Energy Efficiency Education

Market Implementation Committee

December 6, 2023

Acronyms

Acronym	Term & Definition
BRA	**Base Residual Auction**
DY	**Delivery Year** is defined as the 12 months beginning June 1 and extending through May 31 of the following year. Delivery Year may also be referred to as Planning Year or Planning Period.
EDC	**Electric Distribution Company**
EE	**Energy Efficiency** is a project that involves the installation of more efficient devices/equipment, or the implementation of more efficient processes/systems, exceeding then-current building codes, appliance standards, or other relevant standards, at the time of installation
ICAP	**Installed Capacity** is defined as a MW value based on the summer net dependable capability of a unit and within the capacity interconnection right limits of the bus to which it is connected.
LDA	**Locational Deliverability Area** is a sub-region used to evaluate locational constraints.

PJM Glossary

Acronyms

Acronym	Term & Definition
M&V	**Measurement & Verification Plan** is a plan submitted by EE participants which defines projects which will be submitted for an RPM Auction
PIMV	**Post-Install Measurement & Verification** Report is a report that is required prior to the delivery year, which verifies any installed EE
UCAP	**Unforced Capacity** is defined as the MW value of a capacity resource in the PJM Capacity Market. For generating unit, the unforced capacity value is equal to installed capacity of unit multiplied by (1- unit's EFORd). For demand resources and energy efficiency resources, the unforced capacity value is equal to demand reduction multiplied by Forecast Pool Requirement.
VRR	**Variable Resource Requirement** is a demand curve used in the clearing of the Base Residual Auction that defines the price for a given level of Capacity Resource commitment relative to the applicable reliability requirement.

PJM Glossary

What is Energy Efficiency

PJM Manual 18b

- An Energy Efficiency (EE) Resource is a project that involves the installation of more efficient devices/equipment, or the implementation of more efficient processes/systems, exceeding then-current building codes, appliance standards, or other relevant standards, at the time of installation, as known at the time of commitment, and meets the requirements of Schedule 6 (section L) of the Reliability Assurance Agreement.

- The EE Resource must achieve a permanent, continuous reduction in electric energy consumption at the End Use Customer's retail site (during the defined EE Performance Hours and during winter performance hours if such EE Resource is a Capacity Performance Resource) that is not reflected in the peak load forecast used for the Auction Delivery Year for which the EE Resource is proposed.

Eligibility Criteria for EE Installation

- ✓ EE installation must be scheduled for completion prior to Delivery Year
- ✓ EE installation exceeds relevant standards at time of installation as known at time of commitment
- ✓ EE installation achieves load reduction during defined EE Performance Hours and during winter performance hours if Capacity Performance product
- ✓ EE installation is not dispatchable
- ✓ EE provider has the legal rights to claim EE projects in the wholesale market

Types of EE Projects

Lighting (Residential & Commercial)

Home Energy Audits

Envelope (Air) Sealing

High Efficiency HVAC Replacements

Cable Box Replacements

Appliance Replacement Programs

Types of EE Projects

May Qualify
Lighting
Air Conditioner/Heat Pump – replacements or tune-ups
Chiller replacements
Appliance replacements (refrigerators)
Motor replacements
Variable Frequency Drives
Building Weatherization
Manufacturing process improvements

