *Id.* at ¶¶ 49-52.

[50] *Id.* at ¶ 40.

[51] *See* OATT, Definitions – O – P – Q ("'PJM Region Reliability Requirement' shall mean, for purposes of the Base Residual Auction, the Forecast Pool Requirement multiplied by the Preliminary PJM Region Peak Load Forecast, less the sum of all Preliminary Unforced Capacity Obligations of FRR Entities in the PJM Region.").

the fact that these resources perform much better during hours with higher gross loads that are not loss of load risk hours in the model. In other words, while the expected output of resources in the loss of load hours is closer to their Accredited UCAP values, their expected output during hours with high gross loads that are not loss of load risk hours is higher, closer to their installed capacity (ICAP) levels (which explains why these hours are not loss of load hours in the model). As such, the level of committed ICAP that is cleared when meeting the reliability target is sufficient to meet the higher gross loads that do not see resource adequacy risk.

Furthermore, the obligations of committed capacity is to make available to PJM for dispatch the full committed ICAP. The Energy Market rules state that resources still have to offer their ICAP in all hours (or the forecasted hourly output in the case of Variable Resources such as wind and solar) despite the fact that their Accredited UCAP value may be lower. This is why it is not a concern to have an FPR, and therefore a target procurement level of Accredited UCAP, that is less than the forecasted peak load.

Finally, if the EUE were to be concentrated in the peak load hour, the marginal accreditation and the FPR will be reflective of this fact and accordingly, the FPR values would be much closer to the values we see using the current analysis methods where the vast majority of LOLE occurs during peak load conditions. There is nothing in the proposed marginal accreditation framework that artificially lowers the FPR; the FPR is reflective of performance of resources and load levels during hours with high EUE, and those hours may not always be hours with high gross loads.

b. PJM's current OATT, Attachment DD, section 10A defines a resource's Expected Performance during a Performance Assessment Interval based, in part, on the resource's total MW of committed UCAP. Please address how PJM's proposed revisions to resources' Accredited UCAP and the Forecast Pool Requirement affect the total Expected Performance of all capacity resources relative to the forecasted peak load.

Answer:

Conceptually, each resource's Expected Performance is a measure of the amount of each resource's UCAP MW commitment that is needed as actual generation output or demand response load reduction to serve load during a Performance Assessment Interval ("PAI"). Aggregate or total Expected Performance is thus the total amount of UCAP MW actually needed as output or load reduction during a PAI. Neither resource accreditation nor the FPR directly impact this quantity, except as follows.

Each Generation Capacity Resource's Expected Performance is calculated as Resource Committed Capacity, in UCAP, multiplied by the Balancing Ratio, where the Balancing Ratio represents the fraction of total UCAP MW Committed (Generation & Storage) Capacity actually used as output or load reduction during the PAI.[52] This Balancing Ratio is capped at 1.0 in the current OATT, and PJM does not propose to change this. This cap is binding only when resource Actual Performance exceeds UCAP committed capacity levels.

The proposed reforms tend to decrease the FPR, such that total (target) committed capacity in UCAP MW is lower, while also decreasing resources' Accredited UCAP, on average across all resources. The combined effect of these changes is that the balancing ratio will be higher under the proposed reforms than under status quo. When below 1.0, this change in Balancing Ratio does not increase resources' Expected Performance, because it is offset by a decrease in Accredited UCAP MW and committed UCAP MW (for the average resource, as well as on average across the system). However, because the Balancing Ratio tends to be higher, it is more likely to reach the cap of 1.0 under the proposed reforms compared to under status quo. These conditions occur when the aggregate Actual Performance across committed resources exceeds total UCAP committed capacity levels, and would be most likely to occur during high-load conditions.

In other words, the cap on the Balancing Ratio results in the total MW Expected Performance of all capacity resources never exceeding the total UCAP MW Committed Generation and Storage Capacity across the system.

[52] This response is based on the existing Balancing Ratio given that the proposed revisions to the Balancing Ratio was made in Docket No. ER24-98-000 and not this Docket No. ER24-99-000. Regardless, this question is limited to the impact of changes in accredited UCAP and FPR so the rationale described above would remain the same under the Balancing Ratio purposed in Docket No. ER24-98-000.

Note that the "Expected Performance" discussed here is the baseline level against which resource performance is measured for the purpose of the calculation of *financial* Capacity Performance bonuses and penalties. It does not represent the *physical* performance expected of any committed capacity resource, under status quo rules, nor do the proposed revisions intend to change this. As today, the physical level of performance expected of each resource–and, indeed, the obligations to offer into the energy market and otherwise make available MW available to PJM operators–is a function of committed ICAP and resource availability and is entirely independent of UCAP and any quantities whose computation is dependent on UCAP, including the *financial* expected performance discussed here.

10. The Garrido Affidavit explains that the Reserve Requirement Study/ELCC model considers the correlation of Unlimited Resources' forced outages and ambient derates as a function of weather, in addition to planned and maintenance outages scheduled throughout the year.

    a. Please clarify to what extent the Reserve Requirement Study/ELCC analysis consider how an Unlimited Resource's generating capability varies over the year, recognizing that a thermal resource's maximum generating capability generally increases as ambient temperature decreases.

Answer:

One of the principles underlying the ELCC/RRS model is that the modeled hourly output of resources must not be greater than the studied deliverability levels for each resource. In fact, PJM's rules require that all capacity offers submitted into RPM Auctions must be backed by CIRs. This ensures that only deliverable capacity is submitted into RPM Auctions by Generation Capacity Resources.[53] Changes to adhere to this principle were the key component of PJM's CIRs for ELCC filing that the Commission approved earlier this year. The focus of that filing was Variable Resources, Limited Duration Resources and Combination Resources.

In the case of Unlimited Resources, the principles and rules related to deliverable capacity mentioned above also apply. For Unlimited Resources, the studied generation deliverability in summer and winter correspond to the CIR level held by a resource. Consequently, generation capability levels, such as those resulting from ambient temperature decreases, that are above the CIRs of a resource, have not been studied for deliverability, and as such, cannot be included in PJM's ELCC/RRS model.

[53] *PJM Interconnection, L.L.C.*, Capacity Interconnection Rights and the Accreditation of Generation Capacity Resources within PJM's Effective Load Carrying Capability ("ELCC") Construct, Docket No. ER23-1067-000, at 8-17 (Feb. 8, 2023).

E. CAPACITY PERFORMANCE STOP LOSS

11. PJM proposes to revise the Non-Performance Charge Limit specified in OATT, Attachment DD, § 10A to be indexed to the Base Residual Auction (BRA) clearing price rather than to the Net Cost of New Entry (Net CONE).[54]

    a. Considering the fact that under PJM's proposal the BRA clearing price would not be known until after the auction completes, please explain how PJM will evaluate sellers' requests for a Capacity Performance Quantifiable Risk (CPQR) component in their unit-specific Market Seller Offer Caps, if applicable.

Answer:

PJM's assessment of Capacity Market Seller's requested Capacity Performance Quantifiable Risk ("CPQR") component in their unit-specific offer cap would be very similar to the process today. As today, Capacity Market Sellers must provide documentation in support of the various parameters, assumptions, and estimates used to develop their requested CPQR, and PJM must evaluate the request in light of the documentation provided. PJM does not anticipate that an unknown stop loss would materially affect a Capacity Market Seller or PJM's ability to conduct this assessment.

