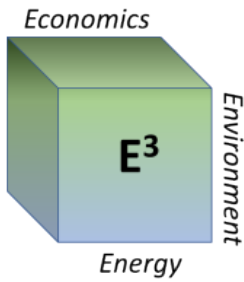


Overview of Issues Regarding CIR for ELCC Resources

Paul M. Sotkiewicz, Ph.D.

June 25, 2022



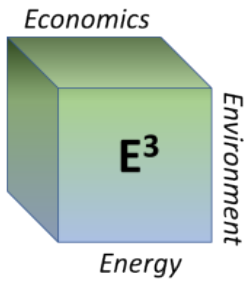
Key Definitions and Terms for the RAA

- **Generation Capacity Resource:**

"Generation Capacity Resource" shall mean a Generating Facility, or the contractual right to capacity from a specified Generating Facility, that meets the requirements of **RAA, Schedule 9 and RAA, Schedule 10**, and, for Generating Facilities that are committed to an FRR Capacity Plan, that meets the requirements of RAA, Schedule 8.1. A Generation Capacity Resource may be an Existing Generation Capacity Resource or a Planned Generation Capacity Resource.

- **Capacity Resources:**

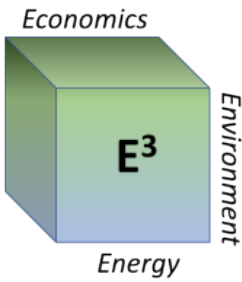
"Capacity Resources" shall mean megawatts of (i) net capacity from Existing Generation Capacity Resources or Planned Generation Capacity Resources meeting the requirements of the **Reliability Assurance Agreement, Schedules 9 and Reliability Assurance Agreement, Schedule 10** that are or will be owned by or contracted to a Party and that are or will be committed to satisfy that Party's obligations under the Reliability Assurance Agreement, or to satisfy the reliability requirements of the PJM Region, for a Delivery Year; (ii) net capacity from Existing Generation Capacity Resources or Planned Generation Capacity Resources not owned or contracted for by a Party which are accredited to the PJM Region pursuant to the procedures set forth in such Schedules 9 and 10; or (iii) load reduction capability provided by Demand Resources or Energy Efficiency Resources that are accredited to the PJM Region pursuant to the procedures set forth in the Reliability Assurance Agreement, Schedule 6.



RAA Schedule 10 Deliverability

SCHEDULE 10: PROCEDURES FOR ESTABLISHING DELIVERABILITY OF GENERATION CAPACITY RESOURCES

-
- **Generation Capacity Resources must be deliverable** consistent with a loss of load expectation as specified by the Reliability Principles and Standards to the total system load, including portion(s) of the system in the PJM Region that may have a capacity deficiency at any time. Deliverability shall be demonstrated by obtaining or providing for Network Transmission Service within the PJM Region such that each Generation Capacity Resource is a Network Resource. In addition, for Generation Capacity Resources located outside the metered boundaries of the PJM Region that are used to meet an Unforced Capacity Obligation, the capacity and energy of such Generation Capacity Resources must comply with the deliverability requirements of PJM Tariff, Attachment DD, section 5.5A, and the receipt of such capacity and energy at the PJM Region interface for delivery to loads in the PJM Region shall be subject to all applicable Capacity Import Limits.
-
- **Certification of deliverability** means that the physical capability of the transmission network has been **tested** by the Office of the Interconnection and found to provide that service consistent with the assessment of available transfer capability as set forth in the PJM Tariff and, for Generation Resources owned or contracted for by a Load Serving Entity, that the Load Serving Entity has obtained or provided for Network Transmission Service to have capacity delivered on a firm basis under specified terms and conditions.



