



Terminology for ICAP, UCAP, CIRs, and ELCC: Definitions and Functions **(July 2020 revision)**

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- CIRs = rights for Generation Capacity Resources to “firm deliverability” on the transmission network. PJM maintains physical firm deliverability commensurate with CIRs.
- UCAP = is the denomination of the Capacity Market. UCAP is also “Unforced Capacity”, i.e., ICAP that is not on forced outage. UCAP is the product being offered/transacted/delivered. A resource can provide up to a given UCAP, which corresponds to their “capacity value”.
- ICAP = “summer rated capability” or “summer rating”, a physical characteristic of a unit.
- The term “CIR” is not a synonym for “capacity value” nor for “ICAP”, and they are often not the same numbers even in the case of in-service wind and solar under the status quo.



Manual 18: UCAP Is the Denomination for RPM

- “In the Reliability Pricing Model, Unforced Capacity is the basis for the market product that is cleared in each auction. Unforced Capacity (UCAP) is installed capacity rated at summer conditions that is not, on average, experiencing a forced outage or forced de-rating. While unforced capacity (UCAP) is the basis for the valuation of generating capacity, in RPM, this concept is also used to value load management (Demand Resources (DR) , Energy Efficiency, Reliability Requirements of RTO and LDAs, and to define load obligations of Load Serving Entities.”
- Manual 18 also offers a view of ICAP: “The installed capacity (ICAP) value of a generation resource is based on the summer net dependable rating of a unit as determined in accordance with PJM’s Rules and Procedures [i.e., Manual 21], also referred to as “Iron in the Ground””.



Suggested ELCC Terminology

- Class ELCCMW – the total reliability value of a class as determined by the ELCC model
- Maximum Facility Output – similar to nameplate, defined in the Tariff: *“Maximum Facility Output” shall mean the maximum (not nominal) net electrical power output in megawatts, specified in the Interconnection Service Agreement, after supply of any parasitic or host facility loads, that a Generation Interconnection Customer’s Customer Facility is expected to produce, provided that the specified Maximum Facility Output shall not exceed the output of the proposed Customer Facility that Transmission Provider utilized in the System Impact Study.*
- Class ELCC%– the ELCC percentage derate for units in a class, applied to a rated MW characteristic of a given unit (e.g., nameplate or Maximum Facility Output or ICAP)
- Performance Adjustment – a factor applied to a specific unit in addition to the class ELCC% in order to arrive at a final **Accredited** UCAP (i.e., capacity value) **accreditation**
- Unit ELCCMW – ultimate result of the ELCC policy process that determines the **Accredited** UCAP value **accreditation** (i.e., capacity value)
- **Accredited UCAP Accreditation – a value used for a capacity market function, for example, determining final UCAP, or capping the amount of MW that can be offered in an auction. The maximum UCAP that a unit is allowed/eligible to offer or deliver. Accredited UCAP accounts for both ClassELCC% and Performance Adjustment.**
- **Fixed ClassELCC% approach Vintage – A “vintage” ELCC approach** fixes the ClassELCC% of a resource at the value calculated for the year the project hits a certain milestone (e.g., entering the Queue or first offering into an RPM auction). This **capacity-value ClassELCC%** is fixed for a number of years or the life of the unit, **however the Accredited UCAP can still vary according to performance.**
- **Locked ClassELCC% approach – a guaranteed ClassELCC% value used for accreditation multiple delivery years in the future. The Locked ClassELCC% may be a different value for different years.**



CIRs for Units Other than Wind and Solar Are Related to and Sometimes Derived from ICAP

- In principle, planned units should not request CIRs in excess of ICAP.
- Existing unit CIRs are updated based on the highest of the last 3 years summer test, not to exceed the current CIRs (unless the unit achieves an uprate in the Queue).
- ICAP is summer rating. Manual 21 Section 1.2: *“The ICAP for any generating unit is the sum of the summer based capacity modifications (CAPMODs) in the RPM Capacity Markets system for that date. The ICAP is equivalent to the claimed installed capacity in PJM eGADS and the Summer Net Capability defined in section 2.2 of this document.”*
- ICAP and CIRs are different parameters that generally use similar metrics (summer test for CIRs vs. summer rating for ICAP).
- ICAP is also capped by CIRs. Manual 21: *“Net capability [that is, ICAP] is discussed in section 2 of this manual and cannot be higher than the CIR level”.*
- Corner case example: unit with 100 MW CIRs and an ICAP of 99 MW:
 - Tests to 100 MW, keeps CIRs. ICAP is still 99 MW, if the unit doesn’t CAPMOD (via testing) then ICAP stays at 99 MW.