More particularly, Capacity Market Sellers today already face many costs and uncertainties that are not resolved at the time of their offer and may not be fully resolved until the Delivery Year itself. Such unknowns include actual Delivery Year net energy and ancillary services("E&AS") market revenue (which itself depends on actual operations, fuel costs, and E&AS market prices); costs of any investments and fixed operation and maintenance costs that are required to remain operational; and Capacity Performance-related potential bonus or penalty payments, themselves dependent on other unknowns including the number of PAIs, resources performance during PAIs, the Balancing Ratio, and other unknowns. In other words, as in any forward market, the actual costs of satisfying the forward commitment depend on conditions at and around the time the commitment must be satisfied that are as of yet unknown when the forward offer is made. Assumptions are inherent in a forward market.

The specific stop-loss level is but one variable among many that Capacity Market Sellers must estimate when developing a cost-reflective competitive offer, and one variable among many that PJM must consider in its assessment of market sellers' requested unit-specific offer cap level.

Indeed, in the context of the other unknowns that must be estimated in the process of constructing an offer, the exact stop loss should be expected to have substantially less of an impact on resources' competitive offer level than many of these other variables. Uncertainty over the level of the stop loss only rarely affects Capacity Market Sellers' cost

[54] Transmittal at 92-97; Proposed OATT, Att. DD, § 10A(f-1).

of risk because it would require a number of PAIs well above the expected amount for any given Delivery Year and a resource would have to perform sufficiently poorly before the stop-loss is ever reached. In other words, reaching the stop-loss is itself a tail-probability event, and thus the impacts of uncertainties in the stop-loss level must be discounted.

Further, certain of these other unknowns also vary directly as a result of capacity auction outcomes. For example, the probability of experiencing PAIs and the number of PAIs change depending on whether the capacity auction clears a high reserve margin compared to a low one. Thus, a stop loss that is calculated as a function of the auction clearing price does not materially impact either marker participants' nor PJM's current need to assess and evaluate the dependence of a competitive offer on potential and uncertain market clearing outcomes.

F. OTHER ISSUES

12. PJM's proposed revisions to OATT, Attachment DD, section 5.5 describe PJM's proposed binding notice of intent to offer as follows:

> Effective with the 2025/2026 Delivery Year and subsequent Delivery Years, a Planned Generation Capacity Resource may be included in a Sell Offer for an RPM Auction only if the Capacity Market Seller of such resource provides a binding notice of intent, as further detailed in the PJM Manuals, to submit a Sell Offer in such auction to the Office of the Interconnection no later than (a) the immediately preceding December 1 for a Base Residual Auction (except that for the 2026/2027 and 2028/2029 Delivery Years, such notice shall be submitted by 180 days prior to the commencement of the offer period), or (b) ninety (90) days prior to the commencement of the offer period for an Incremental Auction.[55]

a. Please clarify how PJM would apply the binding notice of intent to a Capacity Market Seller that only intends to offer a portion of its resource into the corresponding capacity auction.

b. Please clarify to what extent a Capacity Market Seller would be required to specify the quantity of capacity it intends to offer into the corresponding capacity auction, and whether this quantity would have to be specified in terms of installed capacity, Effective Nameplate Capacity, Accredited UCAP, or some other measure.

c. Please clarify whether a Capacity Market Seller would have its preliminary ELCC Class Rating and resource-specific performance adjustment prior to submitting a binding notice of intent to offer. If so, please describe the information provided to the Capacity Market Seller.

d. Please clarify how the binding notice of intent would apply to a Capacity Market Seller that learns its resource will not be available due to factors beyond its control during the corresponding Delivery Year after it submits a binding notice of intent.

Answer:

PJM is cognizant of the concern that Capacity Market Sellers would not know how many megawatts a resource will be able to offer since the notice of intent to offer will be

[55] Proposed OATT, Att. DD, § 5.5

used to inform the final ELCC values.[56] To that end, PJM clarifies that, for implementation purposes, a notice of intent to offer would not need to specify the number of megawatts that will be offered into a specific RPM Auction for a resource that is subject to such notice of intent. As a result, a Capacity Market Seller for a resource that is the subject of a notice of intent will be deemed to have satisfied its offer requirement as long as any MW quantity for the resource is offered into the relevant RPM Auction. Likewise, a Capacity Market Seller of a Planned Generation Capacity Resource does not need to specify the number of megawatts that will be offered into a particular RPM Auction.[57] This is appropriate given that Capacity Market Sellers will not know the final ELCC values until after the notices of intent to offer are submitted (which are used in calculating the final ELCC values). Additionally, it allows Capacity Market Sellers to reduce the potential of non-performance, particularly for Intermittent Resources, by limiting the number of megawatts to be offered as capacity. Finally, because offering even a portion of the total available megawatts into the auction suggests that the resource will likely be in-service by the Delivery Year, it is appropriate that it is modeled in the Reliability Requirement study as in-service regardless of how many megawatts are offered. This is because, as the Commission previously explained, "these resources are likely to be producing energy in the Delivery Year and should therefore be included in the LDA Reliability Requirement as internal capacity that may be available during a local capacity emergency."[58]

A binding notice of intent would continue to apply to a Capacity Market Seller that learns its resource will not be available even due to factors beyond its control during the corresponding Delivery Year after it submits a binding notice of intent. Under this scenario, the binding notice of intent to offer cannot be retracted given the binding nature of such a notice. Should the Capacity Market Seller of such resource decide not to offer the resource into the relevant RPM Auction, that resource would not be allowed to participate in any remaining RPM Auction associated with that Delivery Year. This is appropriate to discourage resource owners from speculating that a resource will be available to service as capacity and provide a notice of intent to offer when the development of the resource is still in the infancy stages. Moreover, depending on how far along a resource is in the development phase, a Capacity Market Seller could still offer a resource that may be delayed into the Base Residual Auction and should the delay persist, the IAs exist to allow Capacity Market Sellers to buy out of their commitment before the Delivery

[56] Notwithstanding, PJM has posted preliminary ELCC class ratings for the 2025/2026 Delivery Year to provide Market Participants with an indication of the preliminary ratings. *See Preliminary ELCC Class Ratings for the 25/26 BRA reflecting the proposed capacity market reforms filed by PJM in FERC Docket No. ER24-99*, PJM Interconnection, L.L.C. (Nov. 15, 2023), https://www.pjm.com/-/media/planning/res-adeq/elcc/preliminary-elcc-class-ratings-for-the-2025-26-bra-ferc-docket-no-er24-99.ashx.

[57] This granular implementation detail appropriately belongs in the PJM Manuals and is not required to be specified in the Tariff. *See Am. Elec. Power Serv. Corp. v. Sw. Power Pool, Inc.*, 184 FERC ¶ 61,207, at P 26 (2023) ("[I]tems better classified as implementation details need not be included in a tariff and may be included in the business practices manual."). Additionally, PJM's proposed Tariff language does not need to be amended to reflect this implementation detail given that it is simply worded to require a resource that is subject to a notice of intent to offer to offer into the relevant RPM Auction and does not specify the quantity of megawatts that must be offered to meet this requirement.

[58] *PJM Interconnection, L.L.C.*, 184 FERC ¶ 61,055, at P 115 (2023).

Year and adjust for such delays. If a resource that is the subject of a notice of intent to offer is so far away from meeting any of the milestones to even be eligible to be offered as a Planned Generation Capacity Resource, then it appropriately should not be allowed to offer into any of the RPM Auctions associated with that Delivery Year given where it is in the development stage.

