



# Final Default CONE Values

Skyler Marzewski  
Sr. Market Design Specialist  
Market Design  
MIC Special Session  
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## **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.**




# 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.**

**PJM updated 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.**

**OCT. 6, 2022**

**NOV. 11, 2022**

**DEC./JAN. 2022**

**Q1 2023**

**NOV. 2023**

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

- MIC special session
- Present initial updated values for feedback

- MIC special session(s)
- Present final CONE values
- Brattle to provide final report with ACR values

- Present final CONE and ACR values
- Advisory vote at the MRC/MC
- Submit a filing to FERC

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

PJM updated Gross CONE values similarly to the previous iteration.

**Notable changes:**

- Changes in ITC and bonus depreciation due to planned sunset of the TCJA
- New reference resource for CC and onshore wind
- Quadrennial Review included BES data

All Gross CONE values increased except for batteries primarily due to ITC eligibility.

**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



# Sources of Technology Costs: 2026/2027

Source	Link
1 NREL: 2022 Annual Technology Baseline	<a href="https://atb.nrel.gov/">https://atb.nrel.gov/</a> <a href="https://data.openei.org/submissions/5716">https://data.openei.org/submissions/5716</a>
2 Lazard: 2021 Levelized Cost of Energy & Storage	<ul style="list-style-type: none"><li>• <a href="https://www.lazard.com/perspective/levelized-cost-of-energy-levelized-cost-of-storage-and-levelized-cost-of-hydrogen/">https://www.lazard.com/perspective/levelized-cost-of-energy-levelized-cost-of-storage-and-levelized-cost-of-hydrogen/</a></li><li>• <a href="https://www.lazard.com/media/451882/lazards-levelized-cost-of-storage-version-70-vf.pdf">https://www.lazard.com/media/451882/lazards-levelized-cost-of-storage-version-70-vf.pdf</a></li><li>• <a href="https://www.lazard.com/media/451905/lazards-levelized-cost-of-energy-version-150-vf.pdf">https://www.lazard.com/media/451905/lazards-levelized-cost-of-energy-version-150-vf.pdf</a></li></ul>
3 EPA: IPM Platform 2021 Reference Case	<a href="https://www.epa.gov/power-sector-modeling/epas-power-sector-modeling-platform-v6-using-ipm-summer-2021-reference-case">https://www.epa.gov/power-sector-modeling/epas-power-sector-modeling-platform-v6-using-ipm-summer-2021-reference-case</a>
4 EIA: 2022 Capital Cost Report	<ul style="list-style-type: none"><li>• <a href="https://www.eia.gov/analysis/studies/powerplants/capitalcost/">https://www.eia.gov/analysis/studies/powerplants/capitalcost/</a></li><li>• <a href="https://www.eia.gov/outlooks/aeo/assumptions/pdf/electricity.pdf">https://www.eia.gov/outlooks/aeo/assumptions/pdf/electricity.pdf</a></li></ul>
5 PJM: Quadrennial Review	<a href="https://www.pjm.com/directory/etariff/FercDockets/6885/20220930-er22-2984-000.pdf">https://www.pjm.com/directory/etariff/FercDockets/6885/20220930-er22-2984-000.pdf</a>
6 LBNL: Utility Scale Solar – 2022 Edition	<a href="https://emp.lbl.gov/utility-scale-solar/">https://emp.lbl.gov/utility-scale-solar/</a>
7 IHS: US Solar PV Capital Cost and LCOE Outlook	<a href="https://ihsmarkit.com/research-analysis/index.html">https://ihsmarkit.com/research-analysis/index.html</a>





# Financial Assumptions for Updated Gross CONE Values

- Financial assumptions for the 2026/2027 CONE values are the same values used in the as-filed 2022 Quadrennial Review.
- Bonus depreciation and Investment Tax Credit (ITC) were also used where applicable. Bonus depreciation drops to 20% for 2026, with the rest eligible for the MACRS depreciation.
- Combined cycle value is from the as-filed 2022 Quadrennial Review.
- PJM determined that the assumed applicable asset life for battery storage resources should be 15 years.

<b>Financial Assumptions</b>	
Expected Life	<b>20 Years</b>
Debt Ratio	<b>55%</b>
Debt Rate	<b>6.3%</b>
Equity Rate	<b>14.1%</b>
Total Tax Rate	<b>27.2%</b>
ATWACC	<b>8.85%</b>
Inflation Rate	<b>2.2%</b>

Financial assumptions developed during 2022 Quadrennial Review were used to determine Gross CONE from the installed capital and fixed O&M costs.