Simplified Description of CIR Status Quo

Note: in general, updated CIRs are the maximum of the last 3 year's values for the below (not to exceed existing CIRs), and so can be slightly higher or lower than the current year's value of the below metrics.

- Wind/solar = 368 hour rule
- Other intermittent = ICAP (planned) or summer test (existing)
- Limited duration = ICAP = lesser of (summer rating as tested) or (MFO*10 hour rule)
- Hybrid solar+storage and wind+storage:
 - If cannot charge from grid: CIRs of wind/solar component
 - If can charge from grid: sum of CIRs of wind/solar component and ESR component



Details of Manual 18 and Manual 21 Regarding ICAP, UCAP, and CIRs

- Resources must have firm deliverability (i.e., CIRs) for MW offered/delivered in the Capacity Market
- That is: Capacity Market offers and deliveries cannot exceed CIR MWs.
- Manual 21 caps ICAP at CIRs:
 - *“Installed Capacity (ICAP) of a generation resource is defined 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.”*
 - *“**The ICAP is equivalent to** the claimed installed capacity in PJM eGADS and **the Summer Net Capability** defined in section 2.2 of this document.”*
 - *“The CIR level of a generating unit is reflective of the net capability of the generating unit at the time of the expected summer peak (this does not include wind and solar units; wind and solar units CIRs are discussed in section 1.1.7 below). **Net capability is discussed in section 2 of this manual and cannot be higher than the CIR level;**”*
- The Tariff caps offers at ICAP:
 - *“The Office of the Interconnection shall determine **the quantity of installed capacity available for sale** in a Base Residual Auction or Incremental Auction as of the beginning of the period during which Buy Bids and Sell Offers are accepted for such auction, as applicable, in accordance with the time schedule set forth in the PJM Manuals.”*



Manual 18 States the Purpose of RPM in terms UCAP & ICAP

- “Section 1.3 Definition and Purpose of the Reliability Pricing Model--...The RPM is a multi-auction structure designed to procure resource and PRD commitments to satisfy the region’s unforced capacity obligation through the following market mechanisms: a Base Residual Auction, Incremental Auctions and a Bilateral Market.”
- “Section 4.1 Overview of Supply in the Reliability Pricing Model--In the Reliability Pricing Model, the supply of installed capacity is procured to meet demand as a function of the clearing of the RPM Auctions. In each auction, a supply curve is defined based on the offers submitted by providers with installed capacity resources. Supply, valued as unforced capacity, which is procured in the RPM multi-auction clearing process, ensures that sufficient resources are committed to meet the PJM Reliability Principles and Standards.”



Manual 18 on the Purpose of RPM—cont'd

- “The purpose of PJM RTO resource adequacy is to determine the amount of Capacity Resources that can be required to serve the forecast load and satisfy the PJM reliability criterion. PJM performs an assessment of resource adequacy each year for an eleven-year future period. The analysis considers load forecast uncertainty, forced outages of Generation Capacity Resources, as well as planned and maintenance outages. **In PJM, studies are performed using the installed capacity values of resources. The reliability value of a resource depends on two variables: the installed capacity of the resource and a measure of the probability that a resource will not be available due to forced outages or forced de-ratings.** The reliability criterion is based on Loss of Load Expectation (LOLE) not exceeding one occurrence in ten years. The resource requirement to meet the reliability criterion is expressed as the Installed Reserve Margin (IRM) as a percentage of forecast peak load.”...
- “While IRM multiplied by peak load forecasts provides the installed capacity required to meet the reliability criterion, the Forecast Pool Requirement (FPR) multiplied by peak load forecasts provides unforced capacity values, required to meet the reliability criterion. Therefore, to express the Installed Reserve Margin (IRM) as an unforced capacity value, the calculation of the Forecast Pool Requirement must consider the forced outage rates of all generating units, or the Pool-wide Average EFORd. The Forecast Pool Requirement is the measure determined for the specified Delivery Year to establish the level of unforced capacity (UCAP) that will provide an acceptable level of reliability consistent with PJM Reliability Principles and Standards.”...
- “The IRM is expressed as the installed capacity reserve as a percent (e.g. 15%) of the forecast peak load, whereas the FPR (e.g., 1.079) when multiplied by forecast peak load provides of the total unforced capacity required.”