PJM reiterates that any Planned Generation Capacity Resource, including planned Intermittent Resources, Capacity Storage Resources, and Hybrid Resources, will be required to provide a notice of intent to offer in order to participate in the RPM Auction. Additionally, any Planned Generation Capacity Resource, including planned Intermittent Resources, Capacity Storage Resources, and Hybrid Resources, that is subject to the notice of intent would be required to be offered into the relevant RPM Auction.[59] To be clear, nothing about this proposal should be construed to revise the must offer requirement for Existing Generation Capacity Resources (and associated exception for existing Intermittent Resources, Capacity Storage Resources, and Hybrid Resources to be offered into the RPM Auctions). The proposed notice of intent to offer, and the obligations that follow, apply only to Planned Generation Capacity Resources. Thus, PJM clarifies that it is only the consequence of an Existing Generation Capacity Resource that does not offer into the RPM Auctions that is similar to a resource that is the subject of a notice of intent but does not offer into the relevant RPM Auction (i.e., a resource is precluded from being offered into any other RPM Auction associated with the same Delivery Year).[60]

Any Planned Generation Capacity Resource that does not provide notice of intent to offer for a Base Residual Auction would not be allowed to be offered into that auction.[61] However, a notice of intent to offer such resource into the Incremental Auction that is associated with the same Delivery Year would still be allowed so that the resource could still be offered as capacity in a subsequent RPM Auction for the same Delivery Year (so long as such notice is submitted at least 90 days prior to the relevant Incremental Auction).[62] The same rights and obligations apply to a resource that is the subject of a notice of intent to offer that is submitted prior to the IAs. That is, the Planned Generation Capacity Resource would be allowed to be offered in such IAs (and subsequent auctions) and such resource would be required to be offered into the IA that corresponds with the auction specified in the notice of intent to offer.[63]

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[59] Proposed Tariff, Attachment DD, sections 6.6(a) & 6.6A(a).

[60] Proposed Tariff, Attachment DD, section 6.6(h).

[61] Proposed Tariff, Attachment DD, section 5.5.

[62] *Id.*

[63] *Id.*; *see* proposed Tariff, Attachment DD, sections 6.6(a) & 6.6A(a).

13. PJM proposes to revise OATT, Attachment M – Appendix to make certain provisions, regarding the Market Monitoring Unit's review of a resource's EFORd for purposes of administering the capacity market must-offer requirement, only applicable through the 2024/2025 Delivery Year.[64] However, in its transmittal letter, PJM does not explicitly explain these proposed revisions.[65]

    a. Please support the proposed revisions.

Answer:

The proposed revision to make certain provisions, regarding the Market Monitor's review of a resource's EFORd for purposes of administering the capacity market must-offer requirement, only applicable through the 2024/2025 Delivery Year, is intended to be a conforming change given that Capacity Market Sellers of Generation Capacity Resources will no longer provide an EFORd with the submission of their sell offer in RPM auctions under the proposal. This change is provided in the proposed revisions to Tariff, Attachment DD, section 5.6.1, which revise the requirement for an EFORd to be specified in the sell offer of a generation capacity resource to only be applicable through the 2024/2025 Delivery Year.

As proposed, effective with the 2025/2026 Delivery Year, Sell Offers for Generation Capacity Resources will instead be converted to UCAP based on the most recent Accredited UCAP Factor established by PJM in accordance with RAA, Schedule 9.2 ahead of the applicable RPM Auction. The existing Tariff provisions in Tariff, Attachment DD, section 5.6.6 that specify the requirement for PJM to determine the "quantity of megawatts of available installed capacity that each Capacity Market Seller must offer in any RPM Auction" have no proposed revisions. As such, Generation Capacity Resources with a must offer requirement in the RPM Auctions shall continue to have an obligation to offer their available ICAP in each RPM Auction, which will be converted to an equivalent megawatt amount of UCAP based on such resource's Accredited UCAP Factor as noted above. Therefore, the current rules regarding the review of a resource's sell offer EFORd that were in place to prevent a resource from withholding capacity by specifying an unreasonably high or uncompetitive EFORd are no longer applicable or necessary. As such, the Market Monitor's role in reviewing an alternative EFORd that is proposed by a market seller is no longer applicable or necessary.

[64] Proposed OATT, Att. M, §§ II.C.3, II.C.5.

[65] Transmittal at 35, n.60.

14. PJM proposes to revise RAA, Schedule 6, section K and the parallel OATT, Attachment DD-1, section K to state that, for Demand Resources, "[c]ompliance is measured for Market Participant Bonus Performance, as applicable prior to the 2025/2026 Delivery Year, and Non-Performance Charges." PJM does not discuss this proposed revision in its transmittal letter.

    a. Please support the proposed revision.

Answer:

This proposed revision is a conforming change associated with the proposed update to bonus eligibility during PAIs and should have been included in Docket No. ER24-98-000. Specifically, this proposed language clarifies that Demand Resources would only be eligible for Bonus Performance prior to the 2025/2026 Delivery Year. This revision was inadvertently included in Docket No. ER24-99-000 rather than Docket No. ER24-98-000. To that end, the Commission should accept the proposed changes as filed and direct PJM to remove the referenced proposed revision in a subsequent compliance filing in the event the Commission rejects PJM's filing in Docket No. ER24-98-000.

III. CORRESPONDENCE AND COMMUNICATIONS

Correspondence and communications regarding this filing should be sent to the following individuals:

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IV. 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,[66] PJM will post a copy of this filing to the Commission 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 e-mail on the same date as this filing to all PJM members and all state utility regulatory commissions in the PJM Region[67] alerting them that this filing has been made by PJM and is available by following such link. PJM also serves the parties listed on the Commission's official service list for this docket. If the document is not immediately available by using the referenced link, the document will be available through the referenced link within 24 hours of the filing. Also, a copy of this filing will be available on the Commission's eLibrary website located at the following link:

[66] *See* 18 C.F.R. §§ 35.2(e) and 385.2010(f)(3).

[67] PJM already maintains, updates, and regularly uses e-mail lists for all PJM members and affected state commissions.

https://elibrary.ferc.gov/eLibrary/search in accordance with the Commission's regulations and Order No. 714. PJM also served this on each person designated on the official service list maintained by the Commission for this proceeding.

V. CONCLUSION

Wherefore, PJM requests that the Commission accept this response to the Commission's deficiency letter.

Respectfully submitted,

_/s/ *Chenchao Lu*_____

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

CERTIFICATE OF SERVICE

I hereby certify that I have this day served the foregoing document upon each person designated on the official service list compiled by the Secretary in this proceeding.

Dated at Washington, D.C., this 1st day of December 2023.

/s/Chenchao Lu
Chenchao Lu

Attachment A

Revisions to the
PJM Reliability Assurance Agreement

(Marked / Redline Format)

SCHEDULE 9.2:

EFFECTIVE LOAD CARRYING CAPABILITY ANALYSIS FOR THE 2025/2026 DELIVERY YEAR AND SUBSEQUENT DELIVERY YEARS

A. Overview of Effective Load Carrying Capability Analysis

The inputs of the effective load carrying capability analysis shall consider similar data and forecasts as that used in development of the FPR, as described in Schedule 4.C, and will include:

-Historical weather and load data;
-Historical output of existing Variable Resources;
-Estimates of putative historical output for planned Variable Resources;
-Forced outage patterns for Unlimited Resources, including consideration of correlated outage risks;
-Resource deployment forecast; and
-Modeling parameters for Limited Duration Resources, Combination Resources, and Demand Resources.

The outputs of the effective load carrying capability analysis include:

-ELCC Class Rating values, in percent.

B. ELCC Classes

(1) (a) The following are the ELCC Classes for Variable Resources:

- Tracking Solar Class
- Fixed-Tilt Solar Class
- Onshore Wind Class
- Offshore Wind Class
- Intermittent Landfill Gas Class
- Intermittent Hydropower Class
- Other Variable Resource Class

(b) The following are the types of ELCC Classes for Limited Duration Resources:

- The type of Capacity Storage Resource Classes
- The type of Other Limited Duration Resource Classes

Within those types, the following are the specific ELCC Classes for Limited Duration Resources:

- Capacity Storage Resource Class (4-Hour Duration)
- Capacity Storage Resource Class (6-Hour Duration)
- Capacity Storage Resource Class (8-Hour Duration)
- Capacity Storage Resource Class (10-Hour Duration)

- Other Limited Duration Class (4-Hour Duration)
- Other Limited Duration Class (6-Hour Duration)
- Other Limited Duration Class (8-Hour Duration)
- Other Limited Duration Class (10-Hour Duration)

(c) The following are the ELCC Classes for Combination Resources:

- The types of Hybrid Resource Classes, as further specified in subpart (2) below
- Hydropower With Non-Pumped Storage Class
- Complex Hybrid Class
- The types of Other Limited Duration Combination Classes, as further specified in subpart (3).

