2026 PJM Gross Avoidable Costs for Existing Generation

Existing Fleet and Representative Plant Analysis

PREPARED BY

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JULY 8, 2026

Brattle

Agenda

1. Overview of Resource Types and Changes from 2022
2. 2026 Analysis of Existing Generation and Draft ACR Ranges
3. Next Steps

Goals and Contents of Today's Presentation

Goals

- **Solicit stakeholder feedback** on initial analysis

Contents

- **Representative plant characteristics** for selected types
- **Initial avoidable cost ranges** for listed types

Proposed Resource Types for Existing Generation

Proposed types cover ~95% of the entire PJM fleet (in ICAP terms)

Technology Type	Total MW (Summer ICAP)	Percent of PJM Fleet Capacity	Recommendation
Natural gas CC	**59,829**	**29%**	**Include**
Coal	**34,986**	**17%**	**Include**
Single-unit nuclear	**32,556**	**16%**	**Include**
Multi-unit nuclear			
Simple-cycle CT	**27,702**	**13%**	**Include**
Large-scale solar PV	**19,672**	**10%**	**Include**
Onshore wind	**11,395**	**6%**	**Include**
Steam oil & gas	**8,100**	**4%**	**Include**
Pumped storage	5,232	3%	Unit Specific
Hydro	3,275	2%	Unit Specific
Other	2,478	1%	Unit Specific

Source: Hitachi Velocity Suite.

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	
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	
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	
Large-scale solar PV	**2022**	5	10	Crystaline silicon, single-axis tracking	NJ	Significant amount of large, new builds in VA.
	2026	5	20	No change	VA	
Onshore wind	**2022**	12	200	-	IL	No major changes in fleet, age updated by 4 years
	2026	16	200	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	
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 Representative Plant Characteristics Compared to 2022

Technology type	2026 range ($/MW-day)	2026 midpoint ($/MW-day)	2022 value ($/MW-day)	2026 midpoint % vs 2022	Observations
Natural Gas CC	$112–$137	$125	$113	+10%	Cost increases mostly in line with inflation
Coal	TBD	TBD	$94	TBD	TBD
Single-Unit Nuclear	$589–$720	$655	$591	+11%	Cost increases mostly in line with inflation
Multi-Unit Nuclear	$542–$663	$603	$537	+12%	Cost increases mostly in line with inflation
Simple-Cycle CT	$59–$73	$66	$52	+27%	Costs have outstripped inflation due to representative plant aging
Solar PV	$35–$43	$39	$70	–44%	Cost reduction mostly due to economies of scale from 2x larger plant
Onshore Wind	$171–$209	$190	$147	+29%	Costs increasing more than inflation due to representative plant aging
ST/O&G	TBD	TBD	$64	TBD	TBD
BESS	$141–$172	$157	N/A	N/A	New resource type in 2026

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

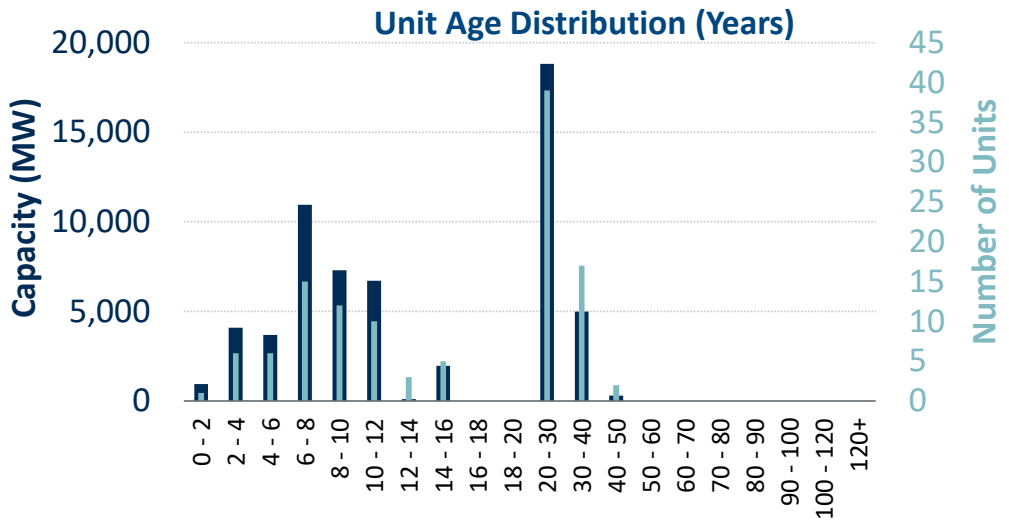
Primary drivers of cost variability

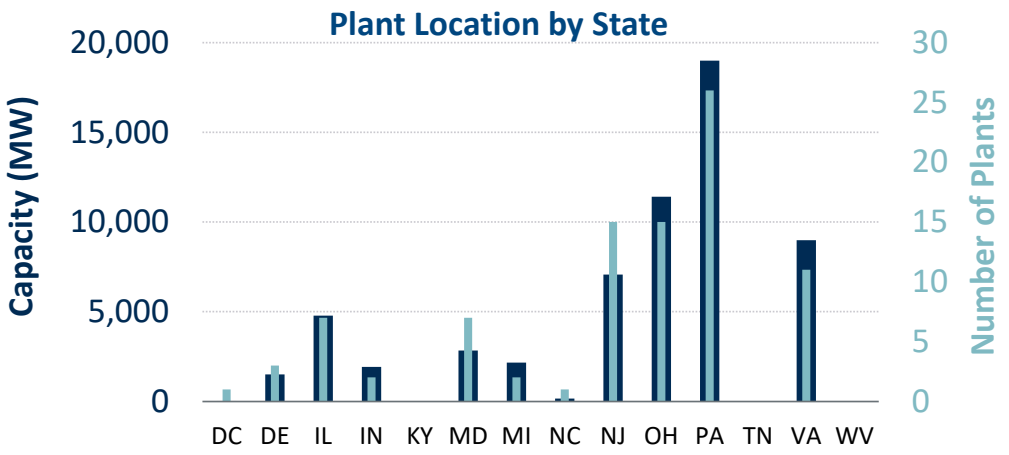
- Capacity, configuration, and turbine type
- Operating years
- Capacity factor
- Location

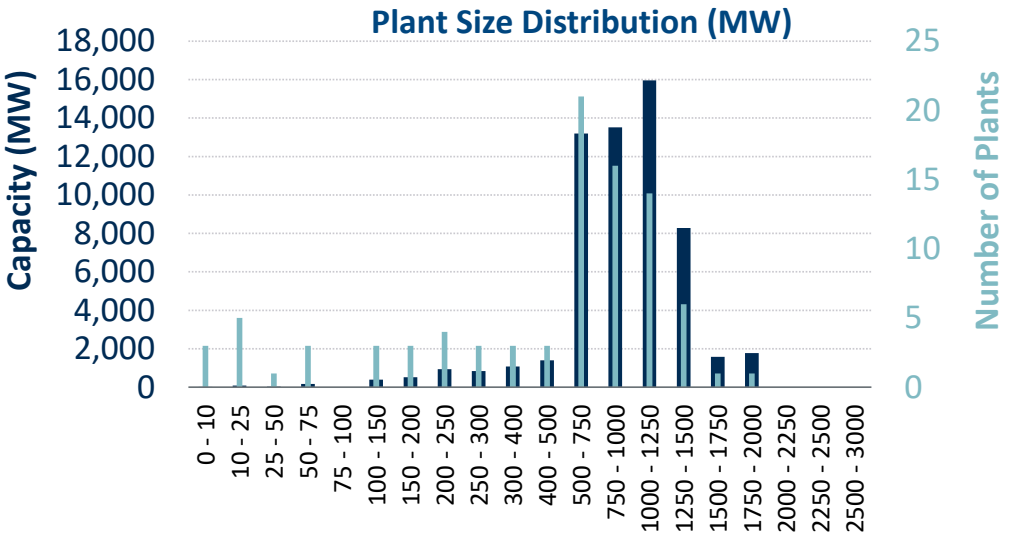
Natural Gas CC Characteristics and Costs in 2026