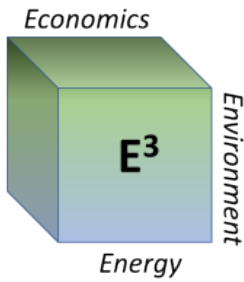
Definition of Energy Resource Distinction from a Capacity Resource in the ISA

- *Pro Forma* Interconnection Service Agreement, section 2.1

Pursuant to and subject to the applicable terms of the Tariff, the Interconnection Customer shall have **Capacity Interconnection Rights at the Point(s) of Interconnection specified in this Interconnection Service Agreement in the amount of ____ MW.** {Instructions: this number is the total of the Capacity Interconnection Rights that are granted as a result of the Interconnection Request, plus any prior Capacity Interconnection Rights}

- *Pro Forma* Interconnection Service Agreement, section 2.1(a)

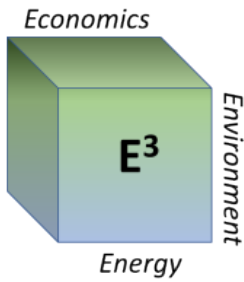
To the extent that any portion of the Customer Facility described in section 1.0 is not a Capacity Resource with Capacity Interconnection Rights, such portion of the Customer Facility shall be an Energy Resource. PJM reserves the right to limit total injections to the Maximum Facility Output in the event reliability would be affected by output greater than such quantity.



Examples

- Wind facility with a Maximum Facility Output (MFO) of 100 MW, requests 13 MW Capacity Interconnection Rights (CIRs).
- Under the terms of the RAA and ISA, only 13 MW have been studied and tested by PJM to be **deliverable**, the remaining 87 MW are considered an energy resource.

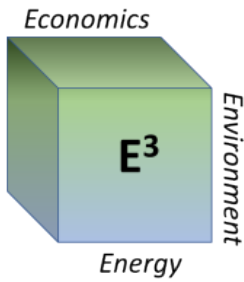
- Thermal resource with 100 MW MFO, requests 95 MW CIRs.
- Under the terms of the RAA and ISA, 95 MW have been studied and tested and the remaining 5 MW are considered an energy resource.



Key RPM Rules from Attachment DD

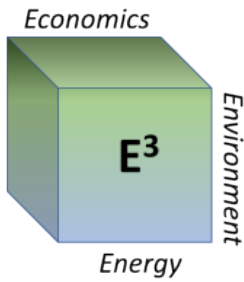
- **5.5 Eligibility for Participation in RPM Auctions**

A Capacity Market Seller may submit a Sell Offer for a Capacity Resource in a Base Residual Auction, Incremental Auction, or Capacity Performance Transition Incremental Auction only if such seller owns or has the contractual authority to control the output or load reduction capability of such resource and has not transferred such authority to another entity prior to submitting such Sell Offer. Capacity Resources must satisfy the capability and deliverability requirements of RAA, [Schedule 9](#) and RAA, [Schedule 10](#), the requirements for Demand Resources or Energy Efficiency Resources in Tariff, [Attachment DD-1](#) and RAA, [Schedule 6](#), as applicable, and, for the 2018/2019 Delivery Year and subsequent Delivery Years, the criteria in Tariff, [Attachment DD, section 5.5A](#).



Capacity Values in RPM: Examples Continued

- Wind facility with a Maximum Facility Output (MFO) of 100 MW has its capacity value determined based upon its capacity factor during the 368 peak summer hours as outlined in Manual 21, Appendix B through the 22/23 DY (pre-ELCC)
- For the sake of example suppose in half those hours, wind output is 26 MW, and the other half it is 0 MW. This gives a capacity factor during summer peak of 13 MW and is the capacity value used in RPM
 - (Consistent reading of previous tariff provision Attachment DD Section 5.6.1 (h) regarding sell offers in isolation without Att. DD Section 5.5)
- Thermal resource with 100 MW MFO, and 95 MW of CIR. Assume a EFORd of 10%, this gives a UCAP value in RPM of 85.5 MW UCAP.



PJM Knows The Capacity of Value of Renewables is Not Entirely Deliverable



Example—Pre-ELCC Accreditation for Wind/Solar: Output Above Tested Deliverability Level Counts

- The “368-hour Rule” in Manual 21 Appendix B sets both the pre-ELCC UCAP levels & the ongoing CIR eligibility/retention of wind/solar based on the **average output across all summer afternoons*** of the last 3 years.
- For example, a hypothetical 100 MW wind unit that during summer afternoons makes 26 MW half the time, and 0 MW the other half of the time, has a 13 MW average summer afternoon output → 13 MW UCAP, can retain 13 MW of CIRs.

