# PJM Manual 21a:

## Determination of Accredited UCAP Using Effective Load Carrying Capability Analysis

**Post December 15, 2020 initial outline and partial first draft**

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# Section 1: Overview, Applicability, Function of ELCC and Accredited UCAP, Definitions, and Classes

## 5.1 Function and Applicability of ELCC and Accredited UCAP

Effective load carrying capability (ELCC) analysis provides ELCC Class Ratings for each class (e.g., onshore wind, tracking solar, 4-hour energy storage resource, etc.) that in part determine the Accredited UCAP of ELCC Resources (a broad category that includes most renewable resources and storage resources). The Accredited UCAP in turn sets a cap on the amount of UCAP that such resources can offer or otherwise provide in the Capacity Market.

The effective load carrying capability analysis identifies a scenario in which the aggregate installed capacity "X" of a group of Unlimited Resources with no outages yields the same annual loss of load expectation as the one produced by the scenario with all ELCC Resources that are expected to offer in a given RPM Auction, or otherwise provide capacity, in the Delivery Year being analyzed. The ELCC Portfolio UCAP is the value "X". The ELCC Portfolio UCAP is allocated to each class to yield the ELCC Class UCAP, from which the ELCC Rating is in turn derived, as described in <**pending reference**>.

RAA Schedule 9.1 provides the following definitions which establish the applicability of ELCC and define broad types of resources that are treated differently in the calculation of Accredited UCAP:

*"**Accredited UCAP**" shall mean the quantity of Unforced Capacity, as denominated in Effective UCAP, that an ELCC Resource is capable of providing in a given Delivery Year.*

***"ELCC Resource"** shall mean a Generation Capacity Resource that is a Variable Resource, a Limited Duration Resource, or a Combination 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 an alternate fuel source. All Intermittent Resources are Variable Resources, with the exception of Hydropower with Non-Pumped Storage.*

***"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.*

***"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.*

Examples of combination resources include solar+battery hybrids and Hydropower with Non-Pumped Storage.

## 1.2 General Approach to Calculation of Accredited UCAP

As further described in Section 3 below, the calculation of the Accredited UCAP of an ELCC Resource is generally derived from the product of:

1. The Effective Nameplate Capacity of the resource X
2. The ELCC Class Rating of the applicable class X
3. The ELCC Resource Performance Adjustment

RAA Schedule 9.1 provides the following definitions for these terms:

*"**Effective Nameplate Capacity**" shall mean (i) for each Variable Resource and Combination Resource, the resource's Maximum Facility Output; (ii) for each Limited Duration Resource, the sustained level of output that the unit can provide and maintain over a continuous period, whereby the duration of that continuous 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, to the extent that such conditions impact such resource's capability.*

*"**ELCC Class Rating**" shall mean the rating factor, based on effective load carrying capability analysis, that applies to ELCC Resources that are members of an ELCC Class as part of the calculation of their Accredited UCAP.*

*"**ELCC Resource Performance Adjustment**" shall mean the performance of a specific ELCC Resource relative to the aggregate performance of the ELCC Class to which it belongs as further described in RAA, Schedule 9.1, section E.*

## 1.3 ELCC Classes

The ELCC Classes are as listed below. ELCC Class Ratings will not be calculated for classes listed below if no units of the class are expected to participate in the Capacity Market in the applicable year.

1. Tracking solar
2. Fixed-tilt solar
3. Onshore wind
4. Offshore wind
5. Landfill gas units that cannot run consistently at ICAP levels for 24 or more hours
6. Intermittent run-of-river hydropower
7. Hydropower With Non-Pumped Storage
8. Energy Storage Resources of 4-hour, 6-hour, 8-hour, and 10-hour duration, or longer duration as required to secure a 100% ELCC Rating. Such classes include pumped storage hydropower.
9. Generic limited duration resources of 4-hour, 6-hour, 8-hour, and 10-hour duration, or longer duration as required to secure a 100% ELCC Rating
10. Hybrids that are combinations of one of the above generation types plus an Energy Storage Resource of 4-hour, 6-hour, 8-hour, or 10-hour duration
11. Hybrids that are combinations of one of the above generation types plus generic limited duration resource of 4-hour, 6-hour, 8-hour, or 10-hour duration

An Energy Storage Resource of "X" hours duration is capable of running continuously at its Effective Nameplate Capacity power level for X hours starting with a full state of charge under

conditions of highest risk of shortage on the PJM system, provided that such calculation excludes any MWh reserved for Black Start service or for other firm commitments, and that such resource is capable of fully recharging in a similar amount of time.