- **“The installed capacity (ICAP) value of a generation resource is based on the summer net dependable rating of a unit as determined in accordance with PJM’s Rules and Procedures, also referred to as “Iron in the Ground””.**
- “Daily Summer Net Dependable Rating is the daily summer ICAP rating of the unit that is based on approved Capacity Modifications for the unit in the Capacity Exchange system.”
- “A party’s Daily ICAP Owned for a specific **demand resource** is equal to the Daily Nominated DR Value adjusted for the ICAP amounts transacted through a party’s approved unit-specific bilateral sales/purchases for such demand resource in effect for such day. The Daily Nominated DR Value for a Demand Resource for a Delivery Year is established based on confirmed Demand Resource Registrations in “completed” status linked to such Demand Resource in the DR Hub system.”
- “The purpose of a CAP MOD is to establish the installed capacity value of a generation resource in the Capacity Exchange system. CAP MOD transactions represent permanent changes to the installed capacity value of a generation unit. CAP MODs are also used by a generation owner to establish the capacity value of a solar or wind resource to be offered into the PJM Capacity Market and by PJM to establish the Delivery Year capacity value of a solar or wind resource.”

- **“The unforced capacity (UCAP) value of a generation resource is installed capacity rated at summer conditions that is not on average experiencing a forced outage or forced de-rating.”**
- “Effective with the 2018/2019 Delivery Year, the unforced capacity (UCAP) value of a Load Management product is equal to the Nominated Value of that product multiplied by the Forecast Pool Requirement.”
- “A resource committed to RPM is expected to be able to deliver unforced capacity during the Delivery Year that is equal to or greater than the unforced capacity committed through RPM Auctions or through the specification of replacement capacity.”
- “The Daily Capacity Resource Deficiency Charge is applicable to a capacity resource with a RPM commitment that does not have enough unforced capacity value on such resource to cover its RPM commitments.”



Manual 18: ICAP can be converted into UCAP denomination

- “The ICAP MW quantity specified in the Offer Segment will be converted into an UCAP MW quantity by the sell offer EFORd for use in the auction clearing. The sell offer price specified in the Offer Segment is in UCAP terms and will not be converted for use in the auction clearing.”



Manual 21: Definition of CIRs & ICAP, also CIRs cap ICAP

- “PJM’s planning department determines whether the transmission and/or distribution system can receive power commensurate with the CIR level of a generating unit and whether upgrades to the system are needed in order to receive the power therein. CIRs are evaluated under summer peak conditions.”
- “Installed Capacity (ICAP) of a generation resource is defined 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... **The ICAP is equivalent to** the claimed installed capacity in PJM eGADS and **the Summer Net Capability** defined in section 2.2 of this document.”
- “The CIR level of a generating unit is reflective of the net capability of the generating unit at the time of the expected summer peak (this does not include wind and solar units; wind and solar units CIRs are discussed in section 1.1.7 below). **Net capability is discussed in section 2 of this manual and cannot be higher than the CIR level;**”
- “CIR calculations for wind and solar resources are based on the summer peak hour capacity factor of each wind/solar resource.”

- *“Capacity Interconnection Rights” shall mean 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.”*
- **Tariff Sec. 230.1 Capacity Interconnection Rights, Purpose:**
“Capacity Interconnection Rights shall entitle the holder to deliver the output of a Generation Capacity Resource at the bus where the Generation Capacity Resource interconnects to the Transmission System.”