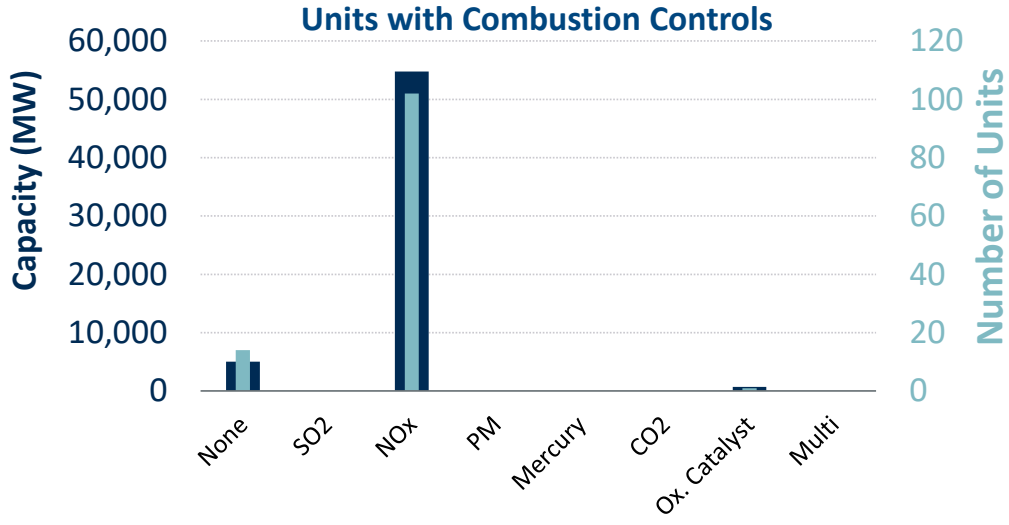
Low-Cost Representative Plant	**Representative Plant** **$112 - $137/MW-day** *compare to $113/MW-day in 2022*	High-Cost Representative Plant
•1,100 MW (2 x 550 MW) •H-class turbines (2x1x1) •SCR •Pennsylvania **•9 yrs old (+4 yrs from 2022)**	•750 MW (2x 375 MW) •F-class turbines (2x1) •SCR •Pennsylvania •11 yrs old	•400 MW (1x 400 MW) •F-class turbines (1x1) •SCR •Virginia **•34 yrs old (+4 yrs for 2022)**

Existing Natural Gas CC Fleet









Source: Hitachi Powergrids, Velocity Suite.

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

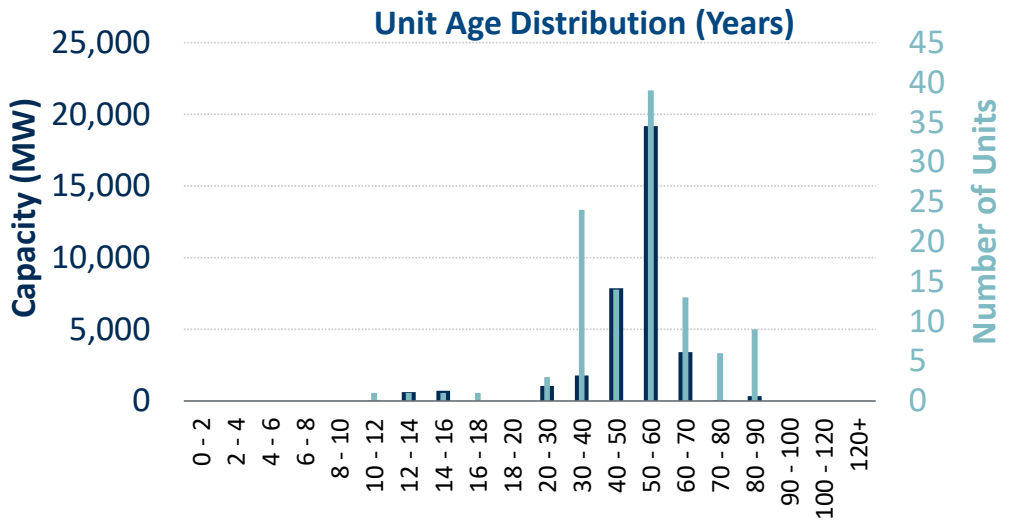
Primary drivers of cost variability

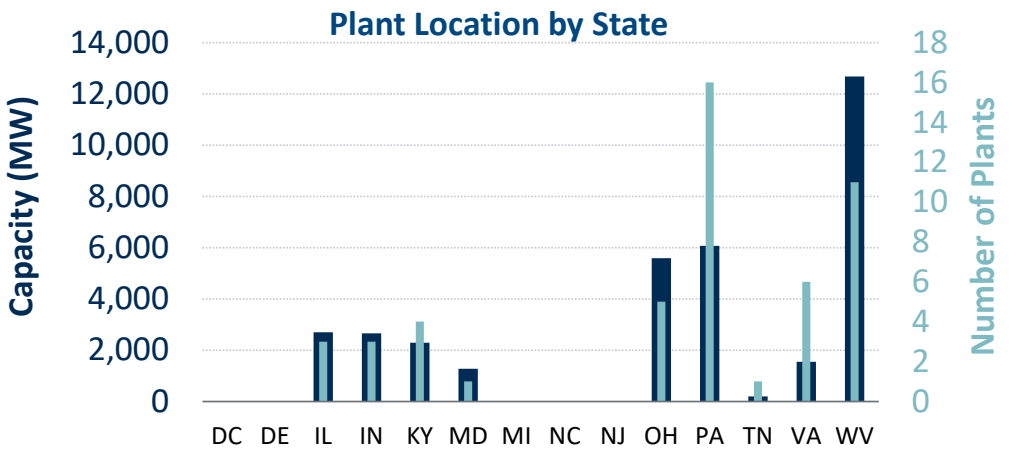
- Range of capacity, configuration, and boiler type
- Operating years
- Capacity factor
- Location

