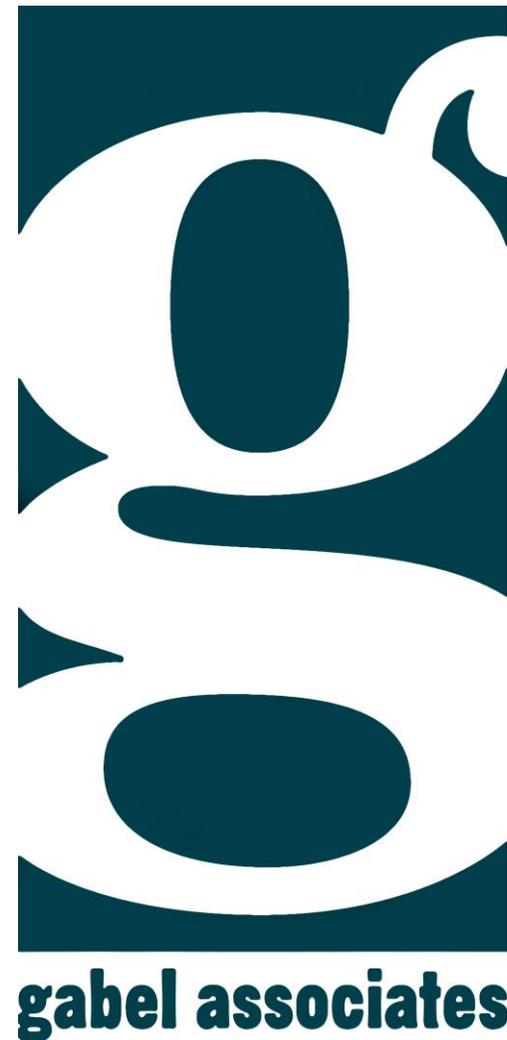


# Minimum Offer Price Rule Unit-Specific Inputs

PRESENTED TO  
*PJM Market Implementation Committee*

PREPARED BY  
*Michael Borgatti, Vice President*  
*Adrian Kimbrough, Vice President*  
*Emma Nix, Senior Associate*



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# FERC Higher Flexibility in Calculating Unit-Specific Floor Prices



- “We direct PJM to **maintain** the Unit-Specific Exemption, expanded to cover existing and new State-Subsidized Resources of all resource types.”
- “PJM’s criteria, parameters, and evaluation processes, moreover, will largely track the Unit-Specific Exemption methodology set forth in PJM’s **currently-effective Tariff**.”
- “We direct PJM to provide more explicit information about the standards that will apply when conducting this review as a safeguard against arbitrary ad hoc determinations that market participants and the Commission may be unable to reliably predict or reconstruct.”
- As indicated above, *see supra* note 36, the [Net CONE] factors listed in proposed Tariff section 5.14(h)(iv)(B)(2) of PJM’s initial filing in the paper hearing **appear to present** a reasonable objective basis for the analysis of new entrants.

## **Key Take-Aways:**

- FERC **did not** require PJM to use Net CONE parameters for unit-specific floor prices
- FERC mandated new construct to be patterned on Existing Tariff Language

# Existing OATT for Unit-Specific Exemptions requires documented cost support with comparable detail to PJM Net CONE study



- Plant Investment Support
  - Vendor quotes for plant or equipment or evidence of actual costs of recent comparable projects
- Cost of Capital Support
  - Financing documents for construction-period and permanent financing or evidence of recent debt costs of the seller for comparable investments and support for the claimed capitalization ratio, rate of return, cost-recovery period, inflation rate, or other parameters used in financial modeling
- E&AS Offset Support
  - Energy price forecasts based on well defined models that include fully documented estimates of future fuel prices, variable operation and maintenance expenses, energy demand, emissions allowance prices, and expected environmental or energy policies that affect the seller's forecast of electricity prices in such region

## **Key Take-Aways:**

- Any further clarification can be provided by PJM and IMM outside of FERC compliance process
- Gabel MOPR prices cite to actual source documents supporting underlying assumptions