A generic limited duration resource of “X” hours duration is capable of running at its Effective Nameplate Capacity power level for X hours under conditions of highest risk of shortage on the PJM system.

A Limited Duration Resource or Combination Resource must be in a given duration class for at least five delivery years.

The RAA provides that the term “Hydropower With Non-Pumped Storage” shall mean “a hydropower facility that can capture and store incoming stream flow, without use of pumps, in pondage or a reservoir, and the Generation Owner has the ability, within the constraints available in the applicable operating license, to exert material control over the quantity of stored water and output of the facility”. A hydropower resource can exert material control over the quantity of stored water and over the output of the facility when it can consistently store at least than 10% of its ICAP for at least 4 hours. This criterion is demonstrated by evaluating the difference of the actual output during the 4 highest load hours of all summer afternoons of a year against the average actual output of all other hours on the same days, and comparing with the ICAP value. Such assessment and determination is once per five years.

## Section 2: Overall Timeline for the ELCC Accreditation Process

### 2.1 Schedule for ELCC Results and Applicability

| ELCC Round | Applicable to Auctions | Posting Date | Note |
|---|---|---|---|
| Round 1 | 2023/24 BRA | June, 2021 | Includes floors for 2021 cohort |
| Round 2 | 2024/25 BRA | December, 2021 | Includes floors for 2022 cohort |
| Round 3 | 2025/26 BRA | July, 2022 | Updated results, but no floors and no report |
| Round 4 | 2026/27 BRA<br>Any IA's run in calendar year 2023 | No later than December 31, 2022 | Includes floors for 2023 cohort |
| 2023 and Subsequent Years | Results and report generally posted in November, include floors during the transition period, and apply to all activities and auctions in the following calendar year, including the Delivery Year that starts the following calendar year. | | |

PJM will post final ELCC Class UCAP and ELCC Class Rating values for use in the upcoming Delivery Year in an annual report that also includes appropriate details regarding methodology and inputs. PJM will post this report and communicate ELCC Resource Performance Adjustment values to applicable Generation Capacity Resource Providers no later than five months prior to the start of the upcoming Delivery Year, as further described in the table above. The report will also include ELCC Class Rating values for nine subsequent Delivery Years. ELCC Ratings and ELCC Resource Performance Adjustment values from the report will apply to Capacity provided in the upcoming Delivery Year, as well as to all auctions and activities executed in the following calendar year, using the applicable ELCC Ratings for the corresponding Delivery Year. PJM may post supplemental reports more often than annually.

Starting with the 2023/2024 Delivery Year, 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.

For any Delivery Year, the Accredited UCAP of an ELCC Resource shall be based on the most recent ELCC Class Rating value for that Delivery Year (considering also the applicable floor rating, as discussed in Section 7 below), 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 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.

# Section 3: Calculation of Accredited UCAP

## 3.1 Calculation of Accredited UCAP

(a) For Variable Resources and Limited Duration Resources, Accredited UCAP values shall be equal to the product of:

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

(b) For Combination Resources, Accredited UCAP values shall be equal to the sum of the Accredited UCAP of each component, but not to exceed the Maximum Facility Output of the resource, where:

(i) The value for a Variable Resource component shall be determined in accordance with subsection (a) above.

(ii) The value for a Limited Duration Resource component shall be equal to the product of:

(A) the Effective Nameplate Capacity determined for the Limited Duration Resource component;

(B) [one minus the EFORd for the Limited Duration Resource component]; and

(C) the applicable Limited Duration Resource component ELCC Class Rating

(iii) The value for an Unlimited Resource component shall be equal to the product of the installed capacity of the Unlimited Resource component and [one minus the EFORd for the Unlimited Resource component].

(iv) The Accredited UCAP for Hydropower With Non-Pumped Storage, and for each member of an ELCC Class whose members are so distinct from one another that a single ELCC Class Rating fails to capture their physical characteristics, shall be based on a resource-specific effective load carrying capability analysis based on the resource's unique parameters.

The applicable class rating of a resource is the lesser of a) the ELCC Class Rating for the applicable Delivery Year and b) the applicable guaranteed minimum floor rating for the resource, as described in Section 7 below.

