

RAA Definitions Section

“**Accredited UCAP**” as denominated in Effective UCAP shall mean the quantity of Unforced Capacity that a Limited Resource is capable of providing in a given Delivery Year.

“**Combination Resource**” shall mean a Generation Capacity Resource that has a component that has the characteristics of a Limited Duration Resource combined with i) a component that has the characteristics of an Unlimited Resource or ii) a component that has the characteristics of a Variable Resource.

“**Effective UCAP**” is a unit of measure that represents the resource adequacy value exchanged in the Capacity Market. One megawatt of Effective UCAP has the same resource adequacy value of one megawatt of Unforced Capacity.

“**Exigent Water Storage**” shall mean water stored in the pondage or reservoir of a hydropower resource which is not typically available during normal operating conditions (as those conditions are described in the relevant FERC hydropower license), but which can be drawn upon during emergency conditions (as described in the FERC license), including in order to avoid a load shed, pursuant to the FERC license governing the operation of the hydropower resource.

“**Limited Class**” shall mean a defined group of Limited Resources that share a common set of operational characteristics and for which effective load carrying capability analysis will establish a unique Limited Class UCAP and corresponding Limited Class Derate. Limited Classes shall be defined in the PJM Manuals. Members of a Limited Class share a common method of calculating the Limited Resource Performance Adjustment. Limited Classes shall be defined such that Accredited UCAP values shall neither unduly discriminate nor unduly advantage a specific group of resources within the Limited Class.

“**Limited Class Derate**” shall mean the derate factor, based on effective load carrying capability analysis, that applies to Limited Resources that are members of a Limited Class as part of the calculation of their Accredited UCAP.

“**Limited Class UCAP**” shall mean the total Effective UCAP all Limited Resources in a given class are capable of providing in a given Delivery Year.

“**Limited Duration Resource**” shall mean a Generation Capacity Resource that is not a Variable Resource, that is not a Combination Resource, and that is not capable of running continuously at Maximum Facility Output for 24 hours or longer. A Capacity Storage Resource is a Limited Duration Resource.

“Limited Portfolio UCAP” shall mean the total Effective UCAP that all Limited Resources are capable of providing in a given Delivery Year.

“Limited Resource” shall mean a Generation Capacity Resource that is a Variable Resource, a Limited Duration Resource, or a Combination Resource.

“Limited Resource Performance Adjustment” shall mean the performance of a specific Limited Resource relative to the performance of the Limited Class to which it belongs.

“Ordinary Water Storage” shall mean water stored in the pondage or reservoir of a hydropower resource which is typically available during normal operating conditions pursuant to the FERC license governing the operation of the hydropower resource.

“Unlimited Resource” shall mean a generating unit having the ability to maintain output at stated capability continuously on a daily basis without interruption. An Unlimited Resource is a Generation Capacity Resource that is not a Limited Resource.

“Variable Resource” shall mean 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 alternate fuel source. All Intermittent Resources are Variable Resources, with the exception of run of river hydroelectric power with non-pumped storage.

RAA SCHEDULE 9: PROCEDURES FOR ESTABLISHING THE CAPABILITY OF GENERATION CAPACITY RESOURCES

A. Such rules and procedures as may be required to determine and demonstrate the capability of Generation Capacity Resources for the purposes of meeting a Load Serving Entity’s obligations under the Agreement shall be developed by the Office of the Interconnection and maintained in the PJM Manuals.

B. The rules and procedures shall recognize the difference in the relative ability of units to maintain output at stated capability over a specified period of time. Factors affecting such ability include, but are not limited to, fuel availability, stream flow and/or reservoir storage for hydro units, energy storage capability for Energy Storage Resources, energy source variability and intermittency, mechanical limitations, and system operating policies. For this purpose, the basis for determining and demonstrating the capability of a particular generating unit shall be as described in sections **AAA** and **BBB**.

Section AAA: Provisions for Unlimited Resources

For Unlimited Resources, the capability of the generating unit is based on the level of output that the unit can provide under the site conditions expected to exist at the time of PJM system peak load where such conditions include, but are not limited to, ambient air temperature, humidity, barometric pressure, intake water temperature, and cooling system performance. Generating units with the ability to operate continuously across all hours of an Operating Day without interruption if needed include, but are not limited to, nuclear and fossil-fired steam units, combined cycle units, combustion turbine units, reciprocating engine units, and fuel cell units.