Some of these may qualify as Demand Resources in the PJM Capacity Market

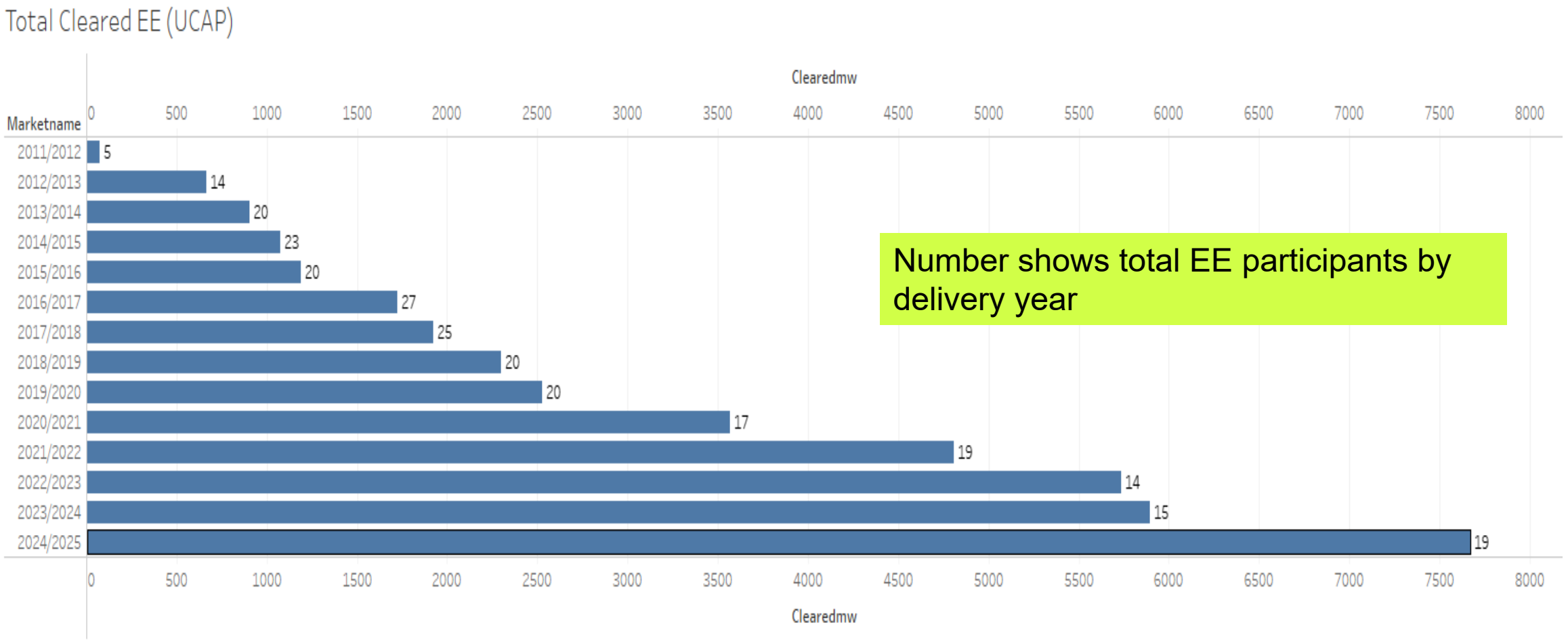
Does not Qualify
Removing devices (e.g., delamping)
Behavioral changes
Reducing load by switching off devices
Behind the meter generation (back up generator, cogeneration, Combined Heat & Power (CHP), renewable generation)
Programmable Thermostats
Fuel switching
Replacing conventional compressor-driven chillers with absorption chillers (powered either by a dedicated heat source or waste heat from an industrial process).
Appliance recycling programs (unless tied to replacement)

EE in the PJM Capacity Market

- EE has been a part of the PJM Capacity Market since the 2011/2012 Delivery Year
  - PJM Cleared 76 MWs/day UCAP across 10 zones
  - Total Yearly Credit ~$140,000

- Big growth in recent auctions - most recent BRA (2024/2025 DY)
  - PJM cleared 7,669 MWs/day UCAP across 19 zones and 14 LDAs
  - Total Yearly Credit ~$119,000,000

Cleared EE By Delivery Year



Number shows total EE participants by delivery year

Installation Periods

- The time period of an Energy Efficiency installation and the date of the peak load forecast used to develop the parameters for an RPM Auction determine whether an installation is eligible to participate as a capacity resource in a particular RPM Auction.