## 3.2 Calculation of ELCC Resource Performance Adjustment

(a) For a Variable Resource, the ELCC Resource Performance Adjustment is based on a metric consisting of the average of (1) actual output during the 200 highest coincident peak load hours over the preceding ten years, regardless of the years in which they occur, and (2) actual output during the 200 highest coincident peak putative net load hours over the preceding ten years, regardless of the years in which 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. For Planned Resources or resources less than 10 years old, estimated hypothetical historical output will be used to develop this metric. 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.

(b) For Limited Duration Resources, the ELCC Resource Performance Adjustment is equal to 1 minus EFORd.

(c) For Combination Resources with only an Unlimited Resource component and a Limited Duration Resource component, the ELCC Resource Performance Adjustment is equal to 1 minus EFORd.

(d) For Combination Resources with a Variable Resource component (except for Hydropower With Non-Pumped Storage): (1) based on the direct metered or estimated output of the Variable Resource component, which is then assessed according to the methodology described in subsection (a) above for Variable Resources and in accordance with the PJM Manuals; and (2) based on the EFORd that is applicable to the Limited Duration Resource component.

(e) For Hydropower With Non-Pumped Storage and other Combination Resources that do not fall into the above categories: equal to 1 minus EFORd.

## Section 4: Determination of Effective Nameplate

The RAA provides that ““**Effective Nameplate Capacity**” shall mean (i) for each Variable Resource and Combination Resource, the resource’s Maximum Facility Output; (ii) for each Limited Duration Resource, the sustained level of output that the unit can provide and maintain over a continuous period, whereby the duration of that continuous 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, to the extent that such conditions impact such resource’s capability.

The installed capacity of a resource is defined in Manual 21, Section 1.2, as further described here in the context of ELCC Resources. 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 (e.g., 4 hours, 8 hours, etc), with consideration given to ambient conditions expected to exist at the time of PJM system peak load. 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, with consideration given to ambient conditions expected to exist at the time of PJM system peak load.

In order to maintain the Effective Nameplate Capacity level, a Limited Duration Resource and a Hydropower with Non-Pumped Storage resource must demonstrate the level of output the resource can reach under ambient conditions expected to exist at the time of PJM system peak load, to the extent that such conditions impact such resource’s capability.

In order to maintain the Effective Nameplate Capacity level, a Combination Resource (other than Hydropower with Non-Pumped Storage) must demonstrate the level of output each component can reach under ambient conditions expected to exist at the time of PJM system peak load, to the extent that such conditions impact such resource’s capability.

# Section 5: Data Submission and Validation

## 5.1 Introduction

The ELCC methodology developed by PJM requires modeling hourly output from ELCC Resources (i.e., Generation Capacity Resources that are not capable of running continuously at their summer rated power level for 24 or more hours). To perform the hourly modeling, PJM needs specific information about such resources (such information may go beyond the information the resources supplied during the interconnection process).

Those Variable Resources (e.g., wind, solar, hydro without storage or pondage, landfill gas without alternate fuel), Limited Duration Resources (e.g., Energy Storage Resources including pumped hydro), and Combination Resources (e.g., hybrids of generation plus energy storage, hydro with non-pumped storage) that wish to offer in any auctions, or otherwise provide Capacity, for Delivery Year 2023/24 or subsequent Delivery Years shall provide the required information and supporting documentation as detailed below by the deadlines also outlined below in order to ensure that PJM can perform the necessary ELCC analysis.

**Data Submission Deadlines**

| Delivery Year | Deadline |
|---|---|
| 2023/24 BRA | Feb. 15, 2021<br>For Hydropower with Non-Pumped Storage and pumped storage hydropower resources, this deadline is March 1, 2021. |
| 2024/25 BRA | Aug. 15, 2021 |
| 2025/26 BRA | Feb. 15, 2022 |

For subsequent delivery years, the data submission deadline is August 1 of each calendar year prior to the calendar year in which the applicable RPM auction is held, or in which the applicable Delivery Year begins, or in which the applicable FRR plan is submitted.

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.

PJM will evaluate, validate, and approve the foregoing information. In evaluating the validity of submitted information, PJM may assess the consistency of such information with observed conditions. If PJM observes that the information provided by the Generation Capacity Resource Provider of the ELCC Resource is inconsistent with observed conditions, PJM 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. PJM may engage the services of a consultant with technical expertise to evaluate the foregoing information.

After PJM has completed its evaluation of the foregoing information, PJM will 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. PJM's determination on the validity of the foregoing information will continue for the applicable Delivery Year and, if requested, for such longer period as PJM may determine is supported by the data.