(d) The following are the ELCC Classes for Unlimited Resources

- Nuclear Class
- Coal Class
- Gas Combined Cycle Class
- Gas Combustion Turbine Class
- Gas Combined Cycle Dual Fuel Class
- Gas Combustion Turbine Dual Fuel Class
- Diesel Utility Class
- Steam Class
- Other Unlimited Resource Class

(e) The following are the ELCC Classes for Demand Resources

- Demand Resource Class

(2) PJM shall establish Hybrid Resource Classes for all "open-loop" combinations of each Capacity Storage Resource class and each Variable Resource class, as well as all "closed-loop" combinations of each Capacity Storage Resource class and each Variable Resource class. An "open-loop" resource is physically and contractually capable of charging from the grid, while a "closed-loop" resource is not.

(3) PJM shall establish "Other Limited Duration Combination Classes" for all combinations of each Variable Resource Class and each Other Limited Duration Resource Class, and for combinations of an Unlimited Resource with each Other Limited Duration Resource Class.

(4) For a given Delivery Year, ELCC Class Ratings will not be calculated for any ELCC Class to the extent that no member of the class is expected to provide, or offer to provide capacity, in the applicable Delivery Year. PJM will determine the ELCC Class Ratings for an ELCC Class when any one of the following criteria are met:

(a) An Existing Generation Capacity Resource is in such class; or
(b) A Planned Generation Capacity Resource has submitted timely and valid data through the ELCC data submission process and is in such class; or
(c) The resource deployment forecast contains a resource in such class.

(5) (a) For each ELCC Resource, except an ELCC Resource that is a Capacity Storage Resource or includes a Capacity Storage Resource component, PJM shall determine the ELCC Class of which such resource is a member by matching the physical characteristics of such resource with the definition of the ELCC Class.

(b) For each ELCC Resource that is a Capacity Storage Resource or includes a Capacity Storage Resource component, PJM shall determine, by matching the physical characteristics of such resource with the definition of the ELCC Class, the type of ELCC Class of which such resource is a member; provided however, the Generation Capacity Resource Provider shall choose the specific ELCC Class within the type ELCC Class identified by PJM that corresponds to the chosen characteristic duration.

If the Generation Capacity Resource Provider fails to choose, PJM will choose a specific ELCC Class to assign to such resource. The election of the specific ELCC Class corresponding to the chosen characteristic duration shall be for a term of five consecutive Delivery Years. After such five Delivery Year period, a Generation Capacity Resource Provider may request a change in the ELCC Class, based on choosing a different characteristic duration, by submitting to the Office of the Interconnection a written request to switch ELCC Classes and provide documentation supporting such change. A Generation Capacity Resource Provider must submit such a request, and supporting documentation, by August 1 prior to the calendar year for the RPM Auction in which the ELCC Resource intends to submit a Sell Offer or otherwise commit to provide capacity, except for 2025/2026 Delivery Year such required information must be provided to the Office of the Interconnection in accordance with the PJM Manuals. The Office of the Interconnection shall provide no later than following November 15 written notification to the Generation Capacity Resource Provider of its determination. If the request is granted, the ELCC Resource shall be considered in the new ELCC Class starting with the next Delivery Year for which no RPM Auction has been conducted and for subsequent Delivery Years. If the request is denied, the Office of the Interconnection shall include in the notice a written explanation for the denial.

(6) Mixed-technology resources are composed of components with different generation technologies, at least one of which would be an ELCC Resource, behind a single Point of Interconnection. For a mixed-technology resource composed of components that do not have significant interaction, the components are eligible to participate as separate resources. A mixed-technology resource composed of components that have significant interaction must participate as a single Combination Resource (or, if the components would all be Variable Resources, then as a single Variable Resource).

The Generation Capacity Resource Provider of a mixed-technology resource eligible to participate as either a single ELCC Resource or as multiple stand-alone resources shall elect, for a term of five consecutive Delivery Years, whether PJM is to model it as a single ELCC Resource or as multiple stand-alone resources. After such five Delivery Year period, a Generation Capacity Resource Provider may request a change in such modelling approach by submitting to the Office of the Interconnection a written request to change the modelling approach and provide documentation supporting such change. A Generation Capacity Resource Provider must submit such a request, and supporting documentation, by August 1 prior to the

calendar year for the RPM Auction in which the ELCC Resource(s) intend(s) to submit a Sell Offer or otherwise commit to provide capacity, except for 2025/2026 Delivery Year such required information must be provided to the Office of the Interconnection in accordance with the PJM Manuals. The Office of the Interconnection shall provide no later than following November 15 written notification to the Generation Capacity Resource Provider of its determination. If the request is granted, the ELCC Resource(s) shall be modelled as requested starting with the next Delivery Year for which no RPM Auction has been conducted and for subsequent Delivery Years. If the request is denied, the Office of the Interconnection shall include in the notice a written explanation for the denial.

C. Calculation of ELCC Class Rating

ELCC Class Ratings for a Delivery Year are calculated by adding to the forecasted resource portfolio incremental quantities of resources belonging to the subject ELCC Class, depending on the resource type:

(1) The ELCC Class Rating of Variable Resources, Limited Duration Resources, Unlimited Resources (except Other Unlimited Resources), and Demand Resources shall be the ratio of the expected unserved energy improvement resulting from adding an incremental quantity of the subject ELCC Class to the expected unserved energy improvement resulting from adding an incremental quantity of an Unlimited Resource with no outages, where expected unserved energy improvement is calculated relative to the Portfolio EUE for the Delivery Year.

(2) No ELCC Class Rating is determined for Combination Resources and ELCC Resources in the Hydropower with Non-Pumped Storage Class, in the Complex Hybrid Class, in the Other Unlimited Resource Class, and in any ELCC Class whose members are so distinct from one another that a single ELCC Class Rating would fail to capture their physical characteristics.

D. Calculation of Accredited UCAP and ELCC Resource Performance Adjustment

(1) (a) For Variable Resources and Limited Duration Resources, Accredited UCAP values shall be equal to the lesser of the resource's Capacity Interconnection Right or the product of:

(i) the Effective Nameplate Capacity;
(ii) the applicable ELCC Class Rating; and
(iii) the ELCC Resource Performance Adjustment.

(b) For any resource in an ELCC Class for which no Class Rating has been calculated pursuant to C(2), the Accredited UCAP shall be based on a resource-specific effective load carrying capability analysis based on the resource's unique parameters.

(c) For Unlimited Resources that have an ELCC Class Rating determined pursuant to C(1), Accredited UCAP values shall be equal to the product of:

(i) the installed capacity;
(ii) the applicable ELCC Class Rating; and
(iii) the ELCC Resource Performance Adjustment.

(d) For Demand Resources, Accredited UCAP values shall be equal to the product of:

(i) the Nominated Value of the Demand Resource; and
(ii) the applicable ELCC Class Rating.