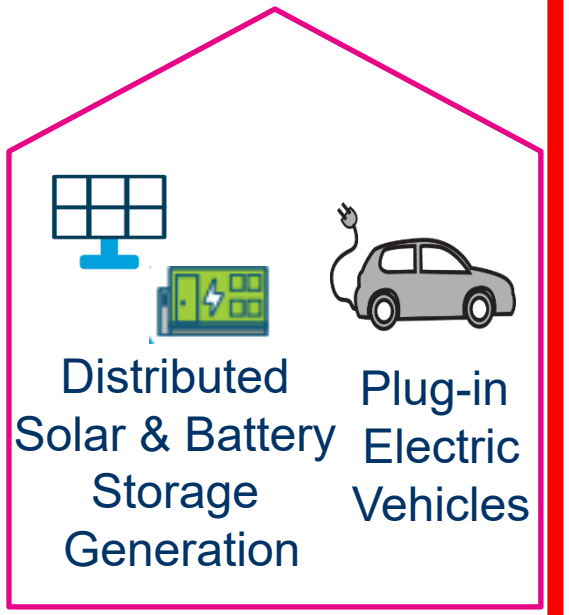
- Energy Efficiency installations are eligible to participate in RPM Auctions for four successive Delivery Years as illustrated in the table below.

Installation Period	Eligible Auctions
June prior to DY – May Prior to DY	DY (BRA, 1st IA, 2nd IA, 3rd IA) DY + 1 (BRA, 1st IA, 2nd IA) DY + 2 (BRA, 1st IA) DY + 3 (BRA)

Load Forecast Model – Drivers

Load Data

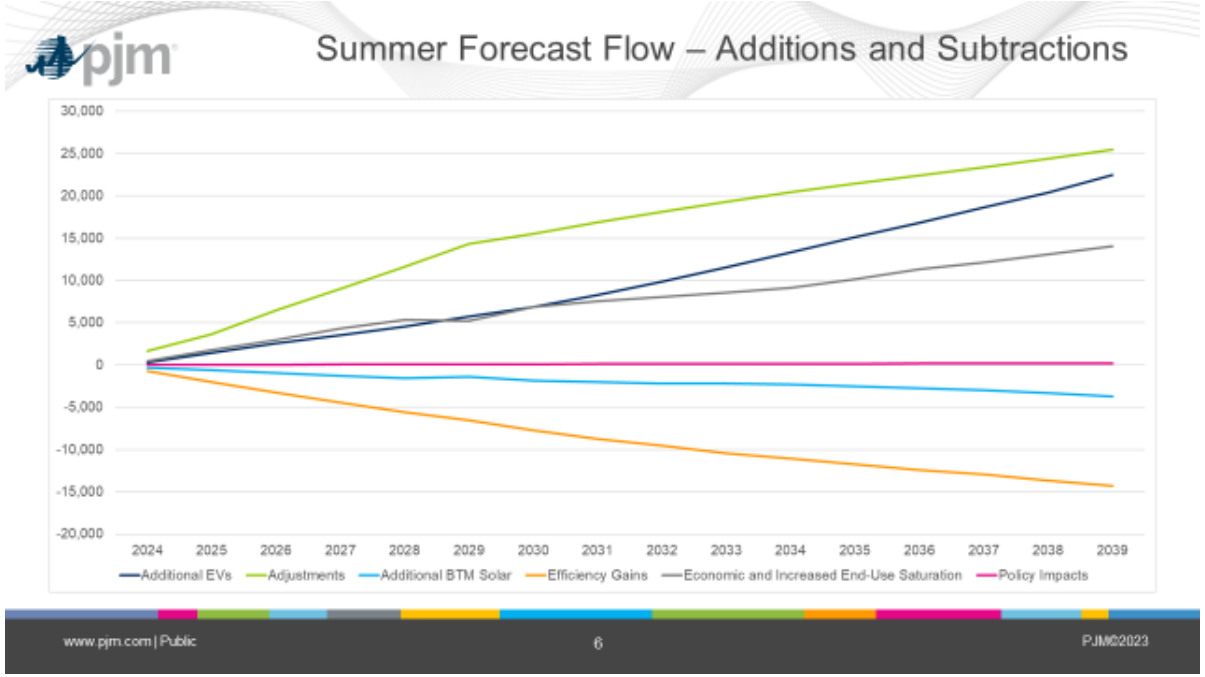
Hourly metered load data and estimated load drops



End-Use Characteristics

- In the load forecast model are variables for end-use characteristics, which are the relative adoption/saturation of various end-uses adjusted for their relative efficiency.

- Graph shows how much assumed efficiency gains in the forecast have on the forecast (orange line).