Inflation Reduction Act signed into law Aug. 16, 2022, and included Investment Tax Credits (ITC) allowable to wind, solar and battery energy storage resources.

## **Eligibility requirements:**

- 30% if prevailing wage and apprenticeship for five years after in service, or reduce the ITC to 30%.
- Increased by 10% if domestic content requirements are satisfied. Facility would need 100% of the steel or iron produced in the U.S. and 40% of the manufactured products produced in the U.S.
- Increased by 10% if built in an “energy community.”

PJM is using a 30% ITC value for determining Gross CONE values.



# Comparison of Installed Capital Costs (\$/kW)

Technology	NREL 2026	Lazard	EPA 2025	EIA 2022	Used by PJM
Nuclear	7,026	7,800–12,800	5,679	6,695	6,695
Coal	2,765	2,950–6,225	3,422	4,074	4,074
Combined Cycle	934	700–1,300	1,009	1,201	1,270 ●
Combustion Turbine	809	700–925	613	785	927 ●
Solar PV – Tracking	1,198 ■	950	1,091	1,327	1,327
Solar PV – Fixed	1,114 ▲	800	1,041 ▲	1,234 ▲	1,234
Onshore Wind	1,155	1,025–1,350	1,456	1,718	1,718
Offshore Wind	2,823	2,500–3,600	1,987	4,833	4,833
Battery Energy Storage	1,285	NA	1,022	1,316	1,681 ●

■ NREL installed capital cost is noted at \$936/kW DC, and PJM multiplied the value by an Inverter Load Ratio of 1.28 to calculate \$1,198/kW AC.

▲ Fixed cost is obtained from multiplying Tracking cost by 0.93.

● As-filed Quadrennial Review values



# Description and Cost for Reference Resource

Resource Type	Technology Description	Source of Information	Fixed O&M (\$/kW-Year)	Installed Capital Costs (\$/kW)
Nuclear	2x Westinghouse AP1000 pressurized water reactor (2,156 MW)	EIA (Case 11)	127.35	6,695
Coal	Ultra-Supercritical coal (650 MW)	EIA (Case 1)	42.49	4,074
Combined Cycle	<b>Double train 1x1 GE Frame 7HA.02 with evaporative cooling, SCR and CO catalyst (1,155 MW)</b>	As-filed Quadrennial Review	38.5	1,270
Combustion Turbine	GE Frame 7HA.02 with evaporating cooling and SCR (357 MW)	As-filed Quadrennial Review	40	927
Solar PV – Tracking	Single-axis tracking (150 MW AC)	EIA (Case 24)	15.97	1,327
Solar PV – Fixed	Fixed tilt (100 MW AC)	EIA, LBNL	14.85	1,234
Onshore Wind	<b>71 x 2.8 MW WTGs (200 MW)</b>	<b>EIA (Case 20)</b>	27.57	1,718
Offshore Wind	40 x 10 MW WTGs, 100' deep (400 MW)	EIA (Case 22)	115.16	4,833
Battery Energy Storage	50 MW utility-scale, lithium-ion, 200 MWh rating	<b>As-filed Quadrennial Review</b>	36.85	1,681



# Final Default CONE values

<b>Resource Types</b>	<b>Gross Cost of New Entry (2022/2023 \$/MW-Day) (Nameplate)</b>	<b>Gross Cost of New Entry (2026/2027 \$/MW-Day) (Nameplate)</b>
<b>1. Nuclear</b>	\$2,000	\$2,568
<b>2. Coal</b>	\$1,068	\$1,480
<b>3. Combined Cycle</b>	\$320	\$540
<b>4. Combustion Turbine</b>	\$294	\$427
<b>5. Fixed Solar PV</b>	\$271	\$298
<b>6. Tracking Solar PV</b>	\$290	\$321
<b>7. Onshore Wind</b>	\$420	\$438
<b>8. Offshore Wind</b>	\$1,155	\$1,351
<b>9. Battery Energy Storage</b>	\$532	\$502