(2) The ELCC Resource Performance Adjustment shall be calculated according to the following methods, as further detailed in the PJM Manuals:

(a) For a Variable Resource, a Limited Duration Resource, and an Unlimited Resource: based on a metric consisting of the weighted average expected hourly output of the resource in the ELCC model during hours of loss of load risk where: (i) the weights correspond to the modeled probability of losing load in such hour and (ii) the expected hourly output is based on the resource's modeled output during the same hour on days since June 1st, 2012 identified as having similar weather from an RTO-perspective. For a given resource or component, the Performance Adjustment shall equal the ratio of such metric to the average (weighted by the Effective Nameplate Capacity) of such metrics for all units in the applicable Variable Resource ELCC Class or applicable Unlimited Resource ELCC Class.

In determining the ELCC Resource Performance Adjustment, the actual output of a Variable Resource shall be adjusted to reflect historical curtailments, and output in any hour shall be capped at: (i) the greater of the Variable Resource's Capacity Interconnection Rights, or the transitional system capability as limited by the transitional resource MW ceiling as defined in the PJM Manuals, awarded for the applicable Delivery Year, for hours in the months of June through October and the following May of the Delivery Year, and (ii) the Variable Resource's assessed deliverability, as defined in the PJM Manuals, for hours in the months of November through April of the Delivery Year. The output of an Unlimited Resource in any hour shall be capped at the greater of the resource's Capacity Interconnection Rights, or the transitional system capability as limited by the transitional resource MW ceiling as defined in the PJM Manuals, awarded for the applicable Delivery Year..

E. Calculation of Accredited UCAP Factor

For Generation Capacity Resources, PJM shall determine an Accredited UCAP Factor, which is the ratio of the resource's Accredited UCAP to the resource's installed capacity.

G. Installed Capacity of ELCC Resources

Rules and procedures for technically determining and demonstrating the installed capacity of ELCC Resources shall be developed by the Office of the Interconnection and maintained in the PJM Manuals. The installed capacity of a Limited Duration Resource is based on the sustained level of output that the unit can provide and maintain over a continuous period, whereby the duration of that period matches the characteristic duration of the corresponding ELCC Class, with consideration given to ambient conditions expected to exist at the time of PJM system peak load, as described in the PJM Manuals. The installed capacity of a Combination Resource (other than Hydropower With Non-Pumped Storage) is based on the lesser of the Maximum Facility Output or the sum of the equivalent Effective Nameplate Capacity values of the resource's constituent components considered on a stand-alone basis. The installed capacity of an Unlimited Resource and Variable Resource shall be determined in accordance with the PJM Manuals. The

installed capacity of Demand Resources, for purposes of the ELCC analysis, is based on the forecasted deployment level in the PJM Load Forecast.

H. Details of the Effective Load Carrying Capability Methodology

The effective load carrying capability analysis shall compare expected hourly load levels (based on historical weather) with the expected hourly output of the expected future resource mix in order to identify the relative marginal resource adequacy value of each individual ELCC Class compared to an Unlimited Resource with no outages. In performing this analysis, the model inputs shall be scaled to meet the annual reliability criteria of the Office of the Interconnection. The effective load carrying capability analysis shall compare hourly values for: (i) expected load based on historical weather; (ii) expected Variable Resource output; (iii) expected output of Limited Duration Resources and of Combination Resources as described below; (iv) expected Unlimited Resource output; and (v) expected Demand Resource output. These expected quantities are based on forecasted load and actual and putative values for Variable Resource output (standalone or as a component of Combination Resources) and Unlimited Resource output after June 1, 2012 (inclusive) through the most recent Delivery Year for which complete data exist. For resources that have not existed each year since June 1, 2012, putative output is an estimate of the hourly output that resource would have produced in a historical hour if that resource had existed in that hour. For Variable Resources, this putative output estimate is developed based on historical weather data consistent with the particular site conditions for each such resource in accordance with the PJM Manuals; for Unlimited Resources, the putative output is developed based on actual performance of similar units in accordance with the PJM Manuals.

Variable Resource actual output shall be adjusted in the ELCC analysis to reflect historical curtailments, and output shall be capped in any hour at: (i) the greater of the Variable Resource's Capacity Interconnection Rights, or the transitional system capability as limited by the transitional resource MW ceiling as defined in the PJM Manuals, awarded for the applicable Delivery Year, during the months of June through October and the following May of the Delivery Year, and (ii) the Variable Resource's assessed deliverability, as defined in the PJM Manuals, during the months of November through April of the Delivery Year. The output of Unlimited Resources shall not exceed the greater of the Unlimited Resource's Capacity Interconnection Rights, or the transitional system capability as limited by the transitional resource MW ceiling as defined in the PJM Manuals, awarded for the applicable Delivery Year.

The effective load carrying capability analysis shall simulate performance of Demand Resources, and shall simulate the output of Limited Duration Resources and Combination Resources based on their Office of the Interconnection-validated parameters, including the putative output of the Variable Resource component of Combination Resources, as described above.

The quantity of deployed resources studied in the analysis shall be based on resource deployment forecasts and, where applicable, on available information based on Sell Offers submitted in RPM Auctions or Fixed Resource Requirement plans for the applicable Delivery Year, and, where applicable, information provided to the Office of the Interconnection regarding intent to offer in an RPM Auction, pursuant to the requirements in the Tariff, Attachment DD, section 5.5.

The model inputs, specifically the load scenarios, shall be scaled to meet the annual reliability criteria of the Office of the Interconnection. The resulting expected unserved energy constitutes the Portfolio EUE for the Delivery Year. Energy Resources are not included in the effective load

carrying capability analysis. Generating units that are expected to only offer or otherwise provide a portion of their Accredited UCAP for that Delivery Year are represented in the analysis in proportion to the expected quantity offered or delivered divided by the Accredited UCAP.

I. Methodology to Simulate Output of Certain Resources in the Effective Load Carrying Capability Model

The effective load carrying capability analysis shall simulate the output of Limited Duration Resources and Combination Resources based on their physical parameters, including limited storage capability, and shall simulate the deployment of Demand Resources. The analysis shall simulate output from the subject Limited Duration Resources, Combination Resources, and Demand Resources in hours in which all output from Unlimited Resources and available output from Variable Resources is insufficient to meet load. The analysis shall first simulate the output of Demand Resources. If the simulated output of Demand Resources is insufficient to meet load, then the output of the subject Limited Duration Resources and Combination Resources shall be simulated on an hour-by-hour basis based on their relative duration, starting from longer duration resources to shorter duration resources. The output of Combination Resources shall be capped in any hour at: (i) the Combination Resource's Capacity Interconnection Rights during the months of June through October and the following May of the Delivery Year, and (ii) the Combination Resource's assessed deliverability, as defined in the PJM Manuals, during the months of November through April of the Delivery Year. Energy Storage Resource charging is during hours with sufficient margin, including between daily peaks if necessary.

J. Administration of Effective Load Carrying Capability Analysis

The Office of the Interconnection shall post final ELCC Class Rating values at least once per year in a report that also includes appropriate details regarding methodology and inputs. The Office of the Interconnection shall post this report and shall communicate ELCC Resource Performance Adjustment values to applicable Generation Capacity Resource Providers no later than five months prior to the start of the target Delivery Year, as described in the PJM Manuals. Accredited UCAP values for the applicable Delivery Year shall establish the maximum Unforced Capacity that an ELCC Resource can physically provide or offer to provide in the applicable Delivery Year.

The Office of the Interconnection shall also post preliminary ELCC Class Rating values for nine subsequent Delivery Years. For any Delivery Year for which a final ELCC Class Rating has not been posted and a preliminary ELCC Class Rating has been posted, the Accredited UCAP of an ELCC Resource for such Delivery Year shall be based on the most recent preliminary ELCC Class Rating value for that Delivery Year, together with the most recently calculated ELCC Resource Performance Adjustment value for that ELCC Resource. Except to the extent specified above or otherwise specified, the preliminary ELCC Class Rating values for future years are non-binding and are only for indicative purposes. A Generation Capacity Resource Provider can offer or provide capacity from an ELCC Resource that is not subject to a capacity market must offer obligation (as specified in Tariff, Attachment DD, Section 6.6) at a level less than the Accredited UCAP for such resource.