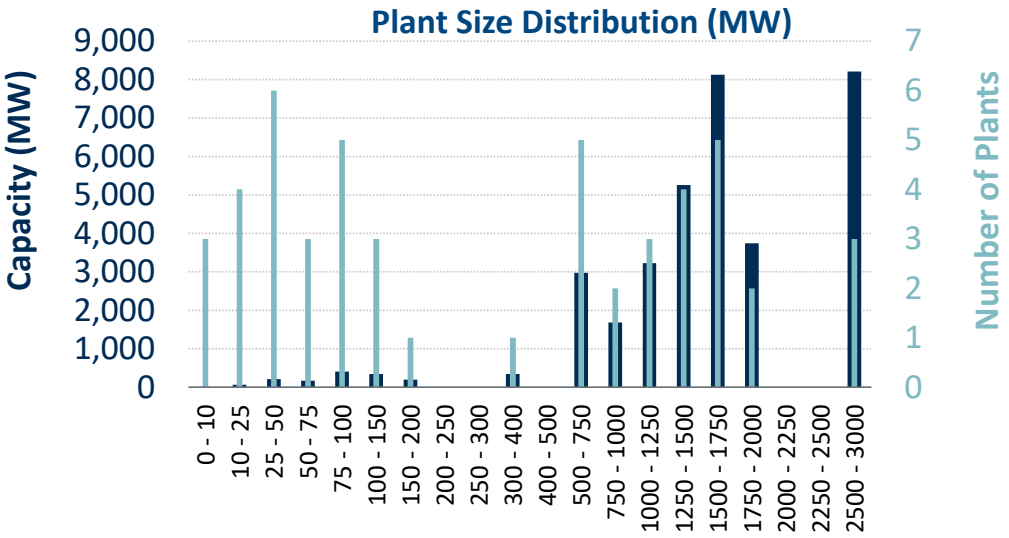
Coal Characteristics and Costs in 2026

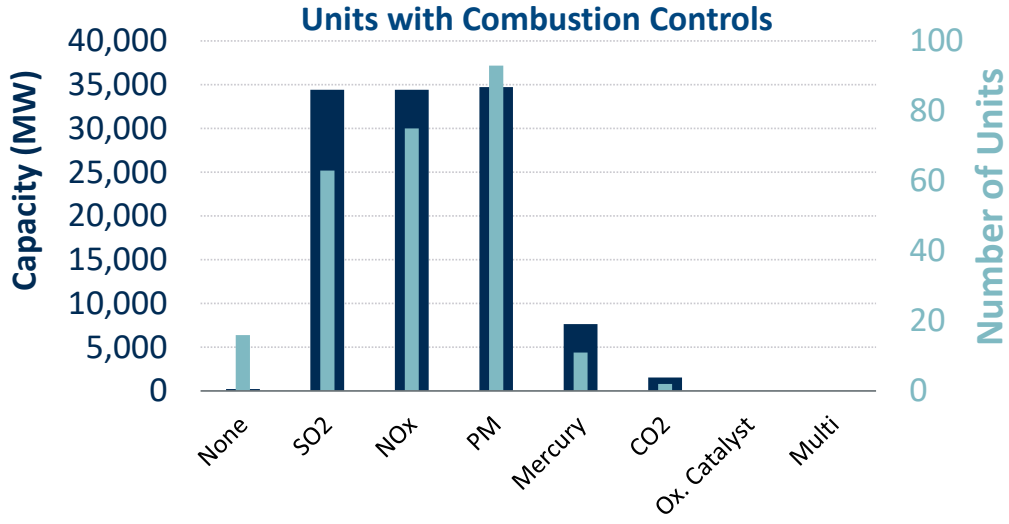
Low-Cost Representative Plant	**Representative Plant** **$TBD/MW-day** *compare to $94/MW-day in 2022*	High-Cost Representative Plant
•**2,700 MW (3 x 900 MW)** •Appalachian coal (high sulfur) •Wet limestone FGD •**Ohio (PA in ’22)** •**51 yrs old (52 yrs old in ’22)**	•1,500 MW (2 x 750 MW) •Appalachian 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 Coal Fleet









Source: Hitachi Powergrids, Velocity Suite.

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

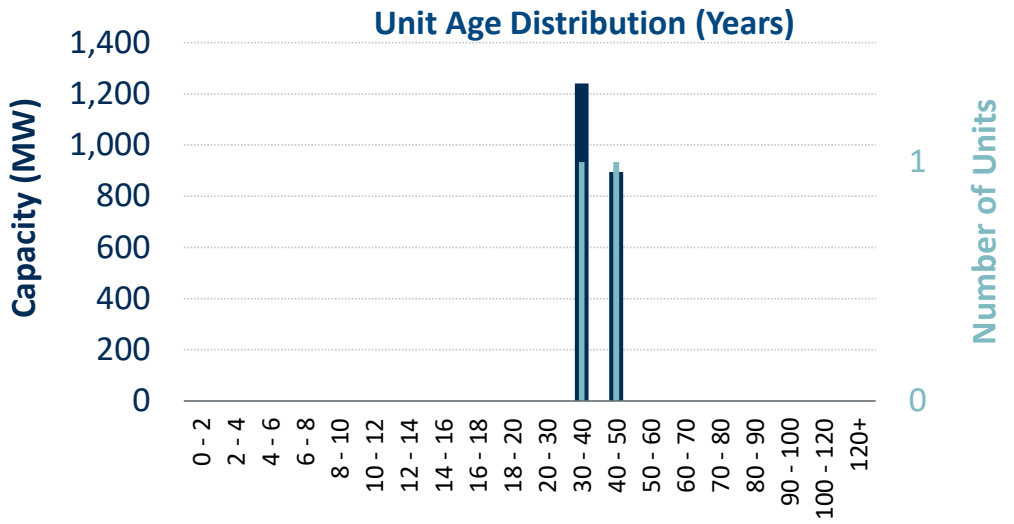
Primary drivers of cost variability

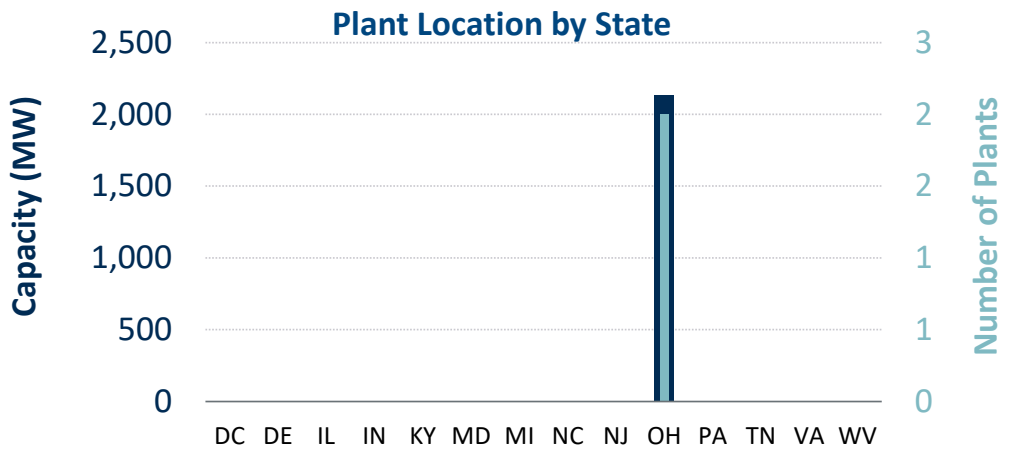
- Market revenue structure: wholesale vs cost of service
- Reactor type: pressurized water or boiling water
- Operator's fleet size: single or multiple plants

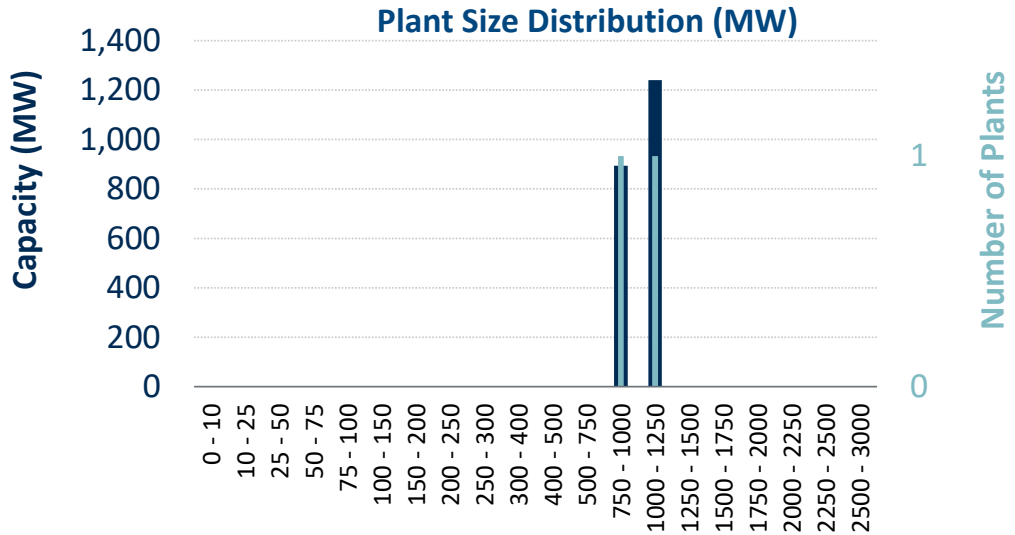
Single-Unit Nuclear Characteristics and Costs in 2026

Low-Cost Representative Plant	**Representative Plant** **$589 - $720/MW-day** *compare to $591/MW-day in 2022*	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 Single-Unit Nuclear Fleet







Source: Hitachi Powergrids, Velocity Suite.

