Periodic Review of Default CONE and ACR Values

Skyler Marzewski
Sr. Market Design Specialist
Market Design
MIC
October 6, 2022

Application of Default CONE and ACR

Minimum Offer Price Rule (MOPR) – Attachment DD § 5.14 (h-2)	• New resources can elect a default Net Cost of New Entry (CONE) by using the default Gross CONE and subtracting the default Energy and Ancillary Service (E&AS) revenue. • Existing resources can elect a default Net Avoidable Cost Rate (ACR) by using the default Gross ACR and subtracting the unit-specific E&AS revenue.
Market Seller Offer Cap (MSOC) – Attachment DD § 6.4	• Existing resources calculate a Net ACR by using the default Gross ACR and subtracting the unit-specific E&AS revenue.

Unit-specific request is an option to calculate MOPR or MSOC.

Current Default CONE and ACR Values

Resource Types	Gross Cost of New Entry (2022/2023 $/MW-day) (Nameplate)
1 Nuclear	$2,000
2 Coal	$1,068
3 Combined Cycle	$320
4 Combustion Turbine	$294
5 Fixed Solar PV	$271
6 Tracking Solar PV	$290
7 Onshore Wind	$420
8 Offshore Wind	$1,155
9 Battery Energy Storage	$532

Existing Resource Types	Default Gross ACR (2022/2023 $/MW-day) (Nameplate)
1 Nuclear – single	$697
2 Nuclear – dual	$445
3 Coal	$80
4 Combined Cycle	$56
5 Combustion Turbine	$50
6 Solar PV (fixed and tracking)	$40
7 Wind Onshore	$83

Gross CONE and Gross ACR are escalated for each subsequent delivery year.

PJM Periodic Review of MOPR and MSOC Values

Beginning with the 2022/2023 Delivery Year, every four delivery years PJM will update default Gross CONE and default Gross ACR values for MOPR purposes.

OATT Attachment DD § 5.14

Updated default Gross ACR values will also be used for MSOC purposes.

Monthly Timeline

OCT. 6, 2022

- Introduction to default Cost of New Entry (CONE) and default Avoidable Cost Rate (ACR)
- Overview on proposed approach for updating values

NOV. 11, 2022

- MIC special session
- Present initial updated values for feedback

DEC./JAN. 2022

- MIC special session
- Brattle to provide final report with ACR values

Q1 2023

- Present final CONE and ACR values
- Advisory vote
- Submit a filing to FERC

NOV. 2023

- 2026/2027 BRA with updated default CONE and default ACR values

Current Gross CONE values

PJM selected installed capital costs (Capex) and fixed operating and maintenance costs (FOM) from public sources.

- National Renewable Energy Laboratory (NREL)
- U.S. Environmental Protection Agency (EPA)
- U.S. Energy Information Agency (EIA)
- Lazard

Current Financial Assumptions for Gross CONE values

- Financial assumptions for the 2022/2023 CONE values were the same values used in the previous quadrennial review.
- Bonus depreciation and Investment Tax Credit (ITC) were also used where applicable.
- Combined cycle and combustion turbine values were those from the 2018 quadrennial study.
- PJM determined that the assumed applicable asset life for battery storage resources should be 15 years.

Financial Assumptions	
Expected Life	20 Years
Debt Ratio	55.0%
Debt Rate	6.0%
Equity Rate	13.0%
Total Tax Rate	27.70%
ATWACC	8.2%
Inflation Rate	2.2%

Financial assumptions developed during 2018 Quadrennial Review were used to determine Gross CONE from the installed capital and fixed O&M costs.

Default Net CONE Calculation

Resource Type	Fixed O&M Cost ($/kW - year)	Installed Capital Cost, ($/kW)	Investment Tax Credit %	Gross CONE ($/MW-Day) (Nameplate)	Average Zonal Net Energy Revenue Offset ($/MW-Day) (Nameplate)	Average Zonal Net Ancillary Services Revenue Offset ($/MW-Day) (Nameplate)	Net CONE ($/MW-Day) (Nameplate)	Capacity Value (% Nameplate MW)	Net CONE ($/ICAP-MW-Day)
Nuclear	$122	$6,041	NA	$2,000	$508	$9	$1,483		$1,483
Coal	$41	$3,676	NA	$1,068	$34	$9	$1,025		$1,025
Combined Cycle			NA	$320	$159	$9	$152		$152
Combustion Turbine			NA	$294	$42	$6	$246		$246
Solar PV (Tracking)	$15	$1,313	30%	$290	$176	$9	$105	60.0%	$175
Solar PV (Fixed)	$14	$1,234	30%	$271	$108	$9	$154	42.0%	$367
Onshore Wind	$35	$1,677	30%	$420	$231	$9	$180	17.6%	$1,023
Offshore Wind	$110	$4,375	30%	$1,155	$328	$9	$818	26.0%	$3,146
Battery Energy Storage	$25	$1,389	NA	$532	$107	$9	$416	40.0%	$1,040
Demand Response (Gen)	$10	$800	NA	$254	$0	$0	$254		$254