Energy Efficiency Resources in RPM Auctions

- EE UCAP can submit resource-specific sell offers into an RPM Auction as normal but do not have a must offer obligation to do so.
- EE MWs will clear normally but will not affect market clearing prices in an LDA on account of the EE addback mechanism[1].
  - PJM will “addback” or increase the reliability requirement based on the amount of EE that offered at or below the clearing price
    - EE is not a resource used to meet the capacity reliability requirement
- IMM 24/25 BRA Report discusses financial impact of EE on BRA

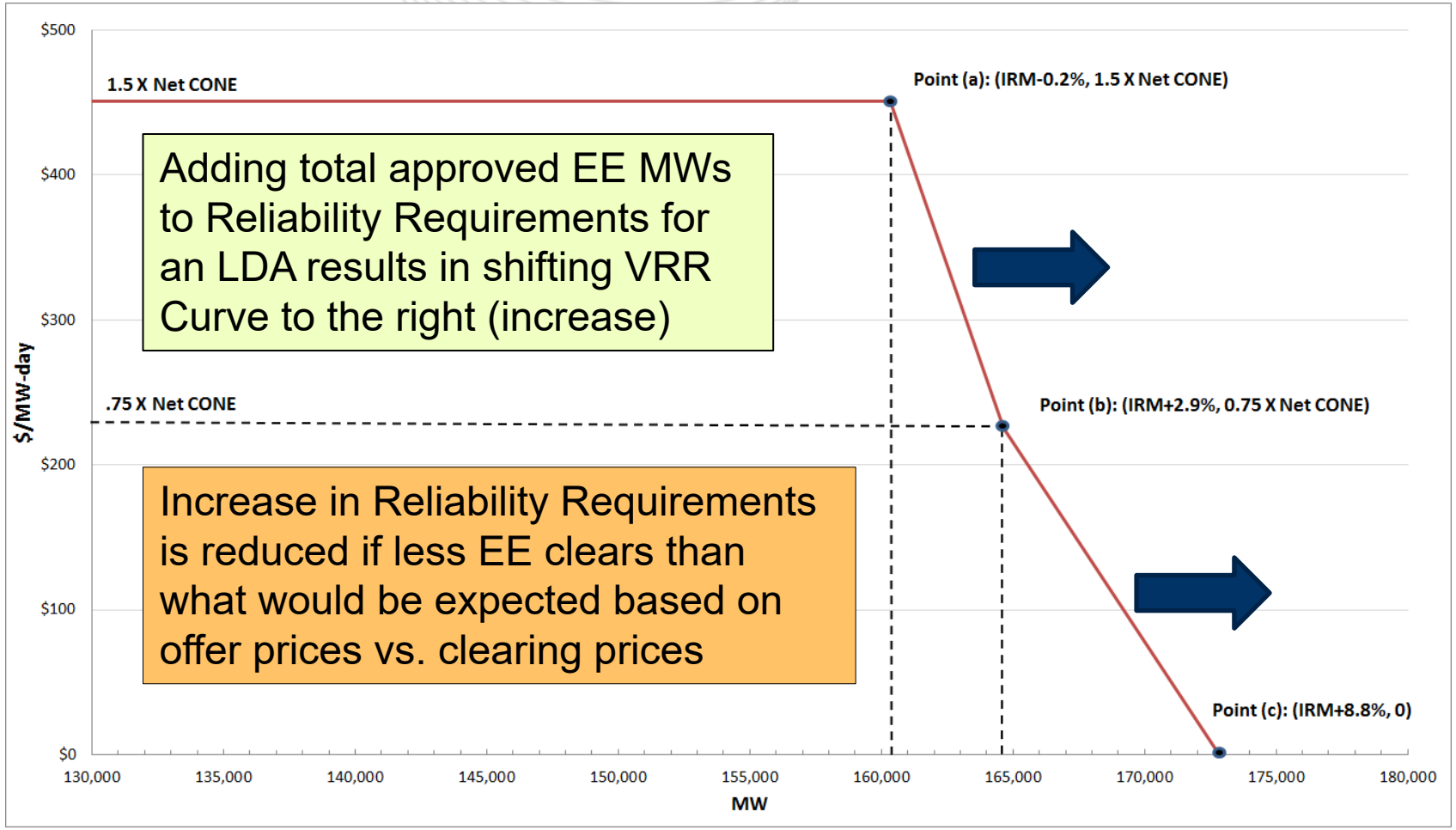
1. Assumes all cleared EE resources are Annual

