

2026 PJM Gross Avoidable Costs for Existing Generation

Final Gross Avoidable Costs

PREPARED BY

The Brattle Group

Samuel Newell

Andrew W. Thompson

James Herrigel

Sargent & Lundy

Joshua Junge

Kelley McGough

Neil Kern

PREPARED FOR

PJM

AUGUST 19, 2026



2026 Representative Plant Characteristics Compared to 2022

Technology Type	Year	Age	Capacity	Configuration	State	Note
Natural gas CC	2022	11	750	2x F-Class, 1xST, SCR installed, firm gas	PA	Median stable despite additions and retirements
	2026	11	750	No change	No change	
Simple-cycle CT	2022	20	320	2x 160 MW F-class turbines, no firm gas	IL	No major changes in fleet, age updated by 4 years
	2026	24	320	No change	No change	
Steam oil & gas	2022	47	900	No firm gas	PA	Retirements of ~1 GW, large, aging fleet remaining.
	2026	51	1,200	No change	No change	
Coal	2022	52	1,500	2x 750 MW units, Appalachian coal, wet limestone FGD unit	PA	Despite retirements most capacity still in large plants
	2026	56	1,500	No change	WV	
Single-unit nuclear	2022	38	1,200	1x BWR unit	OH	No change in fleet, age updated by 4 years
	2026	42	1,200	No change	No change	
Multi-unit nuclear	2022	44	2,400	2x 1,200 BWR unit	IL	No change in fleet, age updated by 4 years
	2026	48	2,400	No change	No change	
Onshore wind	2022	12	200	-	IL	No major changes in fleet, age updated by 4 years
	2026	16	200	No change	No change	
Large-scale solar PV	2022	5	10	Crystalline silicon, single-axis tracking	NJ	Significant amount of large, new builds in VA.
	2026	5	20	No change	VA	
4hr BESS*	2026	2	200	4-hour duration (200 MW / 800 MWh)	NJ	Based on Fast Lane Queue

*4hr BESS is a new resource type that was not included in the 2022 study.

2026 Gross Avoidable Costs for Existing Generation

Resource Type	Representative Low-Cost Plant \$/MW-day	Representative Plant \$/MW-day	Representative High-Cost Plant \$/MW-day
Natural gas CC	120	133	150
Simple-cycle CT	53	64	98
Steam oil & gas	62	72	121
Coal	101	135	217
Multi-unit nuclear	514	580	596
Single-unit nuclear	-	654	-
Onshore wind	159	190	258
Large-scale solar PV	29	35	51
4hr BESS*	177	187	447

All values shown are in Mid-2026 Dollars per Nameplate MW per Day

* 4hr BESS avoidable costs provided with adjustment factor for 2, 6, 8, and 10 hr durations. See slide 22.

2026 Gross Avoidable Costs Compared to 2022

Technology type	2026 value (\$/MW-day)	2022 value (\$/MW-day)	2026 % change vs 2022	Observations
Natural Gas CC	\$133	\$113	+18%	Cost increases roughly in line with PPI; slightly below CONE FOM for new plant with new LTSA; Includes firm gas
Simple-Cycle CT	\$64	\$52	+24%	Costs increased more than PPI due to fleet aging; still fairly low ongoing fixed costs
ST/O&G	\$72	\$64	+12%	Cost increase a bit below PPI
Coal	\$135	\$94	+44%	Large cost increase due to maintaining aging fleet including some catchup maintenance
Single-Unit Nuclear	\$654	\$591	+11%	Based on NEI + escalation, costs increase less than PPI; large labor component more stable than materials & equipment, especially at existing representative plant in VA
Multi-Unit Nuclear	\$580	\$537	+8%	
Onshore Wind	\$190	\$147	+29%	Larger cost increase from aging representative unit at 16 years being on cusp of needing overhauls
Solar PV	\$35	\$70	-50%	Large decrease due to economies of scale from 2x-sized plant
4hr BESS	\$187	N/A	N/A	New resource type for 2026; FOM similar to CONE study

PPI turbines and turbine generator sets = +20% (Nov 2022 to June 2026).
CPI all urban consumer = +12% (Nov 2022 to June 2026).