In the event that PJM 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 PJM will 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 PJM determines new Accredited UCAP values for such resource.

Generation Capacity Resource Providers of Hydropower with Non-Pumped Storage resources must provide documentation to support the physical parameters provided for expected load carrying capability analysis modeling, as specified in Section 5.2.5 below. 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.

## 5.2 Required Information

**Note: Generation Capacity Resource Providers of solar, onshore wind, and landfill gas resources do not have any ELCC data submission requirement.**

For members planning to offer or otherwise include certain hydro, storage, hybrids, offshore wind, landfill gas, and certain other resources in the Capacity Market for the 2023/24 Delivery Year and after, certain data (as described in detail in the subsections below) must be submitted by the deadlines outlined in section 5.1 above. This submission facilitates calculation of Accredited UCAP values for such resources using PJM's effective load carrying capability ("ELCC") method.

### ELCC Data Submission Process:

1. Visit the ELCC web page: https://www.pjm.com/planning/resource-adequacy-planning/effective-load-carrying-capability
2. From the ELCC web page, download the data submission template corresponding to the applicable ELCC Class. For all ELCC Classes except Hydro With Non-Pumped Storage, a separate template for each RPM Resource ID must be submitted.
3. Review all the sheets in the data submission template. Input all the required data following the data submission standards provided in the template.
4. Access the ELCC portal linked on the ELCC web page. If access has not already been granted, access will need to be requested following the instructions available on the ELCC web page.
5. Use the ELCC portal to submit the filled in data submission template together with the accompany form.

### Resubmission of Data:

Generation Capacity Resource Providers who must resubmit data should do so in a complete new data submission template including the full time series and complete set of parameters, as applicable. Supporting documentation does not need to be resubmitted unless it has

changed. Members who already submitted ELCC-related data through the above process do not need to submit new data except in the following circumstances:

1. If the previously submitted data did not include the complete time series from June 1, 2012 through the most recent May 31, or was not valid;
2. If the data has changed since the prior submission;
3. If the PJM data template for the applicable class has been updated since the most recent submission.

In general, providers of all resources other than onshore wind and solar must provide basic physical details of the resource, including geographic coordinates, Effective Nameplate Capacity, technology type, generator make and model, and other relevant physical characteristic of the plant. Providers of Variable Resources other than onshore wind and solar that have not been in service since June 1, 2012 must provide an hourly backcast of estimated hypothetical output of the resource from June 1, 2012 through the most recent May 31. In addition, they must provide the underlying data and method used to develop such backcast (for example, hourly streamflow data from the USGS in the case of hydropower, together with the method to convert streamflow to MWh using the generator characteristics).

The information and data required for specific technology types is as follows:

### 5.2.1 Onshore Wind and Solar

Starting March 1, 2022, providers of onshore wind and solar resources must provide the following data. Prior to March 1, 2022, providers of onshore wind and solar resources must provide the following data only if requesting a unit-specific backcast, otherwise they may provide it if desired.

For onshore wind plants (optional prior to March 1, 2022):

- Latitude and longitude in decimal degrees
- Turbine make, model, rating, and number of such turbines
- Turbine power curves
- Hub height

For solar plants (optional prior to March 1, 2022):

- Latitude and longitude in decimal degrees
- Inverter and panel make, model, AC power ratings, and other specifications
- Number of inverters and total AC power rating of inverters
- Number of panels and total DC power rating panels
- Physical configuration of the panels: fixed tilt, single axis tracking, or dual axis tracking
- For tracking: brand of tracker
- For fixed-tilt: aximuth angle and tilt angle

For onshore wind and solar resource providers that wish to provide their own hourly backcast instead of a PJM-provided backcast, such backcasts must meet the following requirements and are subject to PJM validation:

- Planned Resources and Existing Resources that entered service after June 1, 2012: hourly backcast going back to June 1, 2012, together with the underlying data and method used to develop such backcast.

- Existing resources that entered service on or before June 1, 2012: data submission is only required if there was a change in physical plant configuration as specified in Section YYYYYY below.

After an onshore wind or solar resource enters service, PJM may update its backcast annually by using new production data to calibrate previously developed backcasts.