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

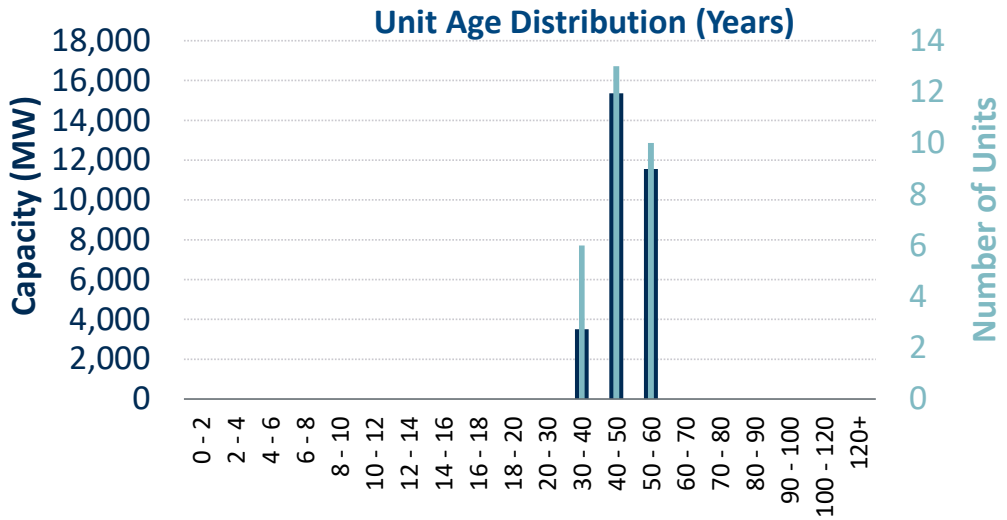
Primary drivers of cost variability

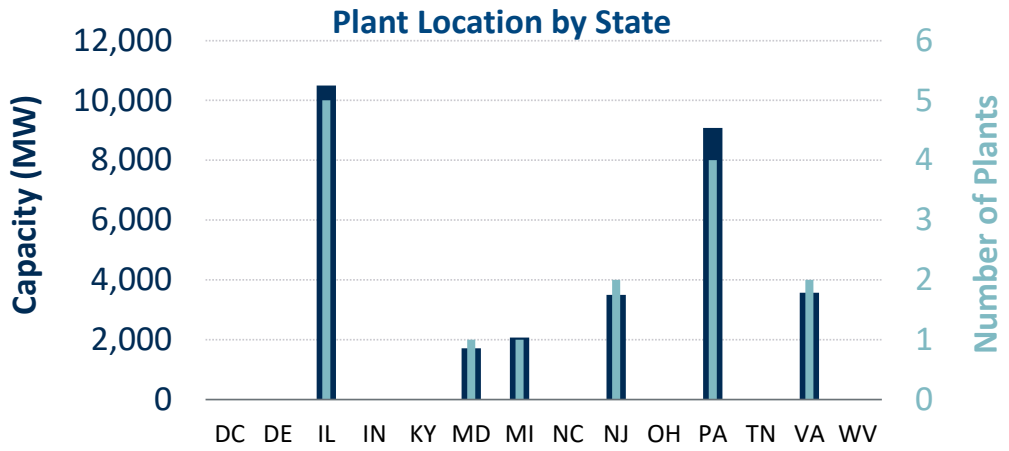
- Market revenue structure: wholesale vs cost of service
- Reactor type: pressurized water or boiling water
- Operator's fleet size: single or multiple plants

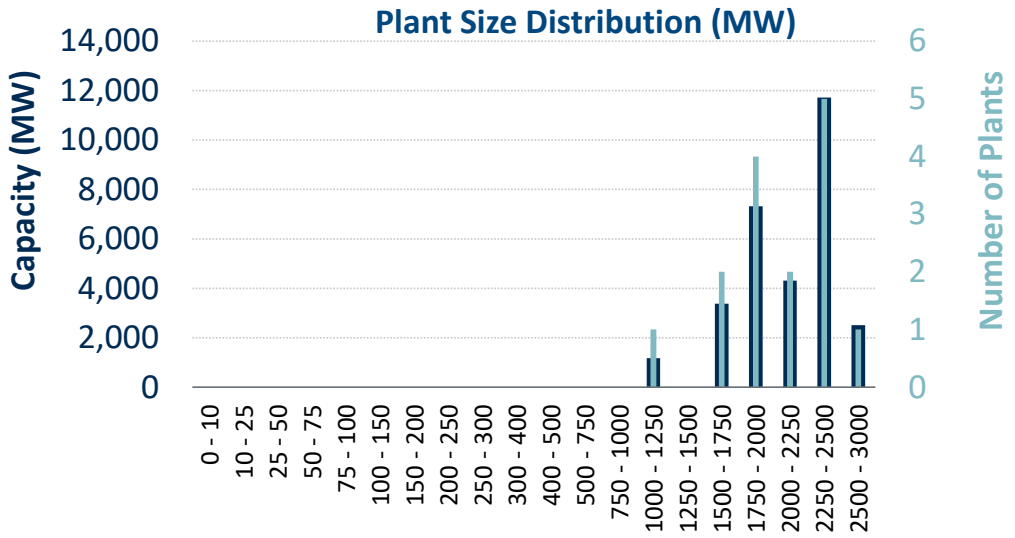
Multi-Unit Nuclear Characteristics and Costs in 2026

Low-Cost Representative Plant	**Representative Plant** **$542 - $663/MW-day** *compare to $537/MW-day in 2022*	High-Cost Representative Plant
•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 Multi-Unit Nuclear Fleet







Source: Hitachi Powergrids, Velocity Suite.