Notes:

Fixed O&M and installed capital costs are from EIA report 2020. Solar PV (fixed) costs are 94% of the costs for Solar PV (Tracking). Nuclear and Coal Fixed O&M costs were reduced by $20 and $25 respectively in calculating Gross CONE.

Combined Cycle and Combustion Turbine CONE values are average of CONE Area values from 2018 Quadrennial Study for 2022.

Solar and Wind Investment Tax Credit depends on start of the construction. An optimistic 30% value is assumed implying Solar construction started before 1/1/2020 and Wind construction started before 1/1/2017.

Class average capacity values as percent of nameplate MW Solar and Wind generation are used to calculate Net CONE in $/ICAP-MW-Day.

Battery energy storage costs are for a 4 hour plant with 15 year life. Gross CONE is calculated based on 15 year economic life and a 40% capacity value as percent of nameplate capacity is used to calculate Net CONE in $/ICAP-MW-Day.

Net Energy Revenue Offset is based on methodologies described in posted 3/11/2020 MIC material and Ancillary Service revenue Offset is based on reactive services of $3350/MW-year or $9/MW-day. The CT value is from the tariff: $2199/MW-year of $6/MW-day.

Description and Cost for Reference Resources

Resource Type	Technology Description	Source of Information	Fixed O&M ($/kW-year)	Installed Capital Cost ($/kW)
Nuclear	2 x Westinghouse AP1000 Pressurized Water Reactor (2,156 MW)	EIA (Case 11)	122	6,041
Coal	Ultra-Super Critical Coal (650 MW)	EIA (Case 1)	41	3,676
Combined Cycle	2x1 GE Frame 7HA with evaporative cooling and SCR (1,152 MW)	Quadrennial Review	24	874
Combustion Turbine	GE Frame 7HA CT with evaporative cooling, SCR, dual fuel (352 MW)	Quadrennial Review	17	875
Solar PV - Tracking	Single-axis tracking (150 MW AC)	EIA (Case 24)	15	1,313
Solar PV - Fixed	Fixed-tilt (100 MW AC)	EIA, LBNL, IHS	14	1,234
Onshore Wind	17 x 2.8 MW WTGs (50 MW)	EIA (Case 21)	35	1,677
Offshore Wind	40 x 10 WTGs, 100' depth (400 MW)	EIA (Case 22)	110	4,375
Battery Storage	50 MW utility scale, Li, 200 MWh rating	EIA (Case 18)	25	1,389
Demand Response *	0.5 MW RICE, diesel, 10,000 Btu/kWh	Lazard LCOE V-11.0	10	800

*Demand Response no longer has a Gross CONE value.

Sources of Technology Costs: 2022/2023

	Source	Link
1	NREL: 2019 Annual Technology Baseline	https://atb.nrel.gov/
2	Lazard: 2019 Levelized Cost of Energy & Storage	https://www.lazard.com/perspective/lcoe2019
		https://www.lazard.com/media/451087/lazards-levelized-cost-of-storage-version-50-vf.pdf
		https://www.lazard.com/media/451086/lazards-levelized-cost-of-energy-version-130-vf.pdf
3	EPA: IPM Platform 2018 Reference Case	https://www.epa.gov/airmarkets/documentation-ipm-platform-v6-november-2018-reference-case-all-chapters
4	EIA: 2020 Capital Cost Report	https://www.eia.gov/analysis/studies/powerplants/capitalcost/
5	PJM: Quadrennial Review	https://pjm.com/-/media/library/reports-notices/special-reports/2018/20180420-pjm-2018-cost-of-new-entry-study.ashx?la=en
6	LBNL: Utility Scale Solar – 2019 Edition	https://emp.lbl.gov/utility-scale-solar/
7	IHS: US Solar PV Capital Cost and LCOE Outlook	https://ihsmarkit.com/research-analysis/index.html

Comparison of Installed Capital Costs ($/kW)