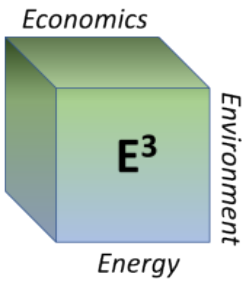
Note: w/ 13 MW of CIRs, there is 13 MW of tested deliverability

*Note: even though the 13 MW of capacity is deliverable under today’s standards, **half of the 26 MW hourly output is above the tested deliverability level. Further note: those MWs can & will still flow in operations if the transmission system has the capability.***

Note: such a wind resource is today not eligible to request 26 MW of CIRs—they are limited to only 13 MW.

**Summer is June, July, and August. afternoon is hour ending 3, 4, 5, and 6 PM Local Prevailing Time*

<https://www.pjm.com/-/media/committees-groups/committees/pc/2022/20220215-special/20220215-item-02d-interactions-of-cirs-deliverability-and-elcc-studies.ashx>



PJM Knows The Capacity of Value of Renewables is Not Entirely Deliverable



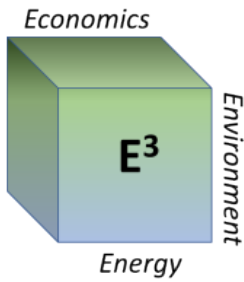
Note: w/ 13 MW of CIRs, there is 13 MW of tested deliverability → **half of the 26 MW hourly output is above the tested deliverability level.**



PJM believes that, under high renewables deployment, it will be important that the transmission system is tested for all meaningful hourly injection levels accounted for in the ELCC accreditation process.

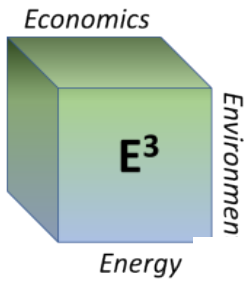
- *I.e., that **the hourly output used for a resource in the UCAP accreditation method does not exceed that resource's tested transmission deliverability level.***

<https://www.pjm.com/-/media/committees-groups/committees/pc/2022/20220215-special/20220215-item-02d-interactions-of-cirs-deliverability-and-elcc-studies.ashx>



Load Has Been Paying for Capacity that Has Not Been Shown or Tested to be Deliverable

- The MMU recommends that intermittent resources, including storage, not be permitted to offer capacity MW greater than the CIR values assigned to such resources. Derating factors and ELCC values are used in capacity auctions to convert the nameplate capacity of intermittent and storage resources into MW of capacity equivalent to resources that can produce for any of the 8,760 hours in a year. Both the capacity derating factors applied to intermittent nameplate capacity in the 2022/2023 BRA and the ELCC calculations to be used for future capacity auctions are based on the assumption that the intermittent resources provide reliable output in excess of their CIRs. But that output is not deliverable when needed for reliability because it is in excess of the defined deliverability rights (CIRs) and therefore should not be included in the definition of intermittent capacity.
- https://www.monitoringanalytics.com/reports/Reports/2022/IMM_Analysis_of_the_20222023_RPM_BRA_20220222.pdf. P.8

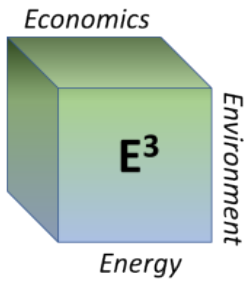


IMM Estimates

Intermittent Generation in Excess of ICAP: 2019-2021

2019 - 2021 Summer Testing Hours (June through August, 2pm - 6pm)			
	MWh	MWh > ICAP	Percent
Solar	1,406,066.2	388,100.9	27.6%
Wind	1,588,997.1	816,952.9	51.4%
Solar & Wind	2,995,063.3	1,205,053.8	40.2%

<https://www.pjm.com/-/media/committees-groups/committees/pc/2022/20220223-special/20220223-item-05-imm-intermittent-output-and-cirs.ashx>