Section BBB [spans the rest of this draft]: Provisions for Limited Resources

The Office of the Interconnection shall determine the capability of Limited Resources to meet a Load Serving Entity's obligations under the Agreement using an effective load carrying capability analysis, as set forth below, with additional implementation details provided in the PJM Manuals. The outputs of the effective load carrying capability analysis include the Limited Portfolio UCAP, Limited Class UCAP, and Limited Class Derate. The inputs of the effective load carrying capability analysis include historical load data, historical output of existing Variable Resources, estimates of putative historical output for planned Variable Energy Resources, forced outage patterns for Unlimited Resources, and modeling parameters for Limited Duration Resources and Combination Resources.

The Accredited UCAP of a Limited Resource shall be calculated based on the Limited Class Derate as well as the Limited Resource Performance Adjustment for the resource, consistent with the methods described below and in the PJM Manuals.

The Limited Resource Performance Adjustment shall be calculated according to the following methods, as further detailed in the PJM Manuals. The Limited Resource Performance Adjustment of Variable Resources shall be based on the average of i) actual output during the 200 highest coincident peak load hours over the preceding ten years, regardless of which year they occur, and ii) actual output during the 200 highest coincident peak putative net load hours over the preceding ten years, regardless of which year they occur, where putative net load is actual load minus the putative hourly output of Variable Resources based on the resource mix of the target year. The Limited Resource Performance Adjustment of Limited Duration Resources shall be based on EFORd. Combination Resources with only an Unlimited Resource component and a Limited Duration resource component shall have a Limited Resource Performance Adjustment based on EFORd. Combination Resources with a Variable Resource component shall have two Limited Resource Performance Adjustments; the first of the Limited Resource Performance Adjustments shall be based on the direct metered or estimated output of such component, which is then assessed according to the methodology described above for Variable

Resources; the second of the Limited Resource Performance Adjustments shall be based on the EFORd of the Combination Resource.

Rules and procedures for technically determining and demonstrating the installed capacity of Limited 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 Limited Class, with consideration given to 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 hydro with non-pumped water storage) is based on the lesser of the Maximum Facility Output or the sum of the nameplate values of the constituent components.

A: Model Details

The Limited Class UCAP and other results of the effective load carrying capability analysis shall be based on the total Effective UCAP of the Limited Class as a whole. The Limited Class UCAP and corresponding Limited Class Derate values may increase or decrease from year to year as the resource mix and load shape change.

The effective load carrying capability analysis shall compare historical hourly load levels with the hourly output of a putative future resource mix in order to identify the relative resource adequacy value of a Limited Class compared to a group of perfect Unlimited Resources with no outages. In performing this analysis, the putative future resource mix shall be scaled to meet the Office of the Interconnection's reliability criteria consistent with other resource adequacy studies. The effective load carrying capability analysis shall compare historical hourly values after 2012 (inclusive) for: i) actual load; ii) actual and putative Variable Resource output; and iii) actual and putative output of the Variable Resource component of Combination Resources. For resources that have not existed each year since 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. This putative output estimate is developed using generally-accepted analytical methods based on historical weather data consistent with the particular site conditions for each such resource. The quantity of deployed resources studied in the analysis shall be based on resource deployment forecasts and, where applicable, on available information regarding offers for auctions for the applicable Delivery Year. The effective load carrying capability analysis shall simulate forced outages of thermal resources based on actual data, and shall simulate the output of Limited Duration Resources and Combination Resources based on their Office of the Interconnection-validated parameters. Forced outages of Limited Duration Resources and Combination Resources shall not be simulated in the effective load carrying capability analysis. The ELCC analysis shall identify a scenario in which the aggregate installed capacity "X" of a subset of Unlimited Resources with no outages yields the same resource adequacy metric for a given hourly load shape and load quantity as the aggregate effective nameplate "Y" of all

Limited Resources that are expected to offer or deliver in the delivery year being analyzed. The Limited Portfolio UCAP shall be the ratio of X/Y, where for Variable Resources and Combination Resources the effective nameplate is the Maximum Facility Output, and for Limited Duration resources the effective nameplate 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 Limited Class, with consideration given to conditions expected to exist at the time of PJM system peak load, to the extent that such conditions impact such capability.