### 5.2.2 Variable Resources Other Than Onshore Wind and Solar

Providers of offshore wind must provide the data specified below. In order to derive the most accurate ELCC analysis, providers of landfill gas units and intermittent hydro units should, if possible, provide the data specified below. In the case of landfill gas and intermittent hydro, PJM may utilize existing data and publicly available data to perform ELCC analysis and calculate Accredited UCAP values when no valid data or incomplete valid data has been submitted.

- Latitude and longitude in decimal degrees.
- Planned Resources and Existing Resources that entered service after June 1, 2012: hourly backcast for all years from June 1, 2012 through the most recent May 31, together with the underlying data and method used to develop such backcast.
- Existing resources that entered service on or before June 1, 2012: data submission is only required if there was a change in physical plant configuration as specified in Section YYYYYY below.

For offshore wind plants:

- Turbine make, model, rating, and number of such turbines
- Turbine power curves
- Hub height
- Rotor diameter

*Supporting Documentation for Run-of-river Hydropower without Storage and Landfill Gas Resources that are Planned Resources or that Entered Service after June 1, 2012*

Run-of-River Hydro without Storage:

- FERC license and any other agreements by which they are required to operate

Landfill gas:

- Expected landfill life
- Size (acreage)

### 5.2.3 Energy Storage Resources Including Pumped Storage Hydropower

Examples of Energy Storage Resources include standalone batteries and pumped storage hydropower. Providers of Energy Storage Resources must provide the following data and information:

A. Maximum combined power output capability of the plant while running all generators simultaneously under conditions corresponding to PJM peak loads (MW)
B. Maximum number of hours plant can run at maximum output. This metric accounts for the water storage capability of upper and lower ponds, assumes conditions corresponding to PJM peak loads, and assumes the plant starts with an upper pond at its maximum elevation. (Hours)

C. Storage inventory capacity in MWh (A times B)
D. Black Start commitments in MW
E. Any other firm commitments in MW and either MWh or duration (hours)
F. Charging/discharging roundtrip efficiency

In addition, Pumped Storage Hydropower plants must submit monthly average values for the ratio of the number of cubic feet of water required to pump a single MWh, as well as for the ratio of the number of cubic feet of water required to produce a single MWh.

*Supporting Documentation for Pumped Storage Hydropower*

This documentation is intended to support the information requested for pumped storage hydropower plants a detailed above.

- FERC-related documents
- Documents from river basin authorities
- Any relevant river-sharing agreements
- Prime mover ratings, power curve and elevation
- Upper and lower ponds volumes (minimum and maximum)
- Pond elevations (minimum and maximum)
- Daily average hourly inflows and outflows (if any) of upper and lower ponds
- Requirements related to elevation changes or discharge rates

*Supporting Documentation for Batteries*

- Battery specifications
- Inverter specifications

### 5.2.4 Combination Resources (Other than Hydropower with Non-Pumped Storage)

Combination Resources (other than Hydropower with Non-Pumped Storage) include hybrids of generation plus storage located at the same site with a single shared Point of Interconnection. Such resources must provide the following data and information:

- Maximum Output Facility (MFO) in MW
- Power rating capability associated with each component (in MW)
- Black Start commitments in MW
- Any other firm commitments in MW and MWh
- Storage inventory capacity for energy storage resource component in MWh
- Charging/discharging roundtrip efficiency

Providers of a Combination Resource that includes a component that is itself a type of ELCC Resource must additionally meet the requirements of the applicable section above for standalone equivalents of such resource. For example, providers of Combination Resources with a wind or solar component must meet the requirements in Section 5.2.1. Providers of Combination Resources with a component that is another types of variable resource must meet the requirements in Section 5.2.2.

### 5.2.5 Hydropower with Non-pumped Storage

A Hydropower with Non-pumped Storage plant is one that has water pondage, a water reservoir, or other water storage that is passively filled from incoming streamflow, and which can actively control the hour-by-hour output of the plant. Providers of such resources must submit the following data and information:

- Hourly maximum power capability for each month since June 2012 through the most recent May 31 (in MW).
- Daily average minimum contractually allowable sustained water flow (in cubic feet per second) for each day from June 2012 through the most recent May 31. Minimum sustained water flow is that which can be maintained for 20 hours per day. These values are not based on historical actual water flow values, but instead on the contracts that will be in place in the target Delivery Year. These values reflect governing agreements (such as FERC licenses), river sharing agreements, and any other governing contracts that will be in place in the target Delivery Year. If such contract levels are dependent on water flow levels or other conditions, these values should reflect the impact of those actual historical water flow levels and other historical conditions on the contractual minimum flows for the applicable day.
- Monthly average values for the ratio of the number of cubic feet of water required to produce a single MWh for each month from June 2012 through the most recent May.
- 24-hour rolling average streamflow data in cubic-feet per hour, for each hour from June 1, 2012, through the most recent May 31, and 24-hour rolling average data on incoming available water energy in MWh per hour, for each hour from June 1, 2012 through the most recent May 31, together with a description and justification for the method for converting streamflow to available MWh. If a valid source of such data is not available, PJM will work with the corresponding owner/operator to identify an alternate data source
- Ordinary daily water storage capability, which can vary monthly, in various forms: cubic feet, converted to MWh, and in terms of daily minimum and maximum forebay elevations, together with a description and justification for the method for converting water storage in cubic feet or forebay elevation to MWh.
- Exigent water storage capability—water storage that is only available on exceptionally high load days or on a PJM-declared emergency, which can vary monthly, in various forms: cubic feet, converted to MWh, and in terms of daily minimum and maximum forebay elevations, together with a description and justification for the method for converting water storage in cubic feet or forebay elevation to MWh.
- Any cascading relationships to ordinary or exigent storage in plants on the same river system in MW. In the ELCC model, water discharges from upstream hydro plants with cascading relationships will be available to downstream hydro plants for generation or storage.
- Any Black Start commitments, in MW.
- Any other firm commitments, in MW and MWh, together with a description of the nature of such firm commitments.

*Supporting Documentation for Hydropower with Non-pumped Storage*

Owners of Hydropower with Non-pumped Storage plants must provide documentation to support the parameters provided for dispatch modeling. This documentation must support a) their plants' physical capabilities; b) show that the parameters do not violate any operational limits of the plant; and c) show full authorization from FERC, river basin commissions, and any other applicable authorities to meet those capabilities.

- FERC license
- Documents from river basin authorities
- Any relevant river-sharing agreements
- Geographical information
- Storage information to support storage MWh values (ordinary and exigent)

## Section 6: Backcasts

For resources that entered service after June 1, 2012, a backcast is required so that a complete time series of estimated output stretching from June 1, 2012 until the most recent May 31 can be identified. This time series is used in developing the ELCC Resource hourly output shapes and in calculating the ELCC Resource Performance Adjustments.

For onshore wind and solar resources, PJM will develop the backcasts, unless a Generation Capacity Resource Provider requests to use their own PJM-validated backcast. Where data is available prior to development of a given backcast, PJM will use the actual plant characteristics to develop a unit-specific backcast; otherwise, PJM will use a generic backcast that corresponds to the overall technology type and location of the resource. PJM will update onshore wind and solar backcasts on a regular basis, including using additional available data to enhance backcasts developed in prior years. Backcasts for existing units that will be tuned on a regular basis using actual output data.

Where possible, backcasts should reflect changes in plant characteristics, including deterioration, enhancements to control systems, derates, uprates, and other physical changes.

# Section 7: ELCC Transition Mechanism

## 7.1 Introduction

<Diagrams and language to assist in understanding corresponding RAA language>

The groupings for the purposes of sharing the risk that a floor "binds" and therefore reduces the ELCC Class Rating are as follows:

A. <insert groupings here>

## 7.2 General Provisions of the ELCC Transition Mechanism

A resource that chooses offer or provide less capacity than its Accredited UCAP will nonetheless maintain its applicable table of minimum values ("floors").

An uprate for a resource is treated as a separate resource with separate floors.

The floor value applicable to an ELCC Resource is not transferable to a different ELCC Resource.

While floor values issued for a specific resource generally would not be changed, such change is required under these circumstances:

A. The resource has inaccurately represented its physical capabilities for the purposes of calculating floors
B. The physical characteristics of the resource have diminished, or the other firm commitments have increased, relative to the time when floors were initially calculated
C. The resource changes its parameters such that it falls into a different resource class
D. The ELCC Class for a resource has been merged with another ELCC Class, or split, or otherwise materially redefined such that the aggregate performance of the new ELCC Class is materially distinct from that of the old ELCC Class
E. The sum of the Accredited UCAP values of the resources in the ELCC model calculated on the basis of the previously issued floors exceeds the Portfolio UCAP

<Method for changing floors in scenario D and E above>

<Arithmetic for allocation the "cost" of supporting floors>

<Development of conservative resource mix forecast>

<handling of plant derates, uprates, and other physical changes>