- “ICAP is also the capability of the generating unit at the expected time of the PJM Summer Peak. This is also referred to as the “rated capability” or “rated ICAP.” Rated capability or rated ICAP is determined by adjusting the generators capability for generator site conditions coincident with the dates and times of the last 15 years PJM summer peaks. Generator site conditions coincident with the last 15 years’ PJM summer peaks are also known as summer conditions. Summer Conditions are specifically defined in section 2.2, item 2 of this manual. Generator capability corrected to summer conditions is a proxy for a generators capability at future PJM summer peaks. All generators that are affected by generator site conditions that participate in the PJM Markets must correct their generators capability to summer conditions...Additionally, streamflow and forebay (reservoir) elevation (head) are generator site conditions specific to hydroelectric units and state of charge is a generator site condition applicable to battery storage units.”
- “If the Net Capability, at times, is limited by water or fuel availability, the Net Capability should be based on the expected streamflow or expected fuel availability at the time of the summer PJM peak.”
- “All or any part of a unit's capability that can be sustained for a number of hours of continuous operation commensurate with PJM load requirements, specified as 10 hours, shall be considered as unlimited energy capability. All or any part of a unit's capability that cannot be sustained for a number of hours of continuous operation commensurate with PJM load requirements, specified as 10 hours, shall be considered as limited energy capability. Such limited energy capability will be used to meet the energy requirements of PJM and depending on the extent to which it meets these requirements such capability may be reduced as provided in Schedule 9 of the Reliability Assurance Agreement (RAA).”



Manual 21 Appendix B for Calculating the Capacity Value of Wind/Solar

- The Capacity Value for a wind or solar capacity resource represents that amount of generating capacity, expressed in MW that it can reliably contribute during summer peak hours and **which can be offered as unforced capacity** into the PJM capacity markets.
- The mean of single year capacity factors for each of the prior three years results in a Capacity Factor representative of the three prior years. **That Capacity Factor, when multiplied by the current Net Maximum Capacity yields the current capacity value (UCAP) for that wind or solar capacity resource.** This two- step process accommodates any changes in the Net Maximum Capacity that may have occurred during the prior three summers of operation.



Summary of Resource-Specific Status Quo Regarding ICAP, UCAP, and CIRs



Status Quo

	Thermal	Wind/Solar	Limited Duration	Hydro w/ Storage	Other Intermittent	DR
ICAP (cannot exceed CIRs)	Summer rating	<N/A> (in Capacity Exchange, ICAP is set to UCAP)	Lesser of summer rating or 10-hour rule derating	Summer rating	Summer rating	Nominated value
UCAP	ICAP* (1-EFORd)	368-hour rule (average of last 3 years, cannot exceed CIRs)	ICAP*(1-EFORd)	ICAP* (1-EFORd)	ICAP* (1-EFORd)	[Nominated value]*(1+FPR)
CIR eligibility of Planned resources should not exceed→	ICAP	Class average or unit-specific 368-hour rule	ICAP	ICAP	ICAP	<N/A>
CIR retention for existing resources is highest of last 3 years metric→	Summer test	368-hour rule	Summer test	Summer test	Summer test	<N/A>
Other term	<N/A>	Capacity value = 368-hour rule = UCAP	<N/A>	<N/A>	<N/A>	Nominated value
DA Must Offer	ICAP	Varies	Varies	Varies	Varies	<N/A>
CP penalty/bonus	UCAP	UCAP	UCAP	UCAP	UCAP	UCAP ICAP
RPM MW value for sales, delivery, FRR, replacement transactions, etc.	UCAP	UCAP	UCAP	UCAP	UCAP	UCAP