Contact Information



Dr. Sam Newell

BRATTLE

PRINCIPAL | BOSTON

Sam.Newell@brattle.com

+1 (781) 801-2652



Dr. Andrew W. Thompson

BRATTLE

ENERGY ASSOCIATE |
BOSTON/MADRID

Andrew.Thompson@brattle.com

+34 666 639 197



Joshua Junge

SARGENT & LUNDY

PRINCIPAL ENERGY
CONSULTANT | CHICAGO

joshua.c.junge@sargentlundy.com

+1 (312) 269 2129

Appendix

Natural Gas-Fired Combined Cycles

Combined Cycle Combustion Turbine Plant				
	Units	Representative Low-Cost Plant	Representative Plant	Representative High-Cost Plant
Capacity	<i>Nameplate MW</i>	1100	750	400
Gross Costs	<i>\$/MW-day</i>	\$120	\$133	\$150
Labor	<i>\$/MW-day</i>	\$21	\$26	\$38
Fixed Expenses	<i>\$/MW-day</i>	\$70	\$79	\$89
Property Taxes	<i>\$/MW-day</i>	\$8	\$7	\$3
Insurance	<i>\$/MW-day</i>	\$21	\$21	\$21
Non-Fuel Variable Costs	<i>\$/MWh</i>	\$3.39	\$3.56	\$4.92
Operating Costs	<i>\$/MWh</i>	\$0.77	\$0.88	\$1.03
Maintenance Adder	<i>\$/MWh</i>	\$2.61	\$2.68	\$3.89

Simple-Cycle Combustion Turbines

Simple Cycle Combustion Turbine Plant				
	Units	Representative Low-Cost Plant	Representative Plant	Representative High-Cost Plant
Capacity	<i>Nameplate MW</i>	640	320	100
Gross Costs	<i>\$/MW-day</i>	\$53	\$64	\$98
Labor	<i>\$/MW-day</i>	\$12	\$17	\$27
Fixed Expenses	<i>\$/MW-day</i>	\$14	\$16	\$34
Property Taxes	<i>\$/MW-day</i>	\$15	\$16	\$17
Insurance	<i>\$/MW-day</i>	\$12	\$15	\$19
Non-Fuel Variable Costs	<i>\$/MWh</i>	\$6.44	\$5.84	\$7.51
Operating Costs	<i>\$/MWh</i>	\$0.72	\$0.81	\$0.84
Maintenance Adder	<i>\$/MWh</i>	\$5.73	\$5.03	\$6.67

Steam Turbine Oil and Gas

Steam Oil and Gas				
	Units	Representative Low-Cost Plant	Representative Plant	Representative High-Cost Plant
Capacity	<i>Nameplate MW</i>	1700	1200	350
Gross Costs	<i>\$/MW-day</i>	\$62	\$72	\$121
Labor	<i>\$/MW-day</i>	\$25	\$27	\$49
Fixed Expenses	<i>\$/MW-day</i>	\$33	\$41	\$65
Property Taxes	<i>\$/MW-day</i>	\$1	\$1	\$2
Insurance	<i>\$/MW-day</i>	\$2	\$3	\$5
Non-Fuel Variable Costs	<i>\$/MWh</i>	\$7.25	\$7.78	\$9.90
Operating Costs	<i>\$/MWh</i>	\$1.48	\$1.58	\$2.03
Maintenance Adder	<i>\$/MWh</i>	\$5.78	\$6.19	\$7.87

Coal

Coal Plant				
	Units	Representative Low-Cost Plant	Representative Plant	Representative High-Cost Plant
Capacity	<i>Nameplate MW</i>	2700	1500	80
Gross Costs	<i>\$/MW-day</i>	\$101	\$135	\$217
Labor	<i>\$/MW-day</i>	\$41	\$54	\$101
Fixed Expenses	<i>\$/MW-day</i>	\$54	\$75	\$94
Property Taxes	<i>\$/MW-day</i>	\$0	\$0	\$15
Insurance	<i>\$/MW-day</i>	\$6	\$7	\$7
Non-Fuel Variable Costs	<i>\$/MWh</i>	\$10.91	\$12.35	\$13.58
Operating Costs	<i>\$/MWh</i>	\$5.21	\$6.16	\$6.64
Maintenance Adder	<i>\$/MWh</i>	\$5.70	\$6.19	\$6.94