Technology	NREL 2022	Lazard 2019	EPA 2021	EIA 2019	Used by PJM
Nuclear	6,506	6,900 – 12,200	5,644	6,041	6,041
Coal	3,944	3,000 – 6,250	3,580	3,676	3,676
Combined Cycle	894	700 – 1,300	1,081	1,084 (H)	874
Combustion Turbine	905	700 – 950	662	713 (7FA)	875
Solar PV (tracking)	1343*	1,100	1,034	1,313	1,313
Solar PV (fixed)	1,262**	900		1,234**	1,234
Onshore Wind	1,472	1,100 – 1,500	1,404	1,677	1,677
Offshore Wind	3,682	2,350 – 3,550	4,529	4,375	4,375
Battery Storage	1,157	898 – 1,874	N/A	1,389	1,389

** NREL installed capital cost is noted as $1033/kW DC and PJM multiplied the value by an Inverter Loading Ratio of 1.3 to calculate $1343/kW AC.*

*** Fixed cost obtained from multiplying Tracking cost by 0.94*

Plan on Updating Gross CONE

PJM plans on updating the Gross CONE values using updated values from public sources and assumptions used in the quadrennial review.

New Gross CONE values will start being used for the 2026/2027 Delivery Year.

Plan on Updating Gross ACR

- Gross ACR values based on work done by The Brattle Group along with Sargent & Lundy.
- PJM plans on updating the Gross ACR values for the same resource types by using Brattle along with Sargent & Lundy.

New Gross ACR values will start being used for the 2026/2027 Delivery Year.

Contact

SME/Presenter:
Skyler Marzewski

Skyler.Marzewski@pjm.com

Facilitator:

Nikki Militello

Nikki.Militello@pjm.com

Periodic Review of Default CONE and ACR Values

Member Hotline

(610) 666 – 8980

(866) 400 – 8980

custsvc@pjm.com

Appendix

PJM Requirements on Updating MOPR

OATT Attachment DD § 5.14

- *Beginning with the Delivery Year that commences June 1, 2022, and continuing no later than for **every fourth Delivery Year** thereafter, the Office of the Interconnection shall review the **default gross cost of new entry values**. Such review may include, without limitation, analyses of the fixed development, construction, operation, and maintenance costs for such resource types. Based on the results of such review, PJM shall propose either to modify or retain the default gross cost of new entry values stated in the table above. The Office of the Interconnection shall post publicly and solicit stakeholder comment regarding the proposal. If, as a result of this process, changes to the default gross cost of new entry values are proposed, the Office of the Interconnection shall **file such proposed modifications with the FERC by October 1**, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.*

- *Beginning with the Delivery Year that commences June 1, 2022, and continuing no later than for **every fourth Delivery Year** thereafter, the Office of the Interconnection shall review the **default Avoidable Cost Rates** for Capacity Resource that is subject to the provisions of the Minimum Offer Price Rule pursuant to Tariff, Attachment DD, section 5.14(h-2)(2) that have cleared in an RPM Auction for any Delivery Year. Such review may include, without limitation, analyses of the avoidable costs of such resource types. Based on the results of such review, PJM shall propose either to modify or retain the default Avoidable Cost Rate values stated in the table above. The Office of the Interconnection shall post publicly and solicit stakeholder comment regarding the proposal. If, as a result of this process, changes to the default Avoidable Cost Rate values are proposed, the Office of the Interconnection shall **file such proposed modifications with the FERC by October 1**, prior to the conduct of the Base Residual Auction for the first Delivery Year in which the new values would be applied.*

PJM Requirements on Updating MSOC

OATT Attachment DD § 6.4 (a)

The Market Seller Offer Cap, stated in dollars per MW/day of unforced capacity, applicable to price-quantity offers within the Base Offer Segment for an Existing Generation Capacity Resource shall be the Avoidable Cost Rate for such resource, less the Projected PJM Market Revenues for such resource, stated in dollars per MW/day of unforced capacity. A Capacity Market Seller offering above $0/MW-day must support and obtain approval of a unit-specific Market Seller Offer Cap pursuant to the procedures and standards of subsection (b) of this section 6.4 or may, at its election, if available, utilize a Market Seller Offer Cap determined using the applicable default gross Avoidable Cost Rate for the applicable resource type shown in the table below, as adjusted for Delivery Years subsequent to the 2022/2023 Delivery Year to reflect changes in avoidable costs, net of projected PJM market revenues equal to the resource's net energy and ancillary service revenues for the resource type, as determined in accordance with Tariff, Attachment DD, section 6.8(d-1).

PROTECT THE POWER GRID

THINK BEFORE YOU CLICK!

pjm

Be alert to malicious phishing emails.

Report suspicious email activity to PJM.

(610) 666-2244 / it_ops_ctr_shift@pjm.com