# MOPR Floor Price Calculation Method



- Calculation method consistent with PJM Net CONE modeling and Industry LCOE Standards
  - Floor Price =  $(\text{CONE} - \text{E\&AS Offset}) / \text{UCAP MWd}$
  - CONE = Levelized Fixed Capital Costs + 1<sup>st</sup>-year Fixed Operating Costs
    - Levelized Fixed Capital Costs = Overnight Costs \* Capital recovery factor
    - Capital Recovery Factor = WACC \* Construction Finance Cost \* PV of Depreciation \* ITC Factor
    - CONE Calculation Method: PJM, <https://www.pjm.com/~media/committees-groups/committees/mic/20180425-special/20180425-pjm-2018-cost-of-new-entry-study.ashx>
    - Capital Recovery Factor Calculation Method: Stanford, GSB, [https://stanford.edu/dept/gsb\\_circle/cgi-bin/sustainableEnergy/GSB\\_LCOE\\_User%20Guide\\_0517.pdf](https://stanford.edu/dept/gsb_circle/cgi-bin/sustainableEnergy/GSB_LCOE_User%20Guide_0517.pdf)
  - E&AS Offset = 1<sup>st</sup>-year Energy Revenue + 1<sup>st</sup>-year Ancillary Revenue – 1<sup>st</sup>-year Variable Operating Costs
    - E&AS Offset Calculation Method: PJM, <https://www.pjm.com/-/media/library/reports-notice/special-reports/2018/20180420-pjm-2018-variable-resource-requirement-curve-study.ashx?la=en>

- Modeled 2 scenarios for Utility-Scale Solar Asset
  - Scenario 1: *PJM Default Inputs*
    - Cost Inputs: PJM IMM, <https://pjm.com/-/media/committees-groups/committees/mic/2020/20200228-mopr/20200228-Item-3A-PJM-Preliminary-CONE-Values.ashx>
  - Scenario 2: *Lazard Benchmarks*
    - Cost Inputs: Lazard, <https://www.lazard.com/media/451086/lazards-levelized-cost-of-energy-version-130-vf.pdf>
    - Energy Revenue Inputs: OTC Global Holdings. 2020. PJM Monthly Futures. S&P Global. <https://platform.marketintelligence.spglobal.com/web/client?auth=inherit#markets/powerFutures?key=5647e4a2-63af-4257-b57f-5a8a1fc4cfac>
    - Ancillary Revenue Inputs: Proxy Reactive ARR Analysis, PJM Reactive Revenue Requirements, <https://www.pjm.com/markets-and-operations/billing-settlements-and-credit.aspx>
- Scenarios were evaluated against the same resource capability and revenue assumptions

# PJM Default MOPR Inputs for Utility-Scale Solar

Case 24 EIA – Capital Cost Estimates – 2019 \$\$		
Configuration	Solar PV w/ Single Axis Tracking	
	150 MW <sub>AC</sub>	
DC / AC Ratio	1.3	
Module Type	Crystalline	
<b>Units</b>		
<b>Plant Characteristics</b>		
Net Plant Capacity	MW <sub>AC</sub>	150
<b>Capital Cost Assumptions</b>		
EPC Contracting Fee	% of Direct & Indirect Costs	5%
Project Contingency	% of Project Costs	5%
Owner's Services	% of Project Costs	4%
Estimated Land Requirement (acres) (Note 1)	\$	400
<b>Typical Project Timelines</b>		
Development, Permitting, Engineering	months	12
Plant Construction Time	months	6
Total Lead Time Before COD	months	18
Operating Life	years	30

Case 24 EIA – Capital Cost Estimates – 2019 \$\$			
Configuration	Solar PV w/ Single Axis Tracking		
	150 MW <sub>AC</sub>		
DC / AC Ratio	1.3		
Module Type	Crystalline		
<b>Units</b>			
<b>Cost Components (Note 2)</b>		<b>Breakout</b>	<b>Total</b>
<i>Civil/Structural/Architectural Subtotal</i>			7,935,000
	Mechanical – Racking, Tracking, & Module Installation	\$ 36,391,000	
<i>Mechanical Subtotal</i>			36,391,000
	Electrical – Inverters	\$ 9,430,000	
	Electrical – BOP and Miscellaneous	\$ 28,328,000	
	Electrical – Transformer, Substation, & MV System	\$ 17,756,000	
	Electrical – Backup Power, Control, & Data Acquisition	\$ 3,733,000	
<i>Electrical Subtotal</i>			59,247,000
	Project Indirects	\$	2,114,000
	EPC Total Before Fee	\$	105,687,000
	EPC Fee	\$	5,284,000
<i>EPC Subtotal</i>			110,971,000
<b>Owner's Cost Components (Note 3)</b>			
	Owner's Services	\$	4,439,000
	Modules (Note 3)	\$	72,150,000
<i>Owner's Costs Subtotal</i>			76,589,000
<i>Project Contingency</i>			9,378,000
<b>Total Capital Cost</b>		<b>\$</b>	<b>196,938,000</b>
			<b>\$/kW net</b>
			<b>1,313</b>