HYPOTHETICAL NUMERICAL EXAMPLES Status Quo

	100 MW MFO Gas Turbine	100 MW MFO Solar	100 MW MFO, 400MWh battery	100 MW MFO Hydro w/ Storage	100 MW Run-of-River Hydro without Storage
ICAP (cannot exceed CIRs)	Summer rating = 96 MW	<N/A> (in Capacity Exchange, ICAP is set to UCAP)	Lesser of summer rating or 10-hour rule derating → $(400\text{MWh}/100\text{MW}) \div (10\text{hrs}) \rightarrow 40\text{ MW}$	Summer rating = 96 MW	Summer rating considering streamflow etc. = 60 MW
UCAP	$\text{ICAP} \times (1 - \text{EFORd}) \rightarrow 96 \times (1 - 12.5\%) = 84\text{ MW}$	3-year average 368-hour rule → 60 MW	$\text{ICAP} \times (1 - \text{EFORd}) \rightarrow 40 \times (1 - 12.5\%) = 35\text{ MW}$	$\text{ICAP} \times (1 - \text{EFORd}) \rightarrow 96 \times (1 - 12.5\%) = 84\text{ MW}$	$\text{ICAP} \times (1 - \text{EFORd}) \rightarrow 60 \times (1 - 12.5\%) = 52.5\text{ MW}$
CIR eligibility of Planned resources should not exceed →	ICAP = 96 MW	Class average 368-hour rule = 60 MW	ICAP = 40 MW	ICAP = 96 MW	ICAP = 60 MW
CIR retention for existing resources is highest of last 3 years metric →	One or more summer tests meet or exceed 96 MW	One or more 368-hour rule results meet or exceed 60 MW	10-hour rule is still 40 MW, summer tests all exceed 40 MW	One or more summer tests meet or exceed 96 MW	One or more summer tests meet or exceed 60 MW
DA Must Offer	ICAP = 96 MW	Varies	Varies	Varies	Varies
CP penalty/bonus	UCAP = 84 MW	UCAP = 60 MW	UCAP = 35 MW	UCAP = 84 MW	UCAP = 52.5 MW
RPM MW value <i>for sales, delivery, FRR, replacement transactions, etc.</i>	UCAP = 84 MW	UCAP = 60 MW	UCAP = 35 MW	UCAP = 84 MW	UCAP = 52.5 MW



Initial PJM Package

	<i>Thermal (for reference)</i>	Wind/Solar	Limited Duration	Hydro w/ Storage	Other Intermittent
ICAP (cannot exceed CIRs)	<i>Summer rating</i>	Status quo - <N/A> (in Capacity Exchange, ICAP is set to UCAP)	Lesser of summer rating or X-hour rule derating, where X is the duration of the class	Status quo = Summer rating	Status quo = Summer rating
UCAP	<i>ICAP* (1-EFORd)</i>	368-hour rule MFO*ClassELCC%* PerfAdj	<i>ICAP*ClassELCC%* (1-EFORd)</i>	<i>ICAP* (1-EFORd) TBD</i>	<i>ICAP*(1-EFORd) MFO*ClassELCC%* PerfAdj</i>
<i>CIR eligibility of Planned resources should not exceed → (status quo)</i>	<i>ICAP</i>	<i>Class average or unit-specific 368-hour rule</i>	<i>ICAP</i>	<i>ICAP</i>	<i>ICAP</i>
<i>CIR retention for existing resources is highest of last 3 years metric → (status quo)</i>	<i>Summer test</i>	<i>368-hour rule</i>	<i>Summer test</i>	<i>Summer test</i>	<i>Summer test</i>
<i>DA Must Offer (status quo)</i>	<i>ICAP</i>	<i>Varies</i>	<i>Varies</i>	<i>Varies</i>	<i>Varies</i>
<i>CP penalty/bonus (status quo)</i>	<i>UCAP</i>	<i>UCAP</i>	<i>UCAP</i>	<i>UCAP</i>	<i>UCAP</i>
<i>RPM MW value for sales, delivery, FRR, replacement transactions, etc.</i>	<i>UCAP</i>	<i>UCAP</i>	<i>UCAP</i>	<i>UCAP</i>	<i>UCAP</i>