Energy Efficiency Treatment in Planning Parameters

2024-2025 RPM Base Residual Auction Planning Parameters		2/27/2023				
	RTO	Notes:				
Installed Reserve Margin (IRM)	14.7%	2021 IRM Study, endorsed at the October 20, 2021 MRC meeting...http				
Pool-Wide Average EFORd	5.02%	2021 IRM Study, endorsed at the October 20, 2021 MRC meeting.				
Forecast Pool Requirement (FPR)	1.0894	2021 IRM Study, endorsed at the October 20, 2021 MRC meeting.				
Preliminary Forecast Peak Load	150,640.3	2022 Load Report with adjustments for load served outside PJM.				
	RTO	MAAC	EMAAC	SWMAAC	PS	
CETO	NA	-4,760.0	2,740.0	6,060.0	5,630.0	
CETL	NA	5,965.0	8,594.0	7,947.0	8,287.0	
Reliability Requirement	164,107.6	63,518.0	35,415.0	14,299.0	11,166.0	
Total Peak Load of FRR Entities	29,421.6	0	0	0	0	
Preliminary FRR Obligation	32,051.9	0	0	0	0	
Reliability Requirement adjusted for FRR	**132,055.7**	**63,518.0**	**35,415.0**	**14,299.0**	**11,166.0**	
Gross CONE, $/MW-Day (UCAP Price)	$348.94	$351.93	$355.14	$357.45	$355.14	
Net CONE, $/MW-Day (UCAP Price)	**$293.19**	**$294.06**	**$312.39**	**$261.07**	**$321.21**	
EE Addback (UCAP)	7,668.7	3,393.8	1,906.7	766.2	676.5	
Variable Resource Requirement Curve:						
Point (a) UCAP Price, $/MW-Day	$439.79	$441.09	$468.59	$391.61	$481.82	
Point (b) UCAP Price, $/MW-Day	$219.89	$220.55	$234.29	$195.80	$240.91	
Point (c) UCAP Price, $/MW-Day	$0.00	$0.00	$0.00	$0.00	$0.00	
Point (a) UCAP Level, MW	138,342.8	66,247.3	36,951.2	14,915.6	11,725.7	
Point (b) UCAP Level, MW	141,911.9	67,964.0	37,908.3	15,302.1	12,027.5	
Point (c) UCAP Level, MW	148,704.6	71,231.2	39,730.0	16,037.6	12,601.8	
Nominated PRD Value, MW	305.0	305.0	35.0	270.0	0.0	
VRR Curve adjusted for PRD:						
Point (a1) UCAP Price, $/MW-Day	$439.79	$441.09	$468.59	$391.61		
Point (b1) UCAP Price, $/MW-Day	$219.89	$220.55	$234.29	$195.80		
Point (prd1) UCAP Price, $/MW-Day	$0.01	$0.01	$0.01	$0.01		
Point (prd2) UCAP Price, $/MW-Day	$0.01	$0.01	$0.01	$0.01		
Point (c) UCAP Price, $/MW-Day	$0.00	$0.00	$0.00	$0.00		
Point (a1) UCAP Level, MW	138,010.5	65,915.0	36,913.1	14,621.5		
Point (b1) UCAP Level, MW	141,579.6	67,631.7	37,870.2	15,008.0		
Point (prd1) UCAP Level, MW	148,372.0	70,898.8	39,691.8	15,743.5		
Point (prd2) UCAP Level, MW	148,704.3	71,231.1	39,729.9	16,037.6		
Point (c) UCAP Level, MW	148,704.6	71,231.2	39,730.0	16,037.6		
Pre-Auction Credit Rate, $/MW	$53,507.18	$53,665.95	$57,011.18	$47,645.28	$58,620.83	
Participant-Funded ICTRs Awarded	NA	1557.0	40.0	NA	1070.0	
FRR Load Requirement (% Obligation):						
Minimum Internal Resource Requirement	NA	97.7%	83.3%	48.8%	28.5%	

Energy Efficiency UCAP in the RTO and any given LDA is added to the respective Reliability Requirements. This action prevents double counting of the EE MW as these MWs are also accounted for in the LDA forecast, which flows through to the Reliability Requirements and ultimately the VRR Curve.