## Key Take-Aways:

- PJM Class Average Capacity Factor for single-axis solar is 60% **not** 42% used in PJM default calculations
- Operating Life is 30-years **not** 20-years used by PJM

### Sources:

EIA Capital Cost Report AEO 2020  
<https://pjm.com/-/media/planning/res-adeq/class-average-wind-capacity-factors.ashx?a=en>

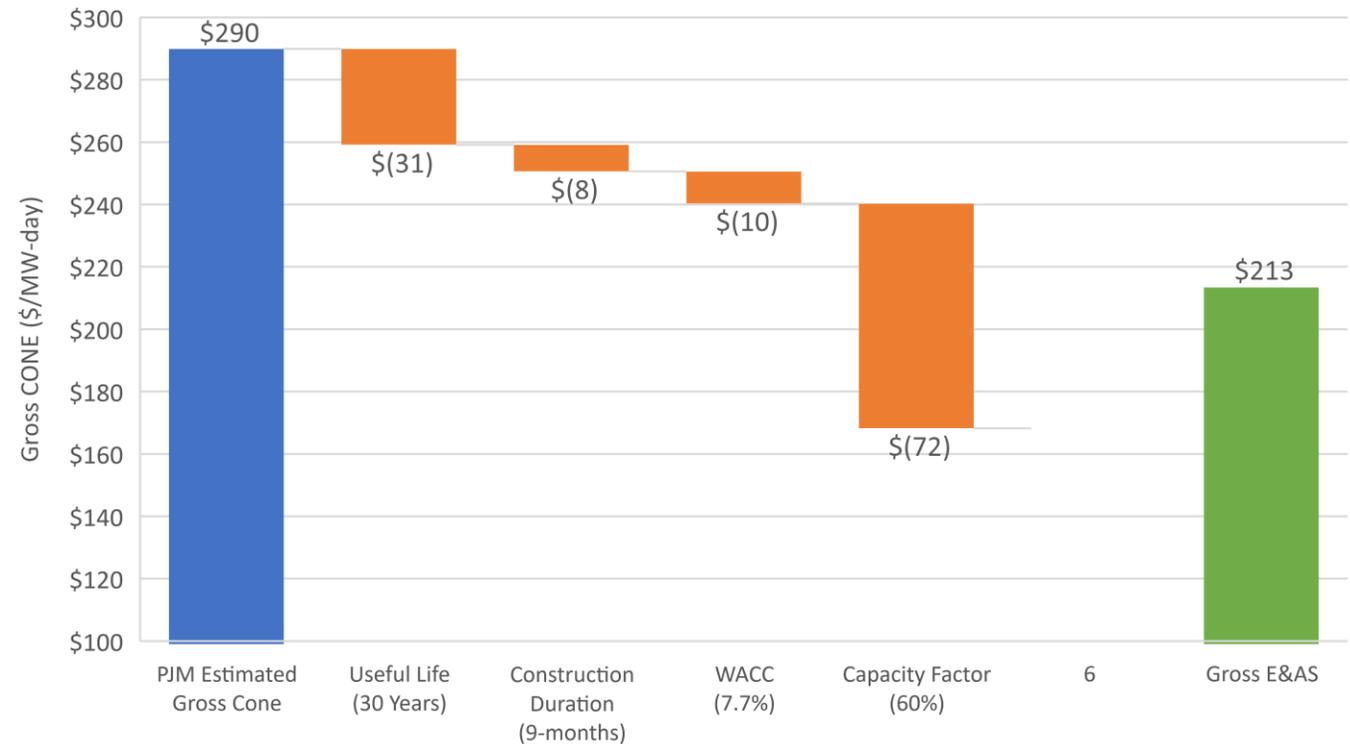
# Market Benchmark Inputs Materially Lower MOPR Floor Price

Utility-Scale Solar			
Project Inputs	Units	PJM	Lazard Market Proxy
Nameplate ("ICAP")	MW	100	100
RPM Capacity Factor	%	42.0%	60.0%
<b>UCAP</b>	<b>MW</b>	<b>42</b>	<b>60</b>
Installed Costs	\$/kW	\$1,313	\$1,000
Fixed O&M	\$/kW-yr	\$15	\$ 12