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

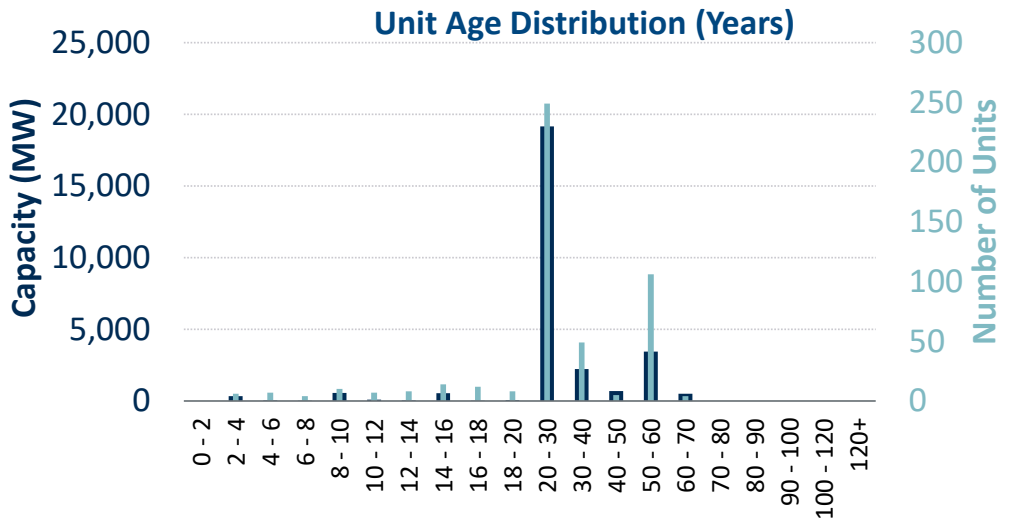
Primary drivers of cost variability

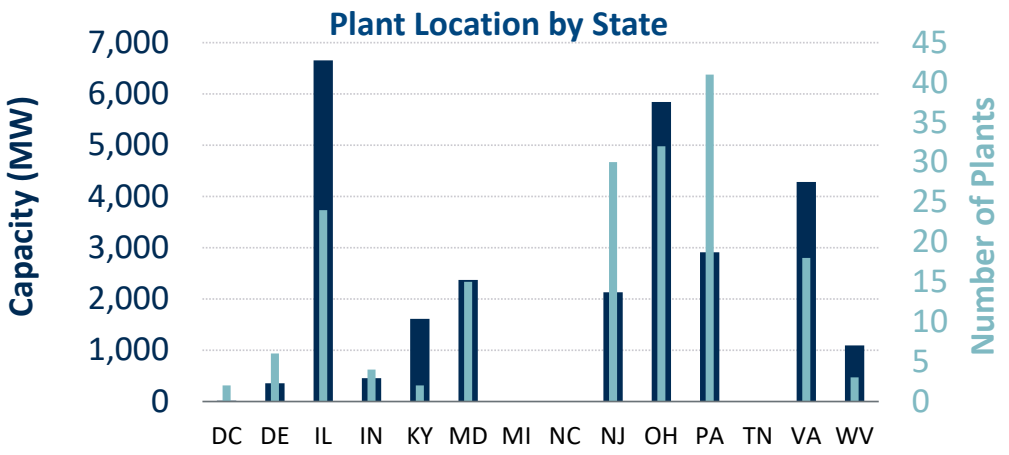
- Capacity, co-located quantity, and turbine type
- Operating years
- Capacity factor
- Location

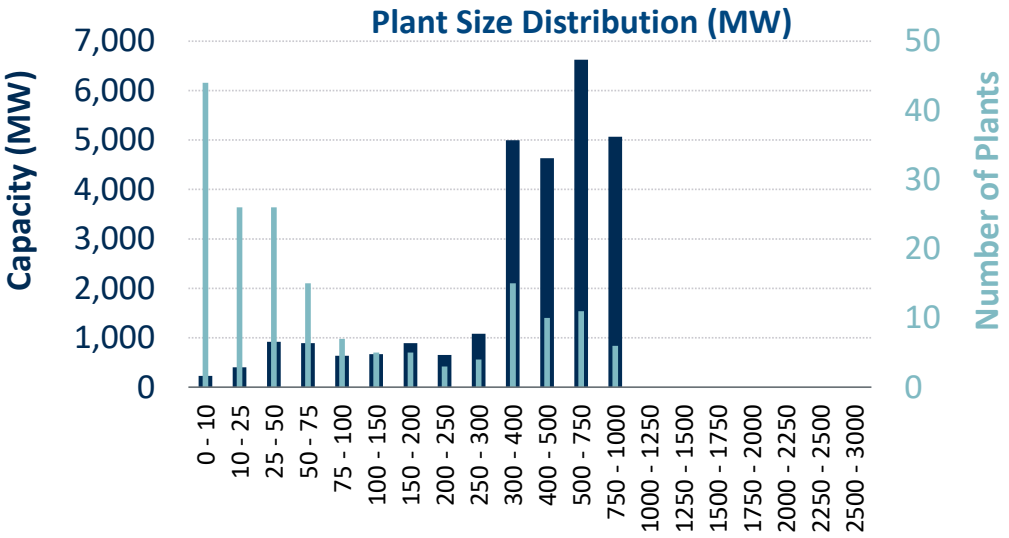
Simple-Cycle CT Characteristics and Costs in 2026

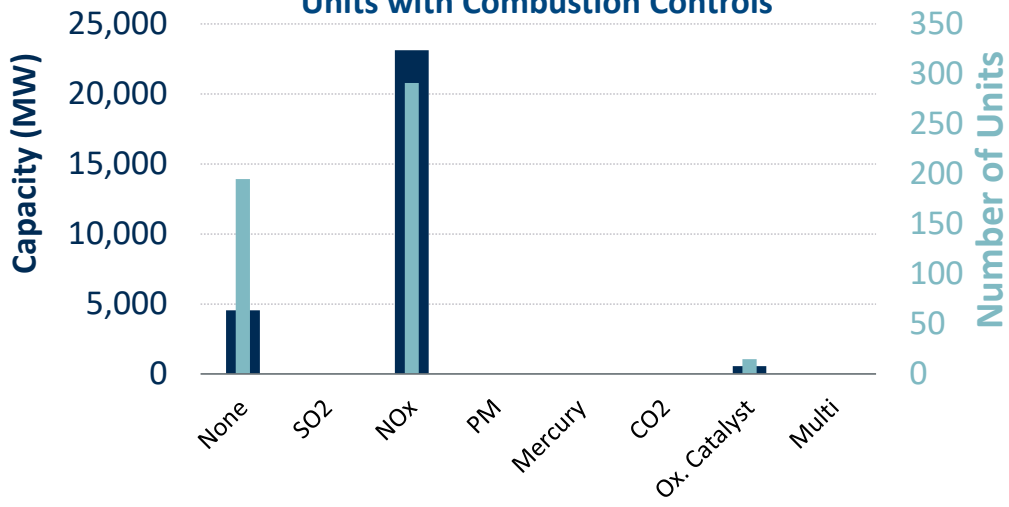
Low-Cost Representative Plant	**Representative Plant** **$59 - $73/MW-day** *compare to $52/MW-day in 2022*	High-Cost Representative Plant
•640 MW (8 x 80 MW) •F-class turbines •No SCR •Illinois •**24 yrs old (+4 yrs from 2022)**	•320 MW (2 x 160 MW) •F-class turbines •No SCR •Illinois •**24 yrs old (+4 yrs from 2022)**	•100 MW (2 x 50 MW) •LM6000 •No SCR •Pennsylvania •**24 yrs old (+4 yrs from 2022)**

Existing Simple-Cycle CT Fleet









Source: Hitachi Powergrids, Velocity Suite.