Variable Resource Requirement (VRR) Curve



EE Resource Requirements

- ✓Submit M&V Plan prior to RPM Auction
  - Single M&V Plan may be submitted to cover multiple EE Resources
  - Single M&V Plan must clearly document the Nominated EE Value/Capacity Performance Value of each EE Resource covered in the Plan
- ✓Establish credit with PJM Credit Department prior to RPM Auction
- ✓Submit Post-Installation M&V Reports
- ✓Cooperate with any Post- Installation M&V Audit by PJM or Independent Third Party

EE Submittal Process

Measurement And Verification Plan (M&V Plan)

- 30 Days prior to each Auction: M&V Plan due to PJM
- 10 Days after receipt of M&V Plan: PJM will notify members of approval or denial or plan
- 1-5 Days Prior to Auction: PJM will add MWs to Capacity Exchange, for use in Auction Bids

Post-Installation Measurement and Verification Report (PIMV)

- 15 Days prior to start of Delivery Year: PIMV Report due to PJM
- 1-5 Days prior to start of Delivery Year: Final Nominated EE Values will be approved by PJM
- 1-5 Days prior to start of Delivery Year: PJM will create EE Mod to add approved EE MWs to resources

M&V Plan Documentation

- Initial Measurement and Verification (M&V) Plan
  - Project Description
  - M&V techniques that will be used to determine and verify the Nominated EE Value/Capacity Performance value of the EE Resource
  - Schedule for project installation and M&V activities
  - Location of EE Resource (transmission zone)
  - Anticipated Nominated EE Value/Capacity Performance value

M&V Plan requirements covered in PJM Manual 18B.

Post-Installation M&V Report Documentation

- Initial Post-Installation (PI) M&V Report
  - Documentation of post-installation activities verifying that equipment/systems were installed and operating
  - Documentation of performance measurements conducted to validate the Nominated EE Value/Capacity Performance value (in accordance with approved M&V Plan)

PI M&V Report requirements covered in PJM Manual 18B.

Examples of verification activities
Sample surveys (via mail or phone)
On-site inspections

Measurements Efforts to validate Nominated Value of EE Resource
Track equipment that was replaced and installed at end-use site
Use manufacturer's equipment data
Measure Coincidence Factors (using time of use loggers)
Sub-meter equipment (measure kw or amps and voltage)
Use simulation models
Use Load Shape Analyses
Use utility billing data

Capacity Rights

- An EE Resource Provider must demonstrate that it has the legal authority to claim the demand reduction associated with such EE Resource. Two options available to satisfy this requirement:

1. Submitting a written sworn, notarized statement of one of its corporate officers certifying that the EE Resource Provider has the legal rights and authority to claim the demand reduction associated with the EE installation(s) that constitute the Energy Efficiency Resource for the applicable Delivery Year.

2. Inserting the following statement directly into the Post-Installation Measurement & Verification Report:

> "By submitting this Post-Installation Measurement & Verification Report to PJM, [insert company name] affirms and acknowledges that it has the legal authority to claim the demand reduction associated with the EE installation(s) that constitute the Energy Efficiency Resource for the applicable Delivery Year."

Performance Requirement for EE Resources

- Capacity Resource Deficiency & Non-Performance Assessment
  - If Available MWs is less than cleared MWs, resource will be subject to Capacity Resource Deficiency Charges
  - During Non-Performance Assessment events
    - If Available MWs is less than cleared MWs, resource may be subject to Non-Performance Charges
    - If Available MWs is greater than cleared MWs, resource will receive Bonus Performance Credits
- May be subject to Post-Installation M&V Audit by PJM or independent Third Party
  - Cost of audit charged to EE Provider

Contact Information

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