**Gross CONE will continue to be escalated for each subsequent delivery year.**



# 2026/2027 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 (\$/ICAP-MW-Day)	Capacity Value Percentages or Factors	Net CONE (\$/UCAP-MW-Day)
Nuclear	\$127	\$6,695	0%	\$2,568	\$448	\$9	\$2,111	99.1%	\$2,131
Coal	\$42	\$4,074	0%	\$1,480	\$76	\$9	\$1,395	87.2%	\$1,599
Combined Cycle			0%	\$540	\$204	\$9	\$327	96.4%	\$339
Combustion Turbine	\$40	\$927	0%	\$427	\$54	\$6	\$367	95.5%	\$384
Solar PV – Tracking	\$16	\$1,327	30%	\$298	\$162	\$9	\$127	47.0%	\$270
Solar PV – Fixed	\$16	\$1,234	30%	\$321	\$99	\$9	\$213	31.0%	\$687
Onshore Wind	\$28	\$1,718	30%	\$438	\$208	\$9	\$221	14.0%	\$1,577
Offshore Wind	\$115	\$4,833	30%	\$1,351	\$302	\$9	\$1,040	34.0%	\$3,058
Battery Energy Storage	\$37	\$1,681	30%	\$502	\$101	\$9	\$392	95.0%	\$1,031

### Notes:

- Fixed O&M and installed capital costs are from EIA report 2022. PV (fixed) costs are 93% of the costs for Solar PV (Tracking).
- Combined Cycle CONE value is the average of the CONE values from the as filed 2022 Quadrennial Review for 2026.
- Solar and Wind Investment Tax Credit depends on prevailing wage and apprenticeship requirements. An optimistic 30% value is assumed for solar and wind resources. The additional 10% ITC adder for domestic content, and additional 10% for building in an energy community, are not included.
- Class average ELCC values, estimated for the 2026/2027 Delivery Year, as percent of nameplate MW solar, wind and battery generation are used to calculate Net CONE in \$/UCAP-MW-day. Class average EFORd percentages are the values used in the 2024/2025 Delivery Year MOPR calculations.
- Battery energy storage costs are the average of the CONE values from the as-filed 2022 Quadrennial Review for 2026 for a four-hour plant with 15-year life. Gross CONE is calculated including an optimistic 30% Investment Tax Credit. The additional 10% ITC adder for domestic content, and additional 10% for building in an energy community, are not included. Net CONE (\$/UCAP-MW-day) is calculated by multiplying Net CONE (\$/ICAP-MW-day) by 2.5, and dividing by a 100% ELCC value and a 5% class average EFORd.
- Net Energy Revenue Offset is based on the posted 2024/2025 E&AS values, and Ancillary Service Revenue Offset is based on reactive services of \$3,350/MW-year or \$9/MW-day. The CT value is from the Tariff: \$2,199/MW-year or \$6/MW-day.

SME/Presenter:  
Skyler Marzewski

[Skyler.Marzewski@pjm.com](mailto:Skyler.Marzewski@pjm.com)

Facilitator:

Nikki Militello

[Nikki.Militello@pjm.com](mailto:Nikki.Militello@pjm.com)

Secretary:

Jeff Falciani

[Jeffrey.Falciani@pjm.com](mailto:Jeffrey.Falciani@pjm.com)

**Periodic Review of Default CONE and ACR Values**



**Member Hotline**

(610) 666-8980

(866) 400-8980

[custsvc@pjm.com](mailto:custsvc@pjm.com)

# Appendix





# 2022/2023 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 (\$/ICAP-MW-Day)	Capacity Value Percentages or Factors	Net CONE (\$/ICAP-MW-Day)
Nuclear	\$122	\$6,041	0%	\$2,000	\$508	\$9	\$1,483		\$1,483
Coal	\$41	\$3,676	0%	\$1,068	\$34	\$9	\$1,025		\$1,025
Combined Cycle			0%	\$320	\$159	\$9	\$152		\$152
Combustion Turbine			0%	\$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	0%	\$532	\$107	\$9	\$416	40.0%	\$1,040
Demand Response (Gen)	\$10	\$800	0%	\$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 the average of the CONE values from the 2018 Quadrennial Review for 2022.
- Solar and Wind Investment Tax Credit depends on the start of construction. An optimistic 30% value is assumed implying solar construction started before Jan. 1, 2020, and wind construction started before Jan. 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 four-hour plant with a 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 the posted March 11, 2020, MIC material and Ancillary Service Revenue Offset is based on reactive services of \$3,350/MW-year or \$9/MW-day. The CT value is from the Tariff: \$2,199/MW-year or \$6/MW-day.

## 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.*

## **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).*

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