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

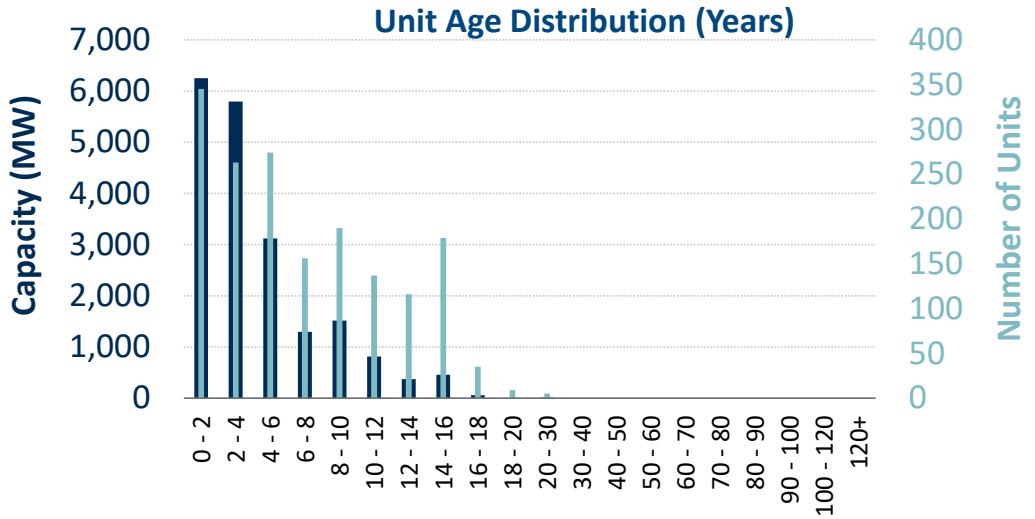
Primary drivers of cost variability

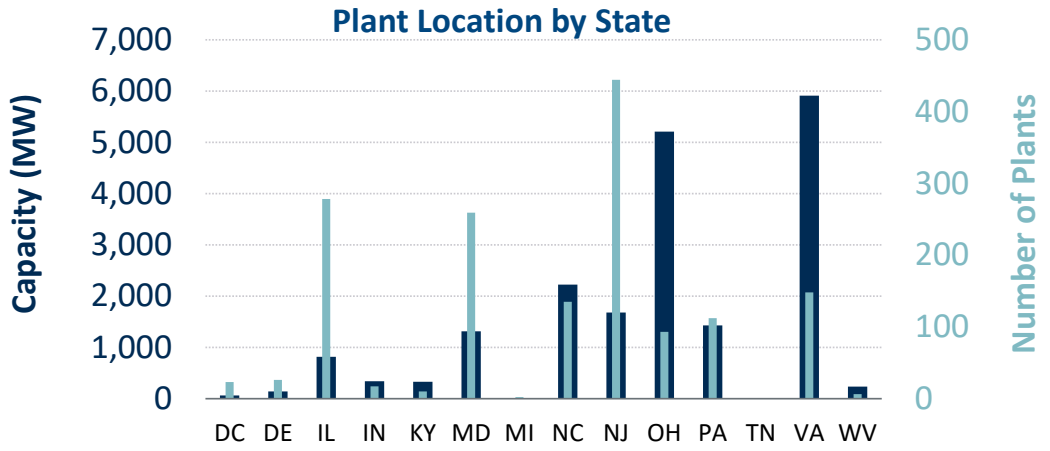
- Capacity, co-located quantity
- Location

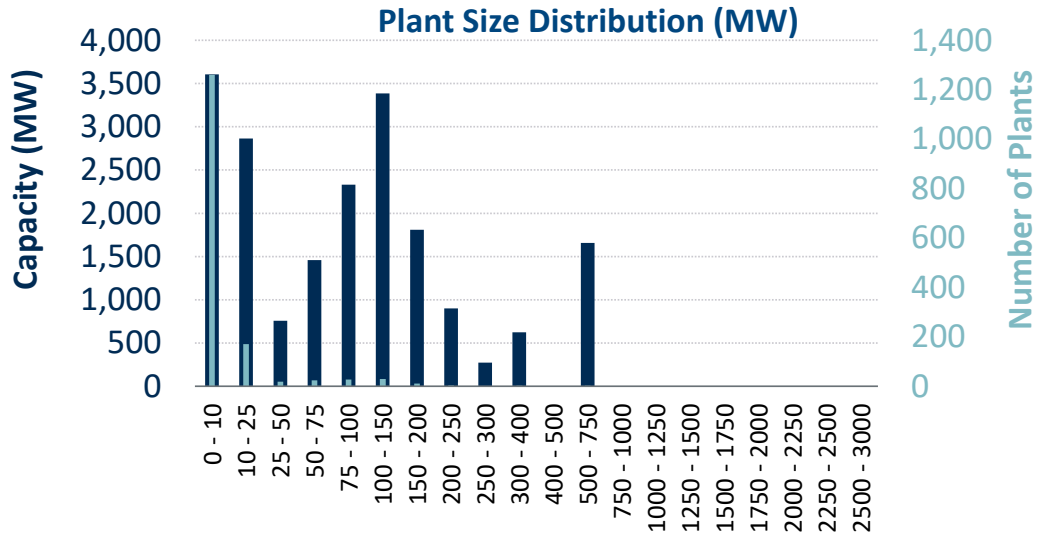
Solar PV Plant Characteristics and Costs in 2026

Low-Cost Representative Plant	Representative Plant **$35 - $43/MW-day** *compare to $70/MW-day in 2022*	High-Cost Representative Plant
•**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)**

Existing Solar PV Fleet







Source: Hitachi Powergrids, Velocity Suite.

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

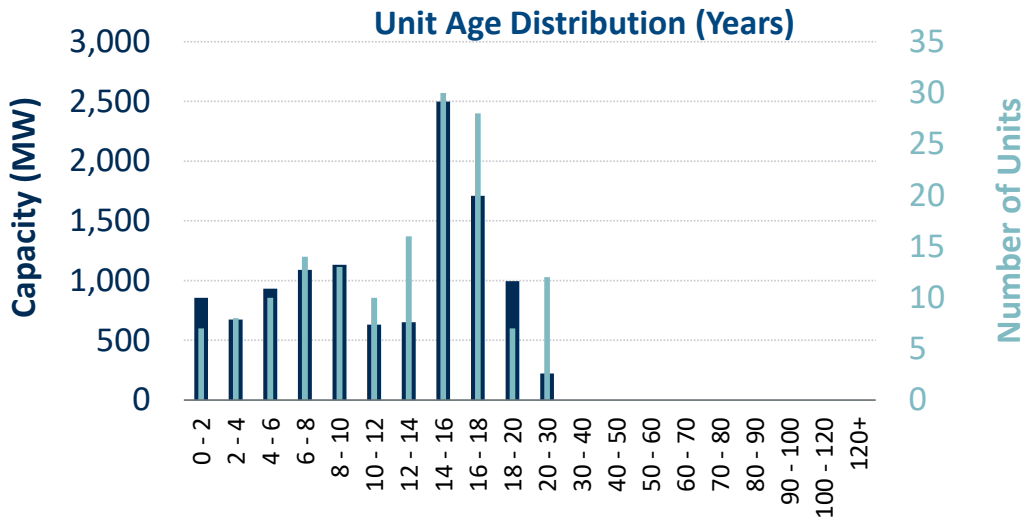
Primary drivers of cost variability

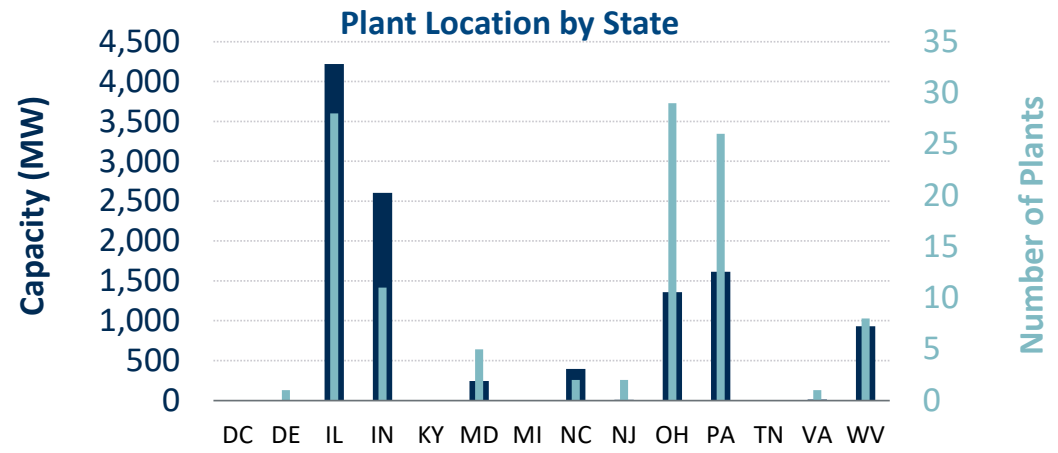
- Capacity, co-located quantity
- Location
- Age