Nuclear

Nuclear Plant					
	Units	Single-Unit Nuclear Plant	Representative Multi-Unit Nuclear Plant		
Capacity	Nameplate MW	1,200	2,400	2,400	2,400
Gross Costs	\$/MW-day	\$654	\$514	\$580	\$596
Capital Costs	\$/MW-day	\$85	\$77	\$75	\$75
Fixed Operating Costs	\$/MW-day	\$543	\$412	\$480	\$496
Property Taxes	\$/MW-day	\$26	\$25	\$25	\$25
Non-Fuel Variable Costs	\$/MWh	\$2.68	\$2.49	\$2.53	\$2.54
Operating Costs	\$/MWh	\$0.36	\$0.29	\$0.34	\$0.35
Major Maintenance	\$/MWh	\$2.32	\$2.19	\$2.19	\$2.19

Onshore Wind

Onshore Wind Plant				
	Units	Representative Low-Cost Plant	Representative Plant	Representative High-Cost Plant
Capacity	<i>Nameplate MW</i>	300	200	30
Gross Costs	<i>\$/MW-day</i>	\$159	\$190	\$258
Labor	<i>\$/MW-day</i>	\$30	\$36	\$62
Fixed Expenses	<i>\$/MW-day</i>	\$108	\$131	\$166
Property Taxes	<i>\$/MW-day</i>	\$12	\$13	\$17
Insurance	<i>\$/MW-day</i>	\$9	\$9	\$13
Non-Fuel Variable Costs	<i>\$/MWh</i>	\$0.00	\$0.00	\$0.00

Solar PV

Large Scale Solar Photovoltaic Plant				
	Units	Representative Low-Cost Plant	Representative Plant	Representative High-Cost Plant
Capacity	<i>Nameplate MW</i>	120	20	2
Gross Costs	<i>\$/MW-day</i>	\$29	\$35	\$51
Labor	<i>\$/MW-day</i>	\$5	\$7	\$14
Fixed Expenses	<i>\$/MW-day</i>	\$12	\$17	\$21
Property Taxes	<i>\$/MW-day</i>	\$3	\$5	\$4
Insurance	<i>\$/MW-day</i>	\$8	\$6	\$12
Non-Fuel Variable Costs	<i>\$/MWh</i>	\$0.00	\$0.00	\$0.00

Standalone BESS

BESS				
	Units	Representative Low-Cost Plant	Representative Plant	Representative High-Cost Plant
Capacity	<i>Nameplate MW</i>	200	200	100
Gross Costs	<i>\$/MW-day</i>	\$177	\$187	\$447
Labor	<i>\$/MW-day</i>	\$3	\$4	\$6
Fixed Expenses	<i>\$/MW-day</i>	\$84	\$67	\$168
Property Taxes	<i>\$/MW-day</i>	\$60	\$53	\$121
Insurance	<i>\$/MW-day</i>	\$30	\$26	\$61
Levelized Augmentations	<i>\$/MW-day</i>	\$0	\$37	\$91
Non-fuel Variable Costs	<i>\$/MWh</i>	\$0.00	\$0.00	\$0.00

Existing Natural Gas CC Plants

Population characteristics

- Mostly built 6-8 or 20-30 years ago
- Most capacity comes from 500-1,500 MW plants
- SCRs are common on CCs. Mostly F-class turbines
- Most capacity in PA, followed by OH, VA, & NJ

Primary drivers of cost variability

- Capacity, configuration, and turbine type
- Operating years
- Capacity factor
- Location

Natural Gas CC Characteristics and Costs in 2026

Low-Cost Representative Plant \$120/MW-day	Representative Plant \$133/MW-day <i>compare to \$113/MW-day in 2022</i>	High-Cost Representative Plant \$150/MW-day
•1,100 MW (2 x 550 MW) •H-class turbines (2x1x1) •SCR •Pennsylvania •9 yrs old (+4 yrs from 2022)	•750 MW (2x 375 MW) •F-class turbines (2x1) •SCR •Pennsylvania •11 yrs old	•400 MW (1x 400 MW) •F-class turbines (1x1) •SCR •Virginia •34 yrs old (+4 yrs for 2022)