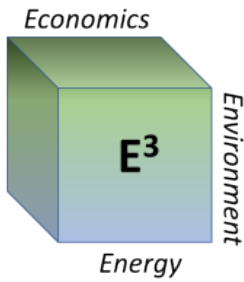


IMM Estimates

Wind and Solar ICAP

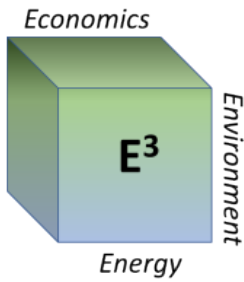
Fuel	Current ICAP (MW)	ICAP based on Max MWH			ICAP based on current CIR levels	
		ICAP ₁ (MW)	Percent Difference	ICAP ₂ (MW)	Percent Difference	
Solar	1,818.4	3,563.3	96.0%	1,455.6	(20.0%)	
Wind	1,575.4	8,922.2	466.3%	804.7	(48.9%)	
Wind & Solar	3,393.8	12,485.5	267.9%	2,260.3	(33.4%)	

<https://www.pjm.com/-/media/committees-groups/committees/pc/2022/20220223-special/20220223-item-05-imm-intermittent-output-and-cirs.ashx>



Capacity Values in RPM and Deliverability: Examples Continued

- By definition from the RAA and ISA:
 - Wind resource when it produces 26 MW, that energy has not been tested as deliverable, only 13 MW has been tested and for which CIRs have been requested and awarded (See PJM presentation July 22, 2021, by Andrew Levitt example on slide 3-6). <https://www.pjm.com/-/media/committees-groups/committees/pc/2021/20210722-special/20210722-item-02-cir-quantities-and-their-use-in-the-elcc-analysis.ashx>
 - Thermal resource with 95 MW of CIR. Assume a EFORd of 10%, this gives a UCAP value in RPM of 85.5 MW UCAP. This resource has been tested up to 95 MW, which supports the UCAP of 85.5 MW
- That is energy that can be produced above the UCAP value has, AND SUPPORTS THE UCAP VALUE, has been tested for the thermal resource but not for the wind resource. (See PJM presentation July 22, 2021, by Andrew Levitt stating, “Because of variable availability for all resource types, CIRs are usually higher than UCAP.” <https://www.pjm.com/-/media/committees-groups/committees/pc/2021/20210722-special/20210722-item-02-cir-quantities-and-their-use-in-the-elcc-analysis.ashx>)

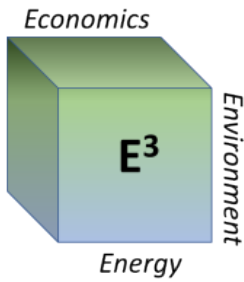


PJM Transition Mechanism



Transition Mechanism for Wind & Solar Units Without ISA

- Alternative 1
 - Transition wind and solar units in Fast Track and Transition Cycle 1 to higher, default CIRs and the load will pay for any required baseline upgrades. (PJM high level estimate of cost to load is ~\$3B – see Appendix 2 for preliminary results summary)
 - Wind and solar units in Transition Cycle 2 need to submit a new queue request for higher CIRs if desired
 - Begin capping ELCC at deliverable MW in 2025/26 BRA

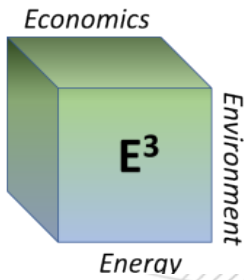


PJM Transition Mechanism



Transition Mechanism for Wind & Solar Units Without ISA

- Alternative 2 (PJM currently recommended)
 - Wind and solar units in Fast Track, Transition Cycle 1 and Transition Cycle 2 that do not have an ISA upon effective date of this proposal will need to submit a new queue request for higher CIRs if desired
 - Begin capping ELCC at deliverable MW in 2025/26 BRA

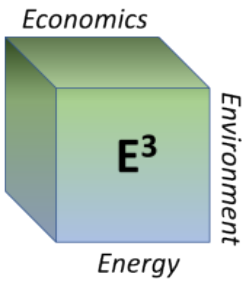


PJM Deliverability in Transition



Assuring Deliverability During the Transition

- During the transition period, prior to each BRA for which such resources are eligible to participate, PJM will run summer, single contingency generator deliverability to determine whether wind and solar units are deliverable.
 - PJM will maximize amount of deliverable wind and solar MW by considering any overloaded flowgates and the DFAX of each wind and solar unit
 - Wind and solar units with an ISA at time of proposal effective date will be turned on first
 - In all cases, wind and solar deliverable MW will be above the requested amount of CIR MW but below the new higher, default amount