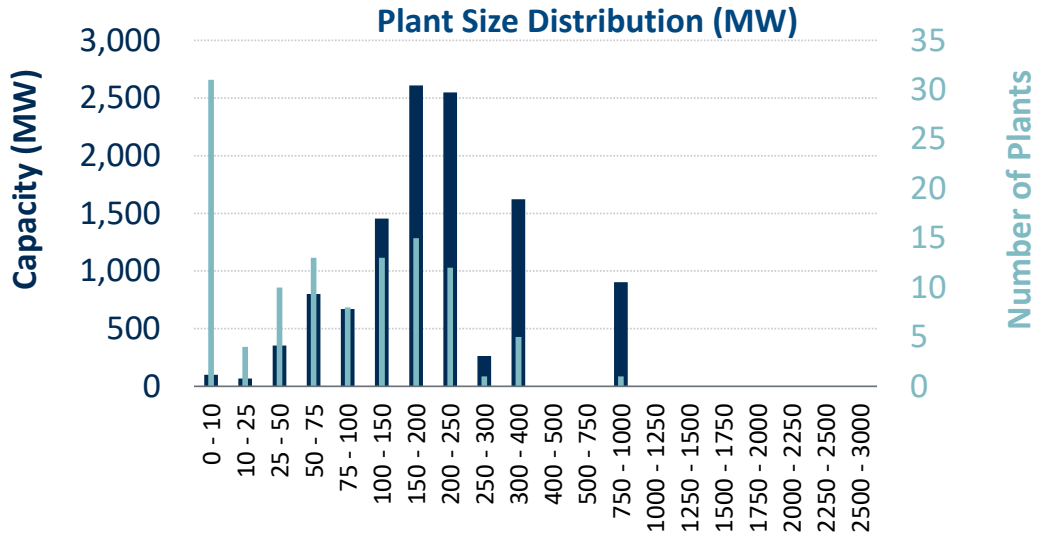
Onshore Wind Characteristics and Costs in 2026

Low-Cost Representative Plant	**Representative Plant** **$171 - $209/MW-day** *compare to $147/MW-day in 2022*	High-Cost Representative Plant
•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 Onshore Wind Fleet







Source: Hitachi Powergrids, Velocity Suite.

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

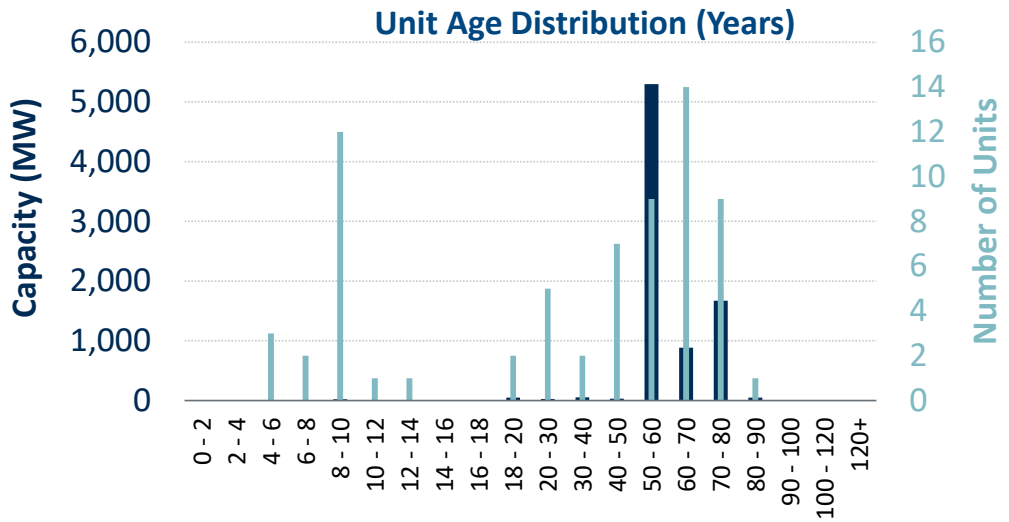
Primary drivers of cost variability

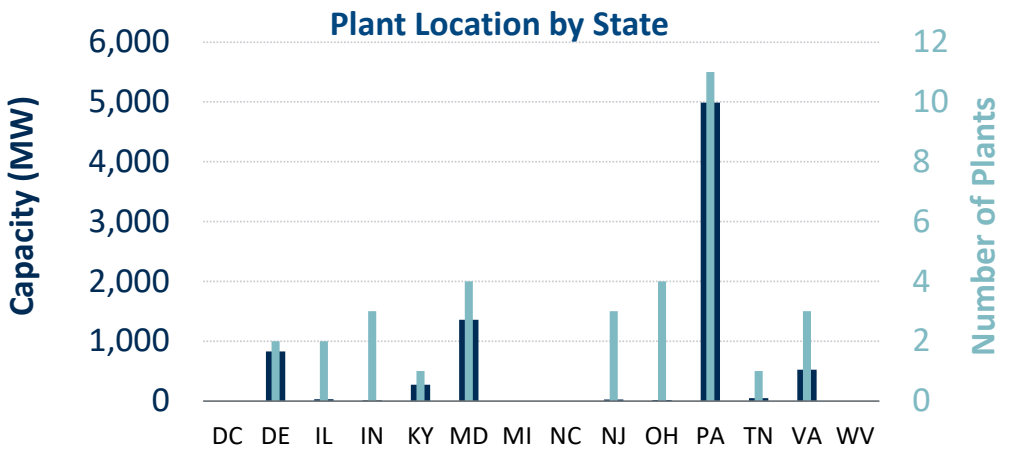
- Age
- Capacity
- Location
- Plant configuration

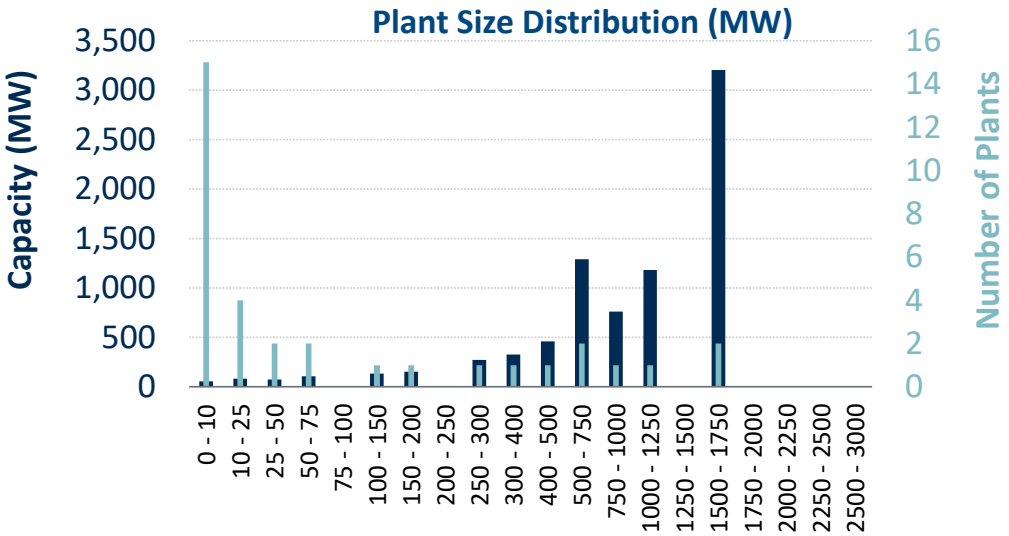
ST/O&G Characteristics and Costs in 2026

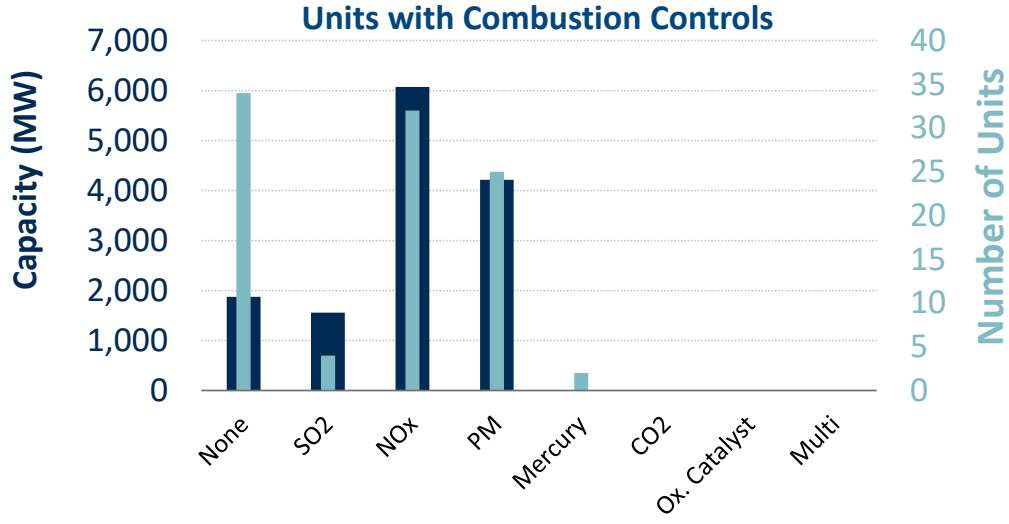
Low-Cost Representative Plant	**Representative Plant** **$TBD/MW-day** *compare to $64/MW-day in 2022*	High-Cost Representative Plant
• **1,700 MW (1,300 MW in ’22)** • Pennsylvania • **50 yrs old (47 yrs old in ’22)**	• **1,200 MW (+300 MW from ‘22)** • Pennsylvania • **51 yrs old (47 yrs old in ‘22)**	• 350 MW • Pennsylvania • **73 yrs old (65 yrs old in ’22)**

Existing ST/O&G Fleet









Source: Hitachi Powergrids, Velocity Suite.