Existing Simple-Cycle CT Plants

Population characteristics

- Most capacity from large plants (300-1000 MW)
- SCR not common on CTs
- Primarily built 20 to 30 years ago
- Most capacity in IL, OH, VA

Primary drivers of cost variability

- Capacity, co-located quantity, and turbine type
- Operating years
- Capacity factor
- Location

Simple-Cycle CT Characteristics and Costs in 2026

Low-Cost Representative Plant \$53/MW-day	Representative Plant \$64/MW-day <i>compare to \$52/MW-day in 2022</i>	High-Cost Representative Plant \$98/MW-day
•640 MW (8 x 80 MW) •E-class turbines •No SCR •Illinois •24 yrs old (+4 yrs from 2022)	•320 MW (2 x 160 MW) •F-class turbines •No SCR •Illinois •24 yrs old (+4 yrs from 2022)	•100 MW (2 x 50 MW) •LM6000 •No SCR •Pennsylvania •24 yrs old (+4 yrs from 2022)

Existing ST/O&G Plants

Population characteristics

- Most plants are <10 MW, but capacity comes mainly from large plants (1,500-1,750 MW)
- Most capacity and plants are in PA
- Plants contributing the most capacity have been operating for 50 – 60 years

Primary drivers of cost variability

- Age
- Capacity
- Location
- Plant configuration

ST/O&G Characteristics and Costs in 2026

Low-Cost Representative Plant \$62/MW-day	Representative Plant \$72/MW-day <i>compare to \$64/MW-day in 2022</i>	High-Cost Representative Plant \$121/MW-day
•1,700 MW (1,300 MW in '22) •Pennsylvania •50 yrs old (47 yrs old in '22)	•1,200 MW (+300 MW from '22) •Pennsylvania •51 yrs old (47 yrs old in '22)	•350 MW •Pennsylvania •73 yrs old (65 yrs old in '22)

Existing Coal Plants

Population characteristics

- Most capacity is from plants in 1,500-1,750 MW and 2,500-3,000 MW ranges
- Nearly all plants have flue-gas desulfurization (FGD)
- Most capacity in WV, PA, OH
- More than 50% of coal units are 50+ years old

Primary drivers of cost variability

- Range of capacity, configuration, and boiler type
- Operating years
- Capacity factor
- Location

Coal Characteristics and Costs in 2026

Low-Cost Representative Plant \$101/MW-day	Representative Plant \$135/MW-day <i>compare to \$94/MW-day in 2022</i>	High-Cost Representative Plant \$217/MW-day
•2,700 MW (3 x 900 MW) •Appalachian coal (high sulfur) •Wet limestone FGD •Ohio (PA in '22) •51 yrs old (52 yrs old in '22)	•1,500 MW (2 x 750 MW) •Appalachian coal (high sulfur) •Wet limestone FGD •West Virginia (PA in '22) •56 yrs old (52 yrs old in '22)	•80 MW (1 x 80 MW) •Appalachian coal (high sulfur) •Wet limestone FGD •Pennsylvania (WV in '22) •35 yrs old (30 yrs old in '22)

Existing Single-Unit Nuclear Plants

Population characteristics

- Only 2 in PJM, both in Ohio
- Plants have capacity of 900 and 1,200 MW, respectively
- 48 and 38 years of operations, respectively

Primary drivers of cost variability

- Market revenue structure: wholesale vs cost of service
- Reactor type: pressurized water or boiling water
- Operator’s fleet size: single or multiple plants

Single-Unit Nuclear Characteristics and Costs in 2026		
Low-Cost Representative Plant	Representative Plant \$654/MW-day <i>compare to \$591/MW-day in 2022</i>	High-Cost Representative Plant
- Only 2 plants in PJM - Too few units to estimate a range	1,200 MW - Boiling Water Reactor - Ohio 42 yrs old (+4 yrs from 2022)	- Only 2 plants in PJM - Too few units to estimate a range