The Limited Portfolio UCAP shall be allocated to Limited Class UCAP values using further effective load carrying capability analysis such that the aggregate of all Limited Class UCAP values does not exceed the Limited Portfolio UCAP plus a margin of error of 250 megawatts. The method of allocating Limited Portfolio UCAP to the Limited Classes shall be specified in the PJM Manuals. The Limited Class UCAP values for Variable Resource classes shall be allocated to individual units of the class based on each unit's Limited Resource Performance Adjustment such that the aggregate of all Accredited UCAP values for the class does not exceed the Limited Class UCAP. The Limited Class UCAP values for Limited Duration Resources shall be allocated to individual units in proportion to their effective nameplate, where effective nameplate 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 Limited Class, with consideration given to conditions expected to exist at the time of PJM system peak load, to the extent that such conditions impact such capability. The Limited Class UCAP values for Combination Resources that are not hydropower with non-pumped storage shall be allocated on the basis of unit performance and EFORd using the method described in the PJM Manuals. Hydropower with non-pumped storage shall have Accredited UCAP values calculated as if they were a standalone class, based on the unique value parameters of the class.

Energy Resources are not included in the effective load carrying capability analysis. Units that only offer a portion of their Accredited UCAP in the Capacity Market are represented in the analysis in proportion to the quantity offered divided by the Accredited UCAP.

B. Simulated Dispatch

The effective load carrying capability analysis shall simulate the output of Limited Duration Resources and Combination Resources based on their validated parameters, including limited storage capability. The analysis shall simulate output from such resources in hours in which all output from thermal resources and available output from Variable Resources is insufficient to meet load. The output of such resources shall be simulated on an hour-by-hour basis in proportion to their installed capacity without foresight to future hours. The simulated deployment of Load Management shall target adequate primary reserves levels if sufficient simulated Load Management is available. Simulated primary reserves shall be allocated among

economic resources in order to maximize simulated reliability. Primary reserves shall be exhausted prior to identifying a loss of load event in the analysis. Energy Storage Resource charging is during hours with sufficient margin to avoid unduly impacting simulated reliability, including between daily peaks if necessary.

RAA Schedule 9.1 Administration of Effective Load Carrying Capability Analysis

The Office of the Interconnection shall publish the actual Limited Class UCAP and Limited Class Derate values once per year in a report that also includes appropriate details regarding methodology and inputs. The Office of the Interconnection shall publish this report and shall publish Performance Adjustment values no later than six months prior to the target Delivery Year, as described in the PJM Manuals. Accredited UCAP values based on the published Limited Class Derate values and published Performance Adjustment establish the maximum Unforced Capacity that a resource can physically provide in the Delivery Year that starts the following June. The Office of the Interconnection shall also publish estimated Limited Class Derate values for nine subsequent Delivery Years in the future. The Accredited UCAP of a Limited Resource as applied to a future Delivery Year for which actual Limited Class Derate values have not yet been published shall be based on the most recent estimated Limited Class Derate value for that Delivery Year, together with the most recently published Performance Adjustment calculation. Except to the extent specified above or otherwise specified, the estimated Limited Class Derate values for future years are non-binding and are only for indicative purposes.

Owner/operators of Limited Resources must submit to the Office of the Interconnection the required information as specified in the PJM Manuals by no later than the July 1 immediately preceding the calendar year in which the Limited Resource intends to offer or commit Capacity. The required information may comprise relevant physical parameters, relevant historical data such as weather data and actual or estimated historical energy output, and documentation to support such submissions. The relevant physical parameters are those that are incorporated into the effective load carrying capability analysis. 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 ELCC modeling parameters provided by the Limited Resource are inconsistent with observed conditions, the Office of the Interconnection will coordinate with the Limited Resource owner to understand the observed conditions before making a determination regarding the validity of the applicable parameters. Submitted parameters must indicate the expected duration for which any submitted physical parameters are valid. 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 owner/operator in writing whether the submitted information is considered invalid by no later than September 1. The parameters required for hydropower with non-pumped storage shall include Ordinary Water Storage and Exigent Water Storage. The effective date of the valid data, if approved by the Office of the Interconnection, shall be no earlier than June 1 of the applicable Delivery Year. 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 the required data, unit parameters, supporting documentation, or other related information submitted by the owner/operator of a Limited Resource, then the Office of the Interconnection shall not calculate Accredited UCAP values for that Limited Resource.

Owners/operators of Limited Resources that are hydropower plants with water storage must provide documentation to support the parameters provided for ELCC 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 operational limits of the plant or of other plants in the same river system; and c) demonstrate full authorization from FERC, river basin commissions, and any other applicable authorities to meet those capabilities.