In order to facilitate the effective load carrying capability analysis, the Generation Capacity Resource Provider of each ELCC Resource must submit to the Office of the Interconnection the required information as specified in the PJM Manuals by no later than August 1 prior to the calendar year for the RPM Auction in which the ELCC Resource intends to submit a Sell Offer or otherwise commit to provide capacity, except for 2025/2026 Delivery Years such required information must be provided to the Office of the Interconnection in accordance with the PJM Manuals. The required information may include relevant physical parameters, relevant historical data such as weather data and actual or estimated historical energy output, and documentation supporting such parameters and historical data. The relevant physical parameters are those that are incorporated into the effective load carrying capability analysis. The parameters required for Hydropower With Non-Pumped Storage shall include Ordinary Water Storage and any applicable Exigent Water Storage. Submitted parameters must indicate the expected duration for which any submitted physical parameters are valid.

The Office of the Interconnection shall evaluate, validate, and approve the foregoing information in accordance with the process set forth in the PJM Manuals. In evaluating the validity of submitted information, the Office of the Interconnection may assess the consistency of such information with observed conditions. If the Office of the Interconnection observes that the information provided by the Generation Capacity Resource Provider of the ELCC Resource is inconsistent with observed conditions, the Office of the Interconnection will coordinate with the Generation Capacity Resource Provider of the ELCC Resource to understand the information and observed conditions before making a determination regarding the validity of the applicable parameters. The Office of the Interconnection may engage the services of a consultant with technical expertise to evaluate the foregoing information.

After the Office of the Interconnection has completed its evaluation of the foregoing information, the Office of the Interconnection shall notify the Generation Capacity Resource Provider in writing whether the submitted information is considered invalid by no later than September 1 following the submission of the information. The Office of the Interconnection's determination on the validity of the foregoing information shall continue for the applicable Delivery Year and, if requested, for such longer period as the Office of the Interconnection may determine is supported by the data.

In the event that the Office of the Interconnection is unable to validate any of the required information, physical parameters, supporting documentation, or other related information submitted by the Generation Capacity Resource Provider of an ELCC Resource, then the Office of the Interconnection shall calculate Accredited UCAP values for that ELCC Resource based only on the validated information. Such ELCC Resource shall not be permitted to offer or otherwise provide capacity above such Accredited UCAP values until the Office of the Interconnection determines new Accredited UCAP values for such resource.

Generation Capacity Resource Providers of ELCC Resources that are hydropower plants with water storage must provide documentation to support the physical parameters provided for expected load carrying capability analysis modeling, as specified in the PJM Manuals. This documentation must: (a) support the plant's physical capabilities; (b) demonstrate that the parameters do not violate any federal, state, river basin, or other applicable authority operating limitations of the plant; and (c) demonstrate full authorization from FERC, any river basin commissions, and any other applicable authorities to meet those capabilities.

Attachment B

Revisions to the
PJM Reliability Assurance Agreement

(Clean Format)

SCHEDULE 9.2:

EFFECTIVE LOAD CARRYING CAPABILITY ANALYSIS FOR THE 2025/2026 DELIVERY YEAR AND SUBSEQUENT DELIVERY YEARS

A. Overview of Effective Load Carrying Capability Analysis

The inputs of the effective load carrying capability analysis shall consider similar data and forecasts as that used in development of the FPR, as described in Schedule 4.C, and will include:

-Historical weather and load data;
-Historical output of existing Variable Resources;
-Estimates of putative historical output for planned Variable Resources;
-Forced outage patterns for Unlimited Resources, including consideration of correlated outage risks;
-Resource deployment forecast; and
-Modeling parameters for Limited Duration Resources, Combination Resources, and Demand Resources.

The outputs of the effective load carrying capability analysis include:

-ELCC Class Rating values, in percent.

B. ELCC Classes

(1) (a) The following are the ELCC Classes for Variable Resources:

- Tracking Solar Class
- Fixed-Tilt Solar Class
- Onshore Wind Class
- Offshore Wind Class
- Intermittent Landfill Gas Class
- Intermittent Hydropower Class
- Other Variable Resource Class

(b) The following are the types of ELCC Classes for Limited Duration Resources:

- The type of Capacity Storage Resource Classes
- The type of Other Limited Duration Resource Classes

Within those types, the following are the specific ELCC Classes for Limited Duration Resources:

- Capacity Storage Resource Class (4-Hour Duration)
- Capacity Storage Resource Class (6-Hour Duration)
- Capacity Storage Resource Class (8-Hour Duration)
- Capacity Storage Resource Class (10-Hour Duration)

- Other Limited Duration Class (4-Hour Duration)
- Other Limited Duration Class (6-Hour Duration)
- Other Limited Duration Class (8-Hour Duration)
- Other Limited Duration Class (10-Hour Duration)

(c) The following are the ELCC Classes for Combination Resources:

- The types of Hybrid Resource Classes, as further specified in subpart (2) below
- Hydropower With Non-Pumped Storage Class
- Complex Hybrid Class
- The types of Other Limited Duration Combination Classes, as further specified in subpart (3).

(d) The following are the ELCC Classes for Unlimited Resources

- Nuclear Class
- Coal Class
- Gas Combined Cycle Class
- Gas Combustion Turbine Class
- Gas Combined Cycle Dual Fuel Class
- Gas Combustion Turbine Dual Fuel Class
- Diesel Utility Class
- Steam Class
- Other Unlimited Resource Class

(e) The following are the ELCC Classes for Demand Resources

- Demand Resource Class

(2) PJM shall establish Hybrid Resource Classes for all "open-loop" combinations of each Capacity Storage Resource class and each Variable Resource class, as well as all "closed-loop" combinations of each Capacity Storage Resource class and each Variable Resource class. An "open-loop" resource is physically and contractually capable of charging from the grid, while a "closed-loop" resource is not.

(3) PJM shall establish "Other Limited Duration Combination Classes" for all combinations of each Variable Resource Class and each Other Limited Duration Resource Class, and for combinations of an Unlimited Resource with each Other Limited Duration Resource Class.

(4) For a given Delivery Year, ELCC Class Ratings will not be calculated for any ELCC Class to the extent that no member of the class is expected to provide, or offer to provide capacity, in the applicable Delivery Year. PJM will determine the ELCC Class Ratings for an ELCC Class when any one of the following criteria are met:

(a) An Existing Generation Capacity Resource is in such class; or
(b) A Planned Generation Capacity Resource has submitted timely and valid data through the ELCC data submission process and is in such class; or
(c) The resource deployment forecast contains a resource in such class.

(5) (a) For each ELCC Resource, except an ELCC Resource that is a Capacity Storage Resource or includes a Capacity Storage Resource component, PJM shall determine the ELCC Class of which such resource is a member by matching the physical characteristics of such resource with the definition of the ELCC Class.

(b) For each ELCC Resource that is a Capacity Storage Resource or includes a Capacity Storage Resource component, PJM shall determine, by matching the physical characteristics of such resource with the definition of the ELCC Class, the type of ELCC Class of which such resource is a member; provided however, the Generation Capacity Resource Provider shall choose the specific ELCC Class within the type ELCC Class identified by PJM that corresponds to the chosen characteristic duration.

