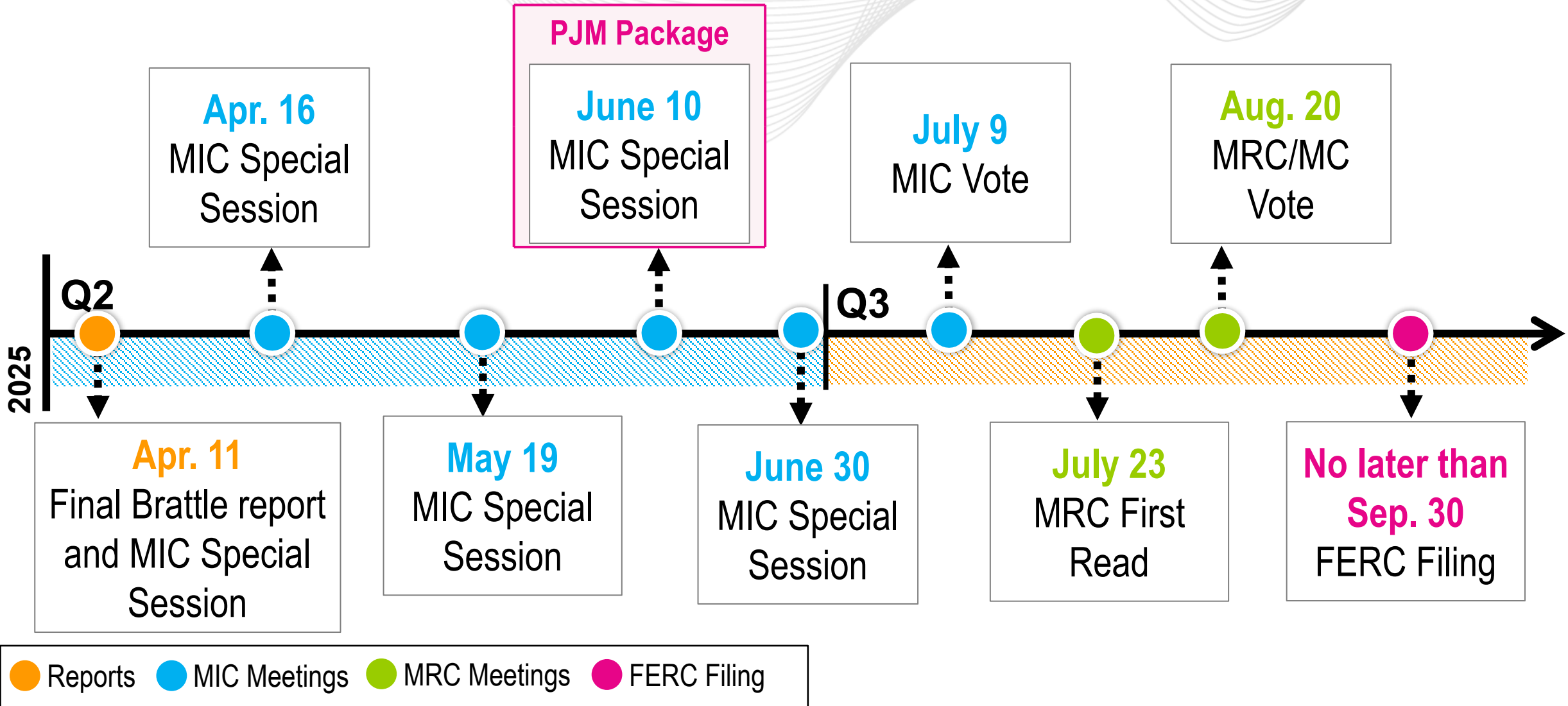


Quadrennial Review Update and Net E&AS details

Market Implementation Committee
May 19, 2025

Skyler Marzewski
Lead Market Design Specialist
Market Design



- PJM's most updated Net Energy & Ancillary Services Revenue Offset values for 2028/2029
- Reference Resource parameters for E&AS