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.

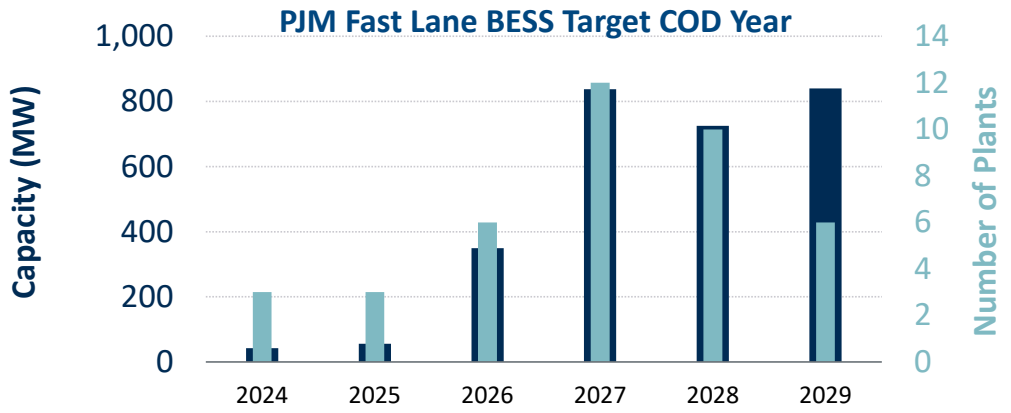
Primary drivers of cost variability

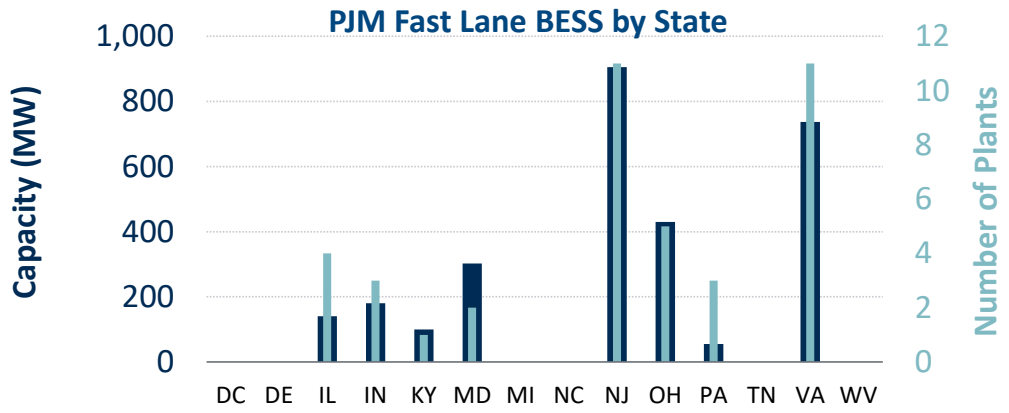
- Size
- Duration
- Overbuild and augmentation approach
- Location

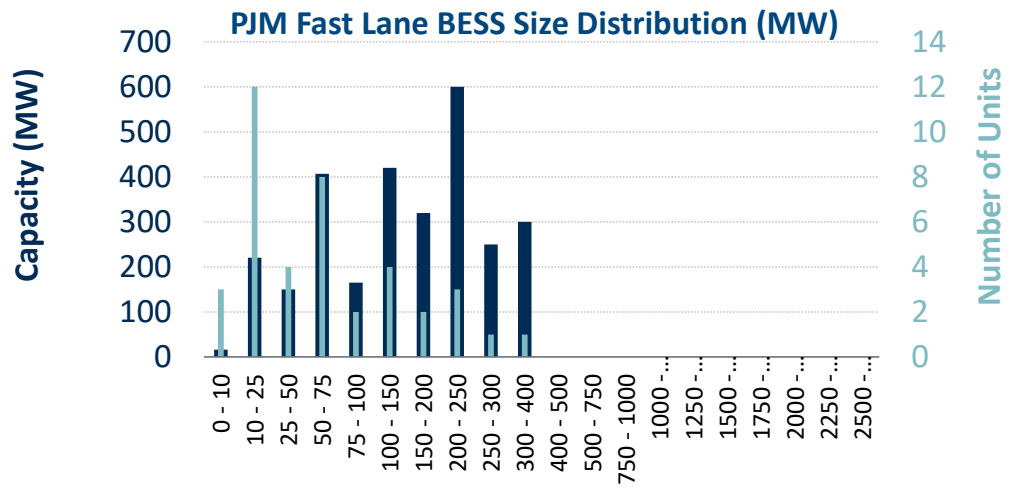
Projected **BESS** Characteristics and Costs by 2030/31

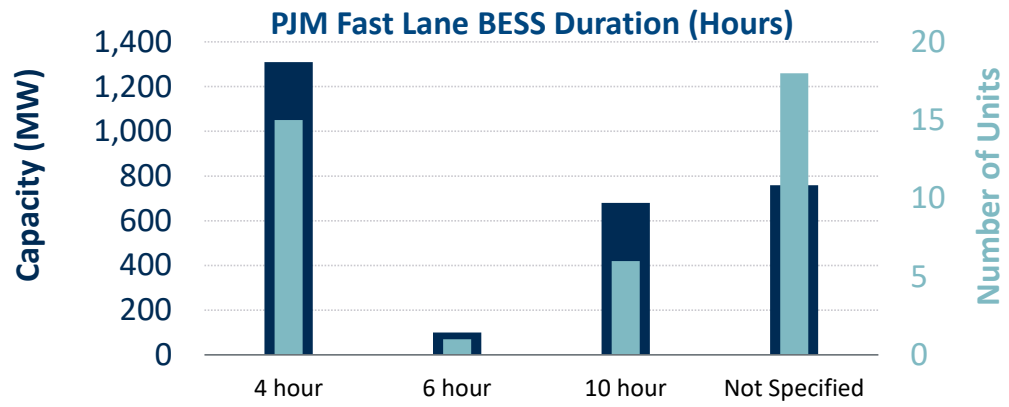
Low-Cost Representative Plant	**Representative Plant** **$141 - $172/MW-day**	High-Cost Representative Plant
•4-hour duration •50 MW / 200 MWh capacity •2028 COD •Virginia	•4-hour duration •200 MW / 800 MWh capacity •2028 COD •New Jersey	•10-hour duration •100 MW / 1,000 MWh capacity •2029 COD •Virginia

PJM Fast Lane BESS Fleet









Source: PJM Fast Lane Queue.

Next steps and plan for MRC meeting July 28th, 2026

Next steps to refine draft avoidable costs

- Consolidate stakeholder feedback
- Finalize representative plant cost ranges for Coal and ST O&G
- Finalize bottom-up cost inputs from ranges down to point estimates for all resource types

Plan for MRC Meeting July 28, 2026

- Present final representative plants and draft avoidable costs for all types
- Present draft avoidable costs for representative high and low plants

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