Initial PJM Package – **Hypothetical** Numerical Examples

	<i>Thermal (for reference)</i>	100 MW MFO Solar	100 MW, 400 MWh Battery in 6 hour class	Hydro w/ Storage TBD	100 MW Run-of-River Hydro without Storage
ICAP (cannot exceed CIRs)	<i>Summer rating</i>	Status quo - <N/A> (in Capacity Exchange, ICAP is set to UCAP)	Lesser of summer rating (100 MW) or 6-hour rule derating (66.7 MW) → 66.7 MW	Status quo = Summer rating	Status quo = Summer rating considering streamflow etc. = 60 MW
UCAP	<i>ICAP* (1-EFORd)</i>	368-hour rule MFO*ClassELCC%*PerfAdj 100MW*50%*110% = 55MW	ICAP*ClassELCC%* (1-EFORd) = 66.7MW*75%*(1-10%) → 45.0 MW	ICAP* (1-EFORd) TBD	ICAP*(1-EFORd) MFO*ClassELCC%*PerfAdj = 100MW*45%*110% = 49.5 MW
<i>CIR eligibility of Planned resources should not exceed → (status quo)</i>	<i>ICAP</i>	<i>Class average or unit-specific 368-hour rule = 60 MW</i>	<i>ICAP = 66.7 MW</i>	<i>ICAP</i>	<i>ICAP = 60 MW</i>
<i>CIR retention for existing resources is highest of last 3 years metric → (status quo)</i>	<i>Summer test</i>	<i>One or more 368-hour rule results meet or exceed 60 MW → 60 MW retained</i>	<i>Summer tests all exceed 66.7 MW, 6-hour rule equals 66.7 MW → 66.7 retained</i>	<i>Summer test</i>	<i>Summer tests all exceed 60 MW → 60 MW retained</i>
<i>DA Must Offer (status quo)</i>	<i>ICAP</i>	<i>Varies</i>	<i>Varies</i>	<i>Varies</i>	<i>Varies</i>
<i>CP penalty/bonus (status quo)</i>	<i>UCAP</i>	<i>UCAP = 60 55 MW</i>	<i>UCAP = 66.7 45 MW</i>	<i>UCAP</i>	<i>UCAP = 49.5 MW</i>
<i>RPM MW value for sales, delivery, FRR, replacement transactions, etc.</i>	<i>UCAP</i>	<i>UCAP = 60 55 MW</i>	<i>UCAP = 66.7 45 MW</i>	<i>UCAP</i>	<i>UCAP = 49.5 MW</i>



Supporting Manual and Tariff Language



Variable Day-ahead Must Offer Obligation

Tariff Att K Appendix Sec. 1.10

- *Such [Day-ahead Energy Market must offer] offers shall be based on the ICAP equivalent of the Market Seller's cleared UCAP capacity commitment, provided, however, **where the underlying resource is a Capacity Storage Resource or an Intermittent Resource**, the Market Seller shall satisfy the must offer requirement by either self-scheduling or offering the unit as a dispatchable resource, in accordance with the PJM Manuals, where the hourly day ahead self-scheduled values for such Capacity Storage Resources and Intermittent Resources may vary hour to hour from the capacity commitment.*



Capacity Performance Expected Performance

Manual 18 Section 8.4A

- For each Performance Assessment Interval, the Expected Performance is equal to:
 - for each generation resource (including External Generation Capacity Resources when applicable), the resource's committed Unforced Capacity times the ratio of [(total amount of Actual Performance for all generation resources, plus net energy imports, plus total Demand Response Bonus Performance for that interval, plus total PRD Bonus Performance for that interval (effective with the 2022/2023 Delivery Year) / (total amount of committed Unforced Capacity of all Generation Capacity Resources)];



CIRs for Units Other than Wind and Solar Are Related to and Sometimes Derived from ICAP

- In principle, planned units should not request CIRs in excess of ICAP.
- Existing unit CIRs are updated based on the highest of the last 3 years summer test, not to exceed the current CIRs (unless the unit Queue for an uprate).
- ICAP is summer rating. Manual 21 Section 1.2: *“The ICAP for any generating unit is the sum of the summer based capacity modifications (CAPMODs) in the RPM Capacity Markets system for that date. The ICAP is equivalent to the claimed installed capacity in PJM eGADS and the Summer Net Capability defined in section 2.2 of this document.”*
- ICAP and CIRs are different parameters that use similar metrics (summer test for CIRs vs. summer rating for ICAP).
- ICAP is also capped by CIRs. Manual 21: *“Net capability [that is, ICAP] is discussed in section 2 of this manual and cannot be higher than the CIR level”.*
- Corner case example: unit with 100 MW CIRs and an ICAP of 99 MW:
 - Tests to 100 MW, keeps CIRs. ICAP is still 99 MW, if the unit doesn’t CAPMOD (via testing) then ICAP stays at 99 MW.