	Initial				CONE Report			
	CC \$/MW-day ICAP	CC 40% \$/MW-day ICAP	CT 40% \$/MW-day ICAP	BESS \$/MW-day ICAP	CC \$/MW-day ICAP	CC 40% \$/MW-day ICAP	CT 40% \$/MW-day ICAP	BESS \$/MW-day ICAP
AECO	\$296.58	\$259.17	\$92.54	\$269.18	\$218.57	\$211.24	\$57.60	\$234.84
AEP	\$615.23	\$433.37	\$304.24	\$275.02	\$534.12	\$406.57	\$278.64	\$237.74
APS	\$719.81	\$500.85	\$373.88	\$290.78	\$603.78	\$456.66	\$340.63	\$250.67
ATSI	\$551.53	\$401.37	\$251.48	\$273.90	\$476.89	\$380.66	\$214.91	\$235.56
BGE	\$722.76	\$573.32	\$349.88	\$401.77	\$608.43	\$513.70	\$302.24	\$350.53
COMED	\$371.24	\$311.76	\$131.13	\$288.50	\$326.81	\$301.46	\$107.61	\$257.45
DAY	\$606.53	\$442.49	\$295.87	\$285.02	\$529.29	\$416.16	\$259.76	\$246.34
DEOK	\$576.78	\$423.85	\$276.22	\$284.13	\$505.55	\$399.28	\$240.64	\$243.57
DOM	\$684.29	\$535.27	\$361.50	\$385.93	\$576.03	\$494.34	\$276.09	\$338.21
DPL	\$429.99	\$389.10	\$197.27	\$367.55	\$343.98	\$333.89	\$142.26	\$328.30
DUQ	\$523.05	\$388.56	\$249.16	\$276.28	\$434.69	\$367.83	\$200.94	\$239.06
EKPC	\$552.93	\$404.86	\$250.51	\$276.99	\$481.49	\$382.34	\$219.73	\$239.16
JCPL	\$307.76	\$263.13	\$86.84	\$260.81	\$222.72	\$211.95	\$54.89	\$225.31
METED	\$504.96	\$392.29	\$220.56	\$296.61	\$415.63	\$358.50	\$157.87	\$250.90
OVEC	\$580.75	\$409.23	\$276.61	\$274.39	\$500.05	\$382.72	\$250.91	\$233.98
PECO	\$397.02	\$330.66	\$145.07	\$271.56	\$311.21	\$295.29	\$90.05	\$241.29
PENELEC	\$678.76	\$479.59	\$353.53	\$276.76	\$570.57	\$441.70	\$311.44	\$239.59
PEPCO	\$534.92	\$448.55	\$215.82	\$372.31	\$425.40	\$387.42	\$152.59	\$327.92
PPL	\$437.27	\$341.76	\$160.85	\$266.02	\$348.04	\$311.34	\$105.43	\$228.21
PSEG	\$288.68	\$253.85	\$88.41	\$267.34	\$207.77	\$199.76	\$49.36	\$228.47
RECO	\$337.58	\$292.77	\$113.84	\$295.08	\$251.72	\$236.63	\$63.79	\$244.56

	CONE Report			
	CC \$/MW-day ICAP	CC 40% \$/MW-day ICAP	CT 40% \$/MW-day ICAP	BESS \$/MW-day ICAP
AECO	\$218.57	\$211.24	\$57.60	\$234.84
AEP	\$534.12	\$406.57	\$278.64	\$237.74
APS	\$603.78	\$456.66	\$340.63	\$250.67
ATSI	\$476.89	\$380.66	\$214.91	\$235.56
BGE	\$608.43	\$513.70	\$302.24	\$350.53
COMED	\$326.81	\$301.46	\$107.61	\$257.45
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EKPC	\$481.49	\$382.34	\$219.73	\$239.16
JCPL	\$222.72	\$211.95	\$54.89	\$225.31
METED	\$415.63	\$358.50	\$157.87	\$250.90
OVEC	\$500.05	\$382.72	\$250.91	\$233.98
PECO	\$311.21	\$295.29	\$90.05	\$241.29
PENELEC	\$570.57	\$441.70	\$311.44	\$239.59
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PPL	\$348.04	\$311.34	\$105.43	\$228.21
PSEG	\$207.77	\$199.76	\$49.36	\$228.47
RECO	\$251.72	\$236.63	\$63.79	\$244.56

Updated EAS accounts for:

- Updated historical years (21, 22, 23 vs 22, 23, 24), LMP futures, and fuel futures data
- Updated unit-specific parameters to reflect updated Reference Resource technologies
- 40% Capacity Factor for CT
- Updated BESS to be the average of 50% between perfect foresight and 50% the day-ahead only value.

Forward market prices from trade dates 12/11/24 to 1/24/25

Reference Resource Operating Parameters: Combustion Turbine

Parameter	Value	Notes
Configuration	GE Frame 7HA.03 CT with evaporative cooling, SCR/CO, dual fuel	
Max Capacity	403.2 MW 389.7 MW	at ISO conditions (59°F, 14.7 psia) average at Max Summer conditions; average of 5 CONE areas
Min Stable Level	170 MW	Sargent & Lundy
Ramp Rate	20 MW/min	Estimated S&L Note: confirm unit offers referenced are specific to technology (CT vs CC) and size (MW).
Heat Rate	12,400 Btu/kWh 9,038 Btu/kWh 9,150 Btu/kWh	at Min Stable Load at ISO conditions (59°F, 14.7 psia); average of 5 CONE areas at Max Summer conditions; average of 5 CONE areas
Min Run	2 hr	Minimum Unit-Specific Operating Parameters for Generation Capacity Resources
Min Down	1 hr	
Time to Start	21 min	Per GE published data, assumes Rapid Response start on a hot unit. Actual time to reach min load from warm, cold, or ambient conditions will be longer.
VO&M	\$1.00/MWh	Consumables & major maintenance; 2025 Quadrennial Review (2025\$)
Start Fuel	502 MMBtu/start	Average fuel use of CONE Area units per S&L 2025 Quadrennial Review
Fuel Pricing Points	See Manual 18, Section 3.3.2	
NOx	0.0093 lb/MMBtu	2018 CONE Study; historical allowance prices escalated for forward
	55 lb/start	
SO2	0.0006 lb/MMBtu	EPA; historical allowance prices escalated for forward
CO2	117 lb/MMBtu	EPA; RGGI ECR trigger price applied to RGGI units
Forced Outages (EFORd)	6.33%	PJM 2015 - 2019 Weighted Average EFORd by Fuel Type, Class Average Values Effective June 1, 2020 S&L Note: S&L 2022 CONE Study Update assumed 2.2% EFORd for CTs
Maintenance Outages	First two weeks in October	