If the Generation Capacity Resource Provider fails to choose, PJM will choose a specific ELCC Class to assign to such resource. The election of the specific ELCC Class corresponding to the chosen characteristic duration shall be for a term of five consecutive Delivery Years. After such five Delivery Year period, a Generation Capacity Resource Provider may request a change in the ELCC Class, based on choosing a different characteristic duration, by submitting to the Office of the Interconnection a written request to switch ELCC Classes and provide documentation supporting such change. A Generation Capacity Resource Provider must submit such a request, and supporting documentation, by August 1 prior to the calendar year for the RPM Auction in which the ELCC Resource intends to submit a Sell Offer or otherwise commit to provide capacity, except for 2025/2026 Delivery Year such required information must be provided to the Office of the Interconnection in accordance with the PJM Manuals. The Office of the Interconnection shall provide no later than following November 15 written notification to the Generation Capacity Resource Provider of its determination. If the request is granted, the ELCC Resource shall be considered in the new ELCC Class starting with the next Delivery Year for which no RPM Auction has been conducted and for subsequent Delivery Years. If the request is denied, the Office of the Interconnection shall include in the notice a written explanation for the denial.

(6) Mixed-technology resources are composed of components with different generation technologies, at least one of which would be an ELCC Resource, behind a single Point of Interconnection. For a mixed-technology resource composed of components that do not have significant interaction, the components are eligible to participate as separate resources. A mixed-technology resource composed of components that have significant interaction must participate as a single Combination Resource (or, if the components would all be Variable Resources, then as a single Variable Resource).

The Generation Capacity Resource Provider of a mixed-technology resource eligible to participate as either a single ELCC Resource or as multiple stand-alone resources shall elect, for a term of five consecutive Delivery Years, whether PJM is to model it as a single ELCC Resource or as multiple stand-alone resources. After such five Delivery Year period, a Generation Capacity Resource Provider may request a change in such modelling approach by submitting to the Office of the Interconnection a written request to change the modelling approach and provide documentation supporting such change. A Generation Capacity Resource Provider must submit such a request, and supporting documentation, by August 1 prior to the

calendar year for the RPM Auction in which the ELCC Resource(s) intend(s) to submit a Sell Offer or otherwise commit to provide capacity, except for 2025/2026 Delivery Year such required information must be provided to the Office of the Interconnection in accordance with the PJM Manuals. The Office of the Interconnection shall provide no later than following November 15 written notification to the Generation Capacity Resource Provider of its determination. If the request is granted, the ELCC Resource(s) shall be modelled as requested starting with the next Delivery Year for which no RPM Auction has been conducted and for subsequent Delivery Years. If the request is denied, the Office of the Interconnection shall include in the notice a written explanation for the denial.

C. Calculation of ELCC Class Rating

ELCC Class Ratings for a Delivery Year are calculated by adding to the forecasted resource portfolio incremental quantities of resources belonging to the subject ELCC Class, depending on the resource type:

(1) The ELCC Class Rating of Variable Resources, Limited Duration Resources, Unlimited Resources (except Other Unlimited Resources), and Demand Resources shall be the ratio of the expected unserved energy improvement resulting from adding an incremental quantity of the subject ELCC Class to the expected unserved energy improvement resulting from adding an incremental quantity of an Unlimited Resource with no outages, where expected unserved energy improvement is calculated relative to the Portfolio EUE for the Delivery Year.

(2) No ELCC Class Rating is determined for Combination Resources and ELCC Resources in the Hydropower with Non-Pumped Storage Class, in the Complex Hybrid Class, in the Other Unlimited Resource Class, and in any ELCC Class whose members are so distinct from one another that a single ELCC Class Rating would fail to capture their physical characteristics.

D. Calculation of Accredited UCAP and ELCC Resource Performance Adjustment

(1) (a) For Variable Resources and Limited Duration Resources, Accredited UCAP values shall be equal to the lesser of the resource's Capacity Interconnection Right or the product of:

(i) the Effective Nameplate Capacity;
(ii) the applicable ELCC Class Rating; and
(iii) the ELCC Resource Performance Adjustment.

(b) For any resource in an ELCC Class for which no Class Rating has been calculated pursuant to C(2), the Accredited UCAP shall be based on a resource-specific effective load carrying capability analysis based on the resource's unique parameters.

(c) For Unlimited Resources that have an ELCC Class Rating determined pursuant to C(1), Accredited UCAP values shall be equal to the product of:

(i) the installed capacity;
(ii) the applicable ELCC Class Rating; and
(iii) the ELCC Resource Performance Adjustment.

(d) For Demand Resources, Accredited UCAP values shall be equal to the product of:

(i) the Nominated Value of the Demand Resource; and
(ii) the applicable ELCC Class Rating.

(2) The ELCC Resource Performance Adjustment shall be calculated according to the following methods, as further detailed in the PJM Manuals:

(a) For a Variable Resource, a Limited Duration Resource, and an Unlimited Resource: based on a metric consisting of the weighted average expected hourly output of the resource in the ELCC model during hours of loss of load risk where: (i) the weights correspond to the modeled probability of losing load in such hour and (ii) the expected hourly output is based on the resource's modeled output during the same hour on days since June 1st, 2012 identified as having similar weather from an RTO-perspective. For a given resource or component, the Performance Adjustment shall equal the ratio of such metric to the average (weighted by the Effective Nameplate Capacity) of such metrics for all units in the applicable Variable Resource ELCC Class or applicable Unlimited Resource ELCC Class.

In determining the ELCC Resource Performance Adjustment, the actual output of a Variable Resource shall be adjusted to reflect historical curtailments, and output in any hour shall be capped at: (i) the greater of the Variable Resource's Capacity Interconnection Rights, or the transitional system capability as limited by the transitional resource MW ceiling as defined in the PJM Manuals, awarded for the applicable Delivery Year, for hours in the months of June through October and the following May of the Delivery Year, and (ii) the Variable Resource's assessed deliverability, as defined in the PJM Manuals, for hours in the months of November through April of the Delivery Year. The output of an Unlimited Resource in any hour shall be capped at the greater of the resource's Capacity Interconnection Rights, or the transitional system capability as limited by the transitional resource MW ceiling as defined in the PJM Manuals, awarded for the applicable Delivery Year..

E. Calculation of Accredited UCAP Factor

For Generation Capacity Resources, PJM shall determine an Accredited UCAP Factor, which is the ratio of the resource's Accredited UCAP to the resource's installed capacity.

G. Installed Capacity of ELCC Resources

Rules and procedures for technically determining and demonstrating the installed capacity of ELCC Resources shall be developed by the Office of the Interconnection and maintained in the PJM Manuals. The installed capacity of a Limited Duration Resource is based on the sustained level of output that the unit can provide and maintain over a continuous period, whereby the duration of that period matches the characteristic duration of the corresponding ELCC Class, with consideration given to ambient conditions expected to exist at the time of PJM system peak load, as described in the PJM Manuals. The installed capacity of a Combination Resource (other than Hydropower With Non-Pumped Storage) is based on the lesser of the Maximum Facility Output or the sum of the equivalent Effective Nameplate Capacity values of the resource's constituent components considered on a stand-alone basis. The installed capacity of an Unlimited Resource and Variable Resource shall be determined in accordance with the PJM Manuals. The

installed capacity of Demand Resources, for purposes of the ELCC analysis, is based on the forecasted deployment level in the PJM Load Forecast.