UCAP = ICAP*(1-EFORd) for All Resources Except Wind/Solar

- Manual 18 Section 4.7.1
“Resource Position for Generation Capacity Resources
A party’s Daily Generation Capacity Resource Position in unforced capacity terms is calculated dynamically by the Capacity Exchange system for each unit and is equal to the party’s Daily ICAP Owned on a unit multiplied by one minus the unit’s Effective EFORd.”
- Manual 18 Section 4.2.5
“Since no forced outage data is collected for solar or wind resources, an EFORd is not calculated for solar or wind resources. The EFORd of solar or wind resources is set to zero in the Capacity Exchange system.”
- And the RAA definition of UCAP:
““Unforced Capacity” shall mean installed capacity rated at summer conditions that is not on average experiencing a forced outage or forced derating, calculated for each Capacity Resource on the 12-month period from October to September without regard to the ownership of or the contractual rights to the capacity of the unit.”

	Wind/Solar
ICAP	<N/A or UCAP>
UCAP	368-hour rule
CIR	368-hour rule
Other term	Capacity value = 368-hour rule = UCAP

Manual 21:

- **CIRs:** Section 1.1.7— “CIR calculations for wind and solar resources are based on the summer peak hour capacity factor of each wind/solar resource.”
- **UCAP:** Appendix B—“The Capacity Value for a wind or solar capacity resource represents that amount of generating capacity, expressed in MW that it can reliably contribute during summer peak hours and which can be offered as unforced capacity into the PJM capacity markets” ...“That Capacity Factor, when multiplied by the current Net Maximum Capacity yields the current capacity value (UCAP) for that wind or solar capacity resource.”

Manual 18

- Section 4.2.5—“Since no forced outage data is collected for solar or wind resources, an EFORD is not calculated for solar or wind resources. The EFORD of solar or wind resources is set to zero in the Capacity Exchange system.”



Run of River Hydro with no storage

	Other Intermittent
ICAP	Summer rating
UCAP	ICAP*(1-EFORd)
CIR	ICAP

Manual 21 on **ICAP**:

- *“Run of river hydroelectric units (without pooling/storage/dispatch capability) must have their ICAP determined by adjusting for forebay inflows and head (reservoir level/elevation) under summer conditions.”*
- *“The determination of Net Capability (rated ICAP) for a hydro unit (without storage and pooling capability) shall be based on the expected head and streamflow at the expected time of the PJM peak under summer conditions.”*
- *“The Net Capability (rated ICAP) of a planned hydro unit (without storage and pooling capability) shall be based on the expected head and streamflow at the expected time of the PJM peak under summer conditions. All units at the respective plant must be rated for simultaneous operation for the expected site conditions coincident with the last 15 years PJM summer peaks (i.e. under summer conditions pursuant to section 1.2 of this manual).”*
- *“If the Net Capability, at times, is limited by water or fuel availability, the Net Capability should be based on the expected streamflow or expected fuel availability at the time of the summer PJM peak.”*



Other Intermittent Resources (Single Fuel Landfill Gas)

	Landfill Gas
ICAP	Summer rating
UCAP	$ICAP * (1 - EFOR_d)$
CIR	ICAP

Manual 21 on **ICAP**:

- The Net Capability (rated ICAP) of a generating unit consuming landfill gas shall be based on the availability of landfill gas at the expected time of the PJM peak under summer conditions.
- The Net Capability (rated ICAP) of a planned generating unit consuming landfill gas shall be based on the availability of landfill gas at the expected time of the PJM peak under summer conditions. All units at the respective plant must be rated for simultaneous operation under the expected site conditions coincident with the last 15 years PJM summer peaks (i.e. under summer conditions pursuant to section 1.2 of this manual).