Reference Resource Operating Parameters: Combined Cycle

Parameter	Value	Notes
Configuration	Two Trains of 1x1 GE Frame 7HA.03 single shaft CC with evaporative cooling and SCR - Dry ACC, Firm Gas	
Max Capacity	1,185.6 MW w/o Duct Burner ; 1,358.2 MW w/ Duct Burner 1,118.5 MW w/o Duct Burner ; 1,282.4 MW w/ Duct Burner	at ISO conditions (59°F, 14.7 psia); average of 5 CONE areas at Max Summer conditions; average of 5 CONE areas
Min Stable Level	194 MW	S&L Note: this is the Min Stable Load for one 1x1x1 CC train = 33% single train MCR (assumes the 2nd train is not operating)
Ramp Rate	40 MW/min	Estimated (20 MW/min per turbine) S&L Note: confirm existing unit offers referenced are appropriately scaled to technology (class of CT) and number of trains (two trains should ramp 2x faster than one).
Heat Rate	7,804 Btu/kWh 6,142 Btu/kWh w/o Duct Firing ; 6,389 Btu/kWh w/ Duct Firing 6,315 Btu/kWh w/o Duct Firing ; 6,594 Btu/kWh w/ Duct Firing	at Min Stable Load at ISO conditions (59°F, 14.7 psia); average of 5 CONE areas at Max Summer conditions; average of 5 CONE areas
Min Run	4 hr	Minimum Unit-Specific Operating Parameters for Generation Capacity Resources
Min Down	3.5 hr	
Time to Start	120 min	Time from ignition to base load, assumes appropriate steam cycle design. S&L Note: GE published startup time for these units is 60 min which assumes rapid response hot and optimal conditions. 120 min has been suggested as a more realistic time to be expected for a 1x1x1 single-shaft CC.
VO&M	\$2.42/MWh	Consumables & major maintenance; 2025 Quadrennial Review (2025\$)
Start Fuel	4,412 MMBtu/start/train (double to account for 2nd train)	Average fuel use of CONE Area units Sargent & Lundy 2025 Quadrennial Review (adjusted for 120 min assumed Time to Start)
Fuel Pricing Points	See Manual 18, Section 3.3.2	
NOx	0.0074 lb/MMBtu 160 lb/start	2018 CONE Study; historical allowance prices escalated for forward
SO2	0.0006 lb/MMBtu	
CO2	117 lb/MMBtu	EPA; RGGI ECR trigger price applied to RGGI units
Forced Outages (EFORd)	3.05%	PJM 2015 - 2019 Weighted Average EFORd by Fuel Type, Class Average Values Effective June 1, 2020 Note: S&L Assumed 2.0% EFOR for 1x1x1 CC in cost estimate assumptions
Maintenance Outages	First two weeks in October	

Reference Resource Operating Parameters: Battery Energy Storage

Parameter	Value	Notes
Configuration	50 MW utility scale, Li, 200 MWh rating – EIA (Case 18) – - https://www.eia.gov/analysis/studies/powerplants/capitalcost/	
Max Capacity	Modeled as 1 MW / 4 MWh resource	
Charged Efficiency*	92.2%	*Used to represent an 85% round trip efficiency in the dispatch model Wesley Cole & A. Will Frazier, Cost Projections for Utility-Scale Battery Storage: 2020 Updated, National Renewable Energy Laboratory (June 2020), https://www.nrel.gov/docs/fy20osti/75385.pdf
Discharge Efficiency*	92.2%	
State of Charge	Between 95% and 5%	
Forced & Maintenance Outages	None at this time	

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Quadrennial Review Update



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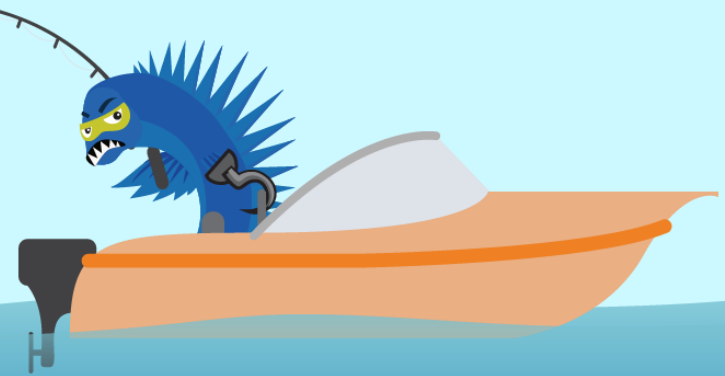
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