H. Details of the Effective Load Carrying Capability Methodology

The effective load carrying capability analysis shall compare expected hourly load levels (based on historical weather) with the expected hourly output of the expected future resource mix in order to identify the relative marginal resource adequacy value of each individual ELCC Class compared to an Unlimited Resource with no outages. In performing this analysis, the model inputs shall be scaled to meet the annual reliability criteria of the Office of the Interconnection. The effective load carrying capability analysis shall compare hourly values for: (i) expected load based on historical weather; (ii) expected Variable Resource output; (iii) expected output of Limited Duration Resources and of Combination Resources as described below; (iv) expected Unlimited Resource output; and (v) expected Demand Resource output. These expected quantities are based on forecasted load and actual and putative values for Variable Resource output (standalone or as a component of Combination Resources) and Unlimited Resource output after June 1, 2012 (inclusive) through the most recent Delivery Year for which complete data exist. For resources that have not existed each year since June 1, 2012, putative output is an estimate of the hourly output that resource would have produced in a historical hour if that resource had existed in that hour. For Variable Resources, this putative output estimate is developed based on historical weather data consistent with the particular site conditions for each such resource in accordance with the PJM Manuals; for Unlimited Resources, the putative output is developed based on actual performance of similar units in accordance with the PJM Manuals.

Variable Resource actual output shall be adjusted in the ELCC analysis to reflect historical curtailments, and output shall be capped in any hour at: (i) the greater of the Variable Resource's Capacity Interconnection Rights, or the transitional system capability as limited by the transitional resource MW ceiling as defined in the PJM Manuals, awarded for the applicable Delivery Year, during the months of June through October and the following May of the Delivery Year, and (ii) the Variable Resource's assessed deliverability, as defined in the PJM Manuals, during the months of November through April of the Delivery Year. The output of Unlimited Resources shall not exceed the greater of the Unlimited Resource's Capacity Interconnection Rights, or the transitional system capability as limited by the transitional resource MW ceiling as defined in the PJM Manuals, awarded for the applicable Delivery Year.

The effective load carrying capability analysis shall simulate performance of Demand Resources, and shall simulate the output of Limited Duration Resources and Combination Resources based on their Office of the Interconnection-validated parameters, including the putative output of the Variable Resource component of Combination Resources, as described above.

The quantity of deployed resources studied in the analysis shall be based on resource deployment forecasts and, where applicable, on available information based on Sell Offers submitted in RPM Auctions or Fixed Resource Requirement plans for the applicable Delivery Year, and, where applicable, information provided to the Office of the Interconnection regarding intent to offer in an RPM Auction, pursuant to the requirements in the Tariff, Attachment DD, section 5.5.

The model inputs, specifically the load scenarios, shall be scaled to meet the annual reliability criteria of the Office of the Interconnection. The resulting expected unserved energy constitutes the Portfolio EUE for the Delivery Year. Energy Resources are not included in the effective load

carrying capability analysis. Generating units that are expected to only offer or otherwise provide a portion of their Accredited UCAP for that Delivery Year are represented in the analysis in proportion to the expected quantity offered or delivered divided by the Accredited UCAP.

I. Methodology to Simulate Output of Certain Resources in the Effective Load Carrying Capability Model

The effective load carrying capability analysis shall simulate the output of Limited Duration Resources and Combination Resources based on their physical parameters, including limited storage capability, and shall simulate the deployment of Demand Resources. The analysis shall simulate output from the subject Limited Duration Resources, Combination Resources, and Demand Resources in hours in which all output from Unlimited Resources and available output from Variable Resources is insufficient to meet load. The analysis shall first simulate the output of Demand Resources. If the simulated output of Demand Resources is insufficient to meet load, then the output of the subject Limited Duration Resources and Combination Resources shall be simulated on an hour-by-hour basis based on their relative duration, starting from longer duration resources to shorter duration resources. The output of Combination Resources shall be capped in any hour at: (i) the Combination Resource's Capacity Interconnection Rights during the months of June through October and the following May of the Delivery Year, and (ii) the Combination Resource's assessed deliverability, as defined in the PJM Manuals, during the months of November through April of the Delivery Year. Energy Storage Resource charging is during hours with sufficient margin, including between daily peaks if necessary.

J. Administration of Effective Load Carrying Capability Analysis

The Office of the Interconnection shall post final ELCC Class Rating values at least once per year in a report that also includes appropriate details regarding methodology and inputs. The Office of the Interconnection shall post this report and shall communicate ELCC Resource Performance Adjustment values to applicable Generation Capacity Resource Providers no later than five months prior to the start of the target Delivery Year, as described in the PJM Manuals. Accredited UCAP values for the applicable Delivery Year shall establish the maximum Unforced Capacity that an ELCC Resource can physically provide or offer to provide in the applicable Delivery Year.

The Office of the Interconnection shall also post preliminary ELCC Class Rating values for nine subsequent Delivery Years. For any Delivery Year for which a final ELCC Class Rating has not been posted and a preliminary ELCC Class Rating has been posted, the Accredited UCAP of an ELCC Resource for such Delivery Year shall be based on the most recent preliminary ELCC Class Rating value for that Delivery Year, together with the most recently calculated ELCC Resource Performance Adjustment value for that ELCC Resource. Except to the extent specified above or otherwise specified, the preliminary ELCC Class Rating values for future years are non-binding and are only for indicative purposes. A Generation Capacity Resource Provider can offer or provide capacity from an ELCC Resource that is not subject to a capacity market must offer obligation (as specified in Tariff, Attachment DD, Section 6.6) at a level less than the Accredited UCAP for such resource.

In order to facilitate the effective load carrying capability analysis, the Generation Capacity Resource Provider of each ELCC Resource must submit to the Office of the Interconnection the required information as specified in the PJM Manuals by no later than August 1 prior to the calendar year for the RPM Auction in which the ELCC Resource intends to submit a Sell Offer or otherwise commit to provide capacity, except for 2025/2026 Delivery Years such required information must be provided to the Office of the Interconnection in accordance with the PJM Manuals. The required information may include relevant physical parameters, relevant historical data such as weather data and actual or estimated historical energy output, and documentation supporting such parameters and historical data. The relevant physical parameters are those that are incorporated into the effective load carrying capability analysis. The parameters required for Hydropower With Non-Pumped Storage shall include Ordinary Water Storage and any applicable Exigent Water Storage. Submitted parameters must indicate the expected duration for which any submitted physical parameters are valid.

The Office of the Interconnection shall evaluate, validate, and approve the foregoing information in accordance with the process set forth in the PJM Manuals. In evaluating the validity of submitted information, the Office of the Interconnection may assess the consistency of such information with observed conditions. If the Office of the Interconnection observes that the information provided by the Generation Capacity Resource Provider of the ELCC Resource is inconsistent with observed conditions, the Office of the Interconnection will coordinate with the Generation Capacity Resource Provider of the ELCC Resource to understand the information and observed conditions before making a determination regarding the validity of the applicable parameters. The Office of the Interconnection may engage the services of a consultant with technical expertise to evaluate the foregoing information.

After the Office of the Interconnection has completed its evaluation of the foregoing information, the Office of the Interconnection shall notify the Generation Capacity Resource Provider in writing whether the submitted information is considered invalid by no later than September 1 following the submission of the information. The Office of the Interconnection's determination on the validity of the foregoing information shall continue for the applicable Delivery Year and, if requested, for such longer period as the Office of the Interconnection may determine is supported by the data.

In the event that the Office of the Interconnection is unable to validate any of the required information, physical parameters, supporting documentation, or other related information submitted by the Generation Capacity Resource Provider of an ELCC Resource, then the Office of the Interconnection shall calculate Accredited UCAP values for that ELCC Resource based only on the validated information. Such ELCC Resource shall not be permitted to offer or otherwise provide capacity above such Accredited UCAP values until the Office of the Interconnection determines new Accredited UCAP values for such resource.

Generation Capacity Resource Providers of ELCC Resources that are hydropower plants with water storage must provide documentation to support the physical parameters provided for expected load carrying capability analysis modeling, as specified in the PJM Manuals. This documentation must: (a) support the plant's physical capabilities; (b) demonstrate that the parameters do not violate any federal, state, river basin, or other applicable authority operating limitations of the plant; and (c) demonstrate full authorization from FERC, any river basin commissions, and any other applicable authorities to meet those capabilities.