Energy Storage Resources (ESR)

	Limited Duration
ICAP	Lesser of summer rating or 10-hour rule derating
UCAP	ICAP*(1-EFORd)
CIR	ICAP

“All or any part of a unit's capability that can be sustained for a number of hours of continuous operation commensurate with PJM load requirements, specified as 10 hours, shall be considered as unlimited energy capability. All or any part of a unit's capability that cannot be sustained for a number of hours of continuous operation commensurate with PJM load requirements, specified as 10 hours, shall be considered as limited energy capability. Such limited energy capability will be used to meet the energy requirements of PJM and depending on the extent to which it meets these requirements such capability may be reduced as provided in Schedule 9 of the Reliability Assurance Agreement (RAA).”

Manual 21 on ESR ICAP:

- The determination of Net Capability (rated ICAP) for a storage (non-hydro) unit shall recognize the MWH energy available, giving proper consideration to other market activities for which the storage (non-hydro) unit may be committed during the expected time of the PJM peak. All units at the respective plant must be rated for simultaneous operation under the expected site conditions coincident with the last 15 years PJM summer peaks (i.e. under summer conditions pursuant to section 1.2 of this manual).
- The Net Capability (rated ICAP) of a planned storage (non-hydro) unit shall be based on the MWH energy available, given proper consideration to other market activities in which the unit may be participating at the expected time of the PJM peak under summer conditions. All units at the respective plant must be rated for simultaneous operation under the expected site conditions coincident with the last 15 years PJM summer peaks (i.e. under summer conditions pursuant to section 1.2 of this manual).
- Pumped storage hydroelectric units must have their ICAP determined by adjusting for head (reservoir level/elevation) under summer conditions.
- Battery storage units must have their ICAP determined by adjusting for state of charge under summer conditions. Also, all units at the plant must have their rated ICAP based on simultaneous operation.



Hydro with Storage

	Hydro w/ Storage
ICAP	Summer rating
UCAP	ICAP*(1-EFORd)
CIR	ICAP

Manual 21 on ICAP:

- The determination of Net Capability (rated ICAP) for a hydro (with storage and/or pooling capability) or pumped storage unit shall recognize the head available giving proper consideration to operating restrictions and the reservoir storage program during a normal cycle at the expected time of the PJM peak under summer conditions.
- The Net Capability (rated ICAP) of a planned hydro (with storage and/or pooling capability) or pumped storage unit shall be based on the expected head and/or streamflow in accordance with item 1 above. All units at the respective plant must be rated for simultaneous operation under the expected site conditions coincident with the last 15 years PJM summer peaks (i.e. under summer conditions pursuant to section 1.2 of this manual).
- The determination of Net Capability (rated ICAP) for a run of river hydro unit (with pooling/storage/dispatch capability) shall recognize the head available giving proper consideration to operating restrictions and the reservoir storage program during a normal cycle at the expected time of the PJM peak under summer conditions.
- The Net Capability (rated ICAP) of a planned run of river hydro unit (with pooling/storage/dispatch capability) shall be based on the expected head and/or streamflow in accordance with item 1 above. All units at the respective plant must be rated for simultaneous operation under the expected site conditions coincident with the last 15 years PJM summer peaks (i.e. under summer conditions pursuant to section 1.2 of this manual).
- Run of river hydroelectric units (with pooling/storage/dispatch capability) must have their ICAP determined by adjusting for forebay inflows and head (reservoir level/ elevation) under summer conditions.



Thermal Resources – Steam Units

	Thermal
ICAP	Summer rating
UCAP	ICAP*(1-EFORd)
CIR	ICAP

Manual 21 on **ICAP** (small sample):

- a. Steam units with only once through cooling must have their ICAP determined by adjusting for cooling body (circulating water) temperature under summer conditions.
- b. Steam units with only wet cooling towers must have their ICAP determined by adjusting for wet bulb temperature under summer conditions. Basically this is an adjustment for temperature and relative humidity; however, barometric pressure can affect the wet bulb temperature and adjustments for barometric pressure are permitted and encouraged.
- c. Steam units with only dry cooling towers must have their ICAP determined by adjusting for dry bulb temperature under summer conditions.
- d. Steam units with both wet and dry cooling towers must have their ICAP determined by adjusting appropriately for the generator site conditions listed in (b) and (c) above under summer conditions.
- e. Steam units with a combination of once through cooling and wet cooling towers must have their ICAP determined by adjusting appropriately for the generator site conditions in (a) and (b) above under summer conditions.