Existing Multi-Unit Nuclear Plants

Population characteristics

- Most capacity comes from 2,250 – 2,500 MW plants
- Most capacity in IL and PA
- Most plants have been operating for 40-60 years

Primary drivers of cost variability

- Market revenue structure: wholesale vs cost of service
- Reactor type: pressurized water or boiling water
- Operator’s fleet size: single or multiple plants

Multi-Unit Nuclear Characteristics and Costs in 2026

Low-Cost Representative Plant \$514/MW-day	Representative Plant \$580/MW-day <i>compare to \$537/MW-day in 2022</i>	High-Cost Representative Plant \$596/MW-day
•2,400 MW (2 x 1,200 MW) •Pressurized Water Reactor •Virginia •51 yrs old (+4 yrs from 2022) •Operator with multiple plants	•2,400 MW (2 x 1,200 MW) •Boiling Water Reactor •Illinois •48 yrs old (+4 yrs from 2022) •Operator with multiple plants	•2,400 MW (2 x 1,200 MW) •Boiling Water Reactor •Illinois •48 yrs old (+4 yrs from 2022) •Operator with single plant

Existing Onshore Wind Plants

Population characteristics

- Most capacity comes from 150-250 MW plants. Average (100 MW) is skewed by a few large plants (750-1000 MW)
- Most capacity in IL and IN, but mainly larger plants; smaller plants mostly in OH and PA
- Most plants have been operating for 14 – 18 years

Primary drivers of cost variability

- Capacity, co-located quantity
- Location
- Age

Onshore Wind Characteristics and Costs in 2026

Low-Cost Representative Plant \$159/MW-day	Representative Plant \$190/MW-day <i>compare to \$147/MW-day in 2022</i>	High-Cost Representative Plant \$258/MW-day
•300 MW •Illinois •14 yrs old (+4 yrs from 2022)	•200 MW •Illinois •16 yrs old (+4 yrs from 2022)	•30 MW •Pennsylvania •16 yrs old (+4 yrs from 2022)

Existing Solar PV Plants

Population characteristics

- Most capacity is from 1-10 and 100-150 MW plants
- Most capacity in VA and OH, but mostly from large plants. Smaller plants are concentrated in NJ, IL, & MD
- Most capacity comes from plants that are 0-4 years old

Primary drivers of cost variability

- Capacity, co-located quantity
- Location

Solar PV Plant Characteristics and Costs in 2026

Low-Cost Representative Plant \$29/MW-day	Representative Plant \$35/MW-day <i>compare to \$70/MW-day in 2022</i>	High-Cost Representative Plant \$51/MW-day
•120 MW (+40 MW from '22) •Polysilicon •Single-axis tracking •Virginia (NC in '22) •2 yrs old (5 yrs old in '22)	•20 MW (+10 MW from '22) •Crystalline silicon •Single-axis tracking •Virginia (NJ in '22) •5 yrs old	•2 MW •Crystalline silicon •Single-axis tracking •New Jersey •5 yrs old (7 yrs old in '22)

Projected BESS Plants Based on PJM Fast Lane IX Queue

Population characteristics

- 40 standalone BESS projects in PJM Fast Lane IX queue
- 22 plants report duration. Of these plants, 63% of capacity (68% of plants) have 4-hour duration.

Primary drivers of cost variability

- Size
- Duration
- Overbuild and augmentation approach
- Location

Projected **BESS** Characteristics and Costs by 2030/31

Low-Cost Representative Plant \$177/MW-day	Representative Plant \$187/MW-day	High-Cost Representative Plant \$447/MW-day
4-hour duration 200 MW / 800 MWh capacity 2028 COD - Virginia	4-hour duration 200 MW / 800 MWh capacity 2028 COD - New Jersey	10-hour duration 100 MW / 1,000 MWh capacity 2029 COD - Virginia

	4-Hour (Reference)	2-Hour	6-Hour	8-Hour	10-Hour
Adjustment Factor	1.000	0.574	1.436	1.866	2.297

THE POWER OF ECONOMICS

BRATTLE.COM