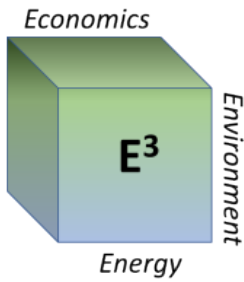
From Slides 7 and 2: These Cannot both Be Right



Additional RTEP Baseline Reliability Violations Under New Generator Deliverability Test

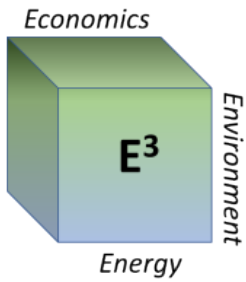
Violation Driver		Summer	Winter	Light Load	Total
Higher Intermittent	# of Violations:	2	0	2	4
	\$M Cost	\$ 7.00	\$ -	\$ 12.00	\$ 19.00
Block Dispatch	# of Violations:	1	1	4	6
	\$M Cost	\$ 28.00	\$ 8.50	\$ 75.00	\$ 111.50
Block Dispatch + Lower Intermittent Helpers	# of Violations:	2	0	0	2
	\$M Cost	\$ 11.50	\$ -	\$ -	\$ 11.50
Impact of All Drivers	# of Violations:	5	1	6	12
	\$M Cost	\$ 46.50	\$ 8.50	\$ 87.00	\$ 142.00

- Both award wind and solar resources having an ISA at time of effective date of proposal with higher, default CIRs and the system will pay for any required baseline upgrades in the 2023 RTEP (currently 5 MW with \$7M upgrades)
 - Summer P80% for solar and offshore wind
 - Summer P90% for onshore wind



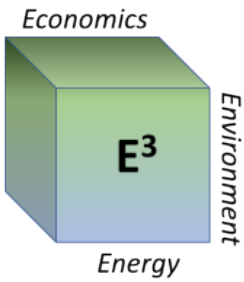
PJM Transition Proposal is Discriminatory

- Treats old and new variable/intermittent resources and thermal resources differently
 - Existing resources plus others are given extra CIRs without having to pay for them. Load pays in part, but the final cost is unknown.
 - Existing resources plus others are effectively allowed to “queue jump” and not required to get back into the queue to obtain extra CIRs.
 - Existing resources plus others are given extra CIRs without having to pay for them. Uses up headroom that queued resources based their decisions on and now will have to pay for more upgrades that they may otherwise not had to pay for.
 - Treats queue positions with existing CIRs in a discriminatory fashion by prioritizing existing resources of a certain type, while existing CIRs must get in the queue and wait their turn.



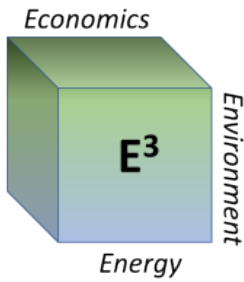
PJM Transition Proposal is Anti-Competitive

- Favors older, less efficient renewables over newer, more efficient renewables by providing load-funded subsidies or direct cross subsidies from those in the queue to existing resources.
- This results in deterring, all else equal, lower cost more efficient renewables to enter while retaining existing renewables
- Picks winners in renewables over other generation types that must get into the back of the queue for uprates



PJM Has Not Thought Through Details of Transition

- PJM has stated it has not decided on whether or not the existing resources getting additional CIRs will get another ISA for the uprates or will have their current ISAs adjusted
- Problem: Absent an ISA memorializing CIRs in an ISA, which are a property right, the CIRs do not contractually exist, cannot be sold, and it is unclear how they can be accounted for in future interconnection studies.
- Problem: CIRs being paid for by load to support renewables...should not load own the CIRs? If it is even possible, how would it be done as no means exists in the PJM governing documents for such possibilities.



PJM Has Not Thought Through Details of Transition

- PJM has not thought about the logical impacts on projects in the queue in moving to the cluster process.
- Problem: PJM has stated it will use the original base cases for the queue positions that applied when they entered. But this does not include upgrades PJM proposes in the transition to give additional CIRs to make existing resources deliverable.
- Problem: Mismatch between the base case studies in the transition queues and what is needed to make existing resources deliverable.
- Problem: The only way this can work is if PJM puts in upgrades in each base case to make existing resources deliverable, so that the base cases for transition queues are not the same as when they entered the queue.