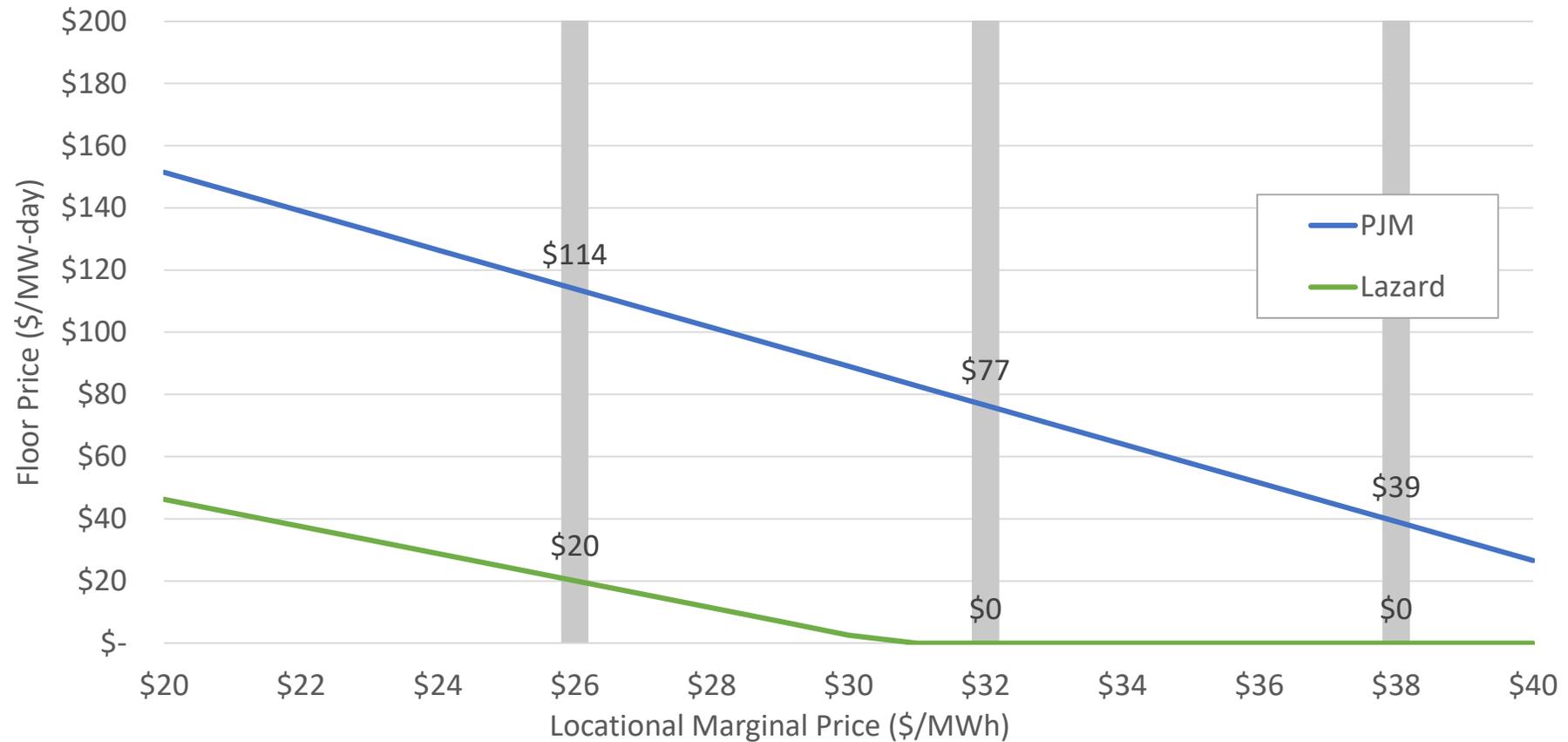
Project Inputs	Units	PJM	Lazard Market Proxy
Asset Life	Yrs	20	30
Debt %	%	55.0%	60.0%
Debt Cost	%	6.0%	8.0%
Equity Cost	%	12.0%	12.0%
Combined Income Tax Rate	%	27.7%	25.5%
Investment Tax Credit	%	30.0%	30.0%
<b>ATWAAC</b>	<b>%</b>	<b>8.2%</b>	<b>7.7%</b>

MOPR Floor Prices	Units	PJM	Lazard Market Proxy
Gross CONE	\$/MW-day	290	143
E&AS Offset	\$/MW-day	213	213
<b>Net CONE</b>	<b>\$/MW-day</b>	<b>77</b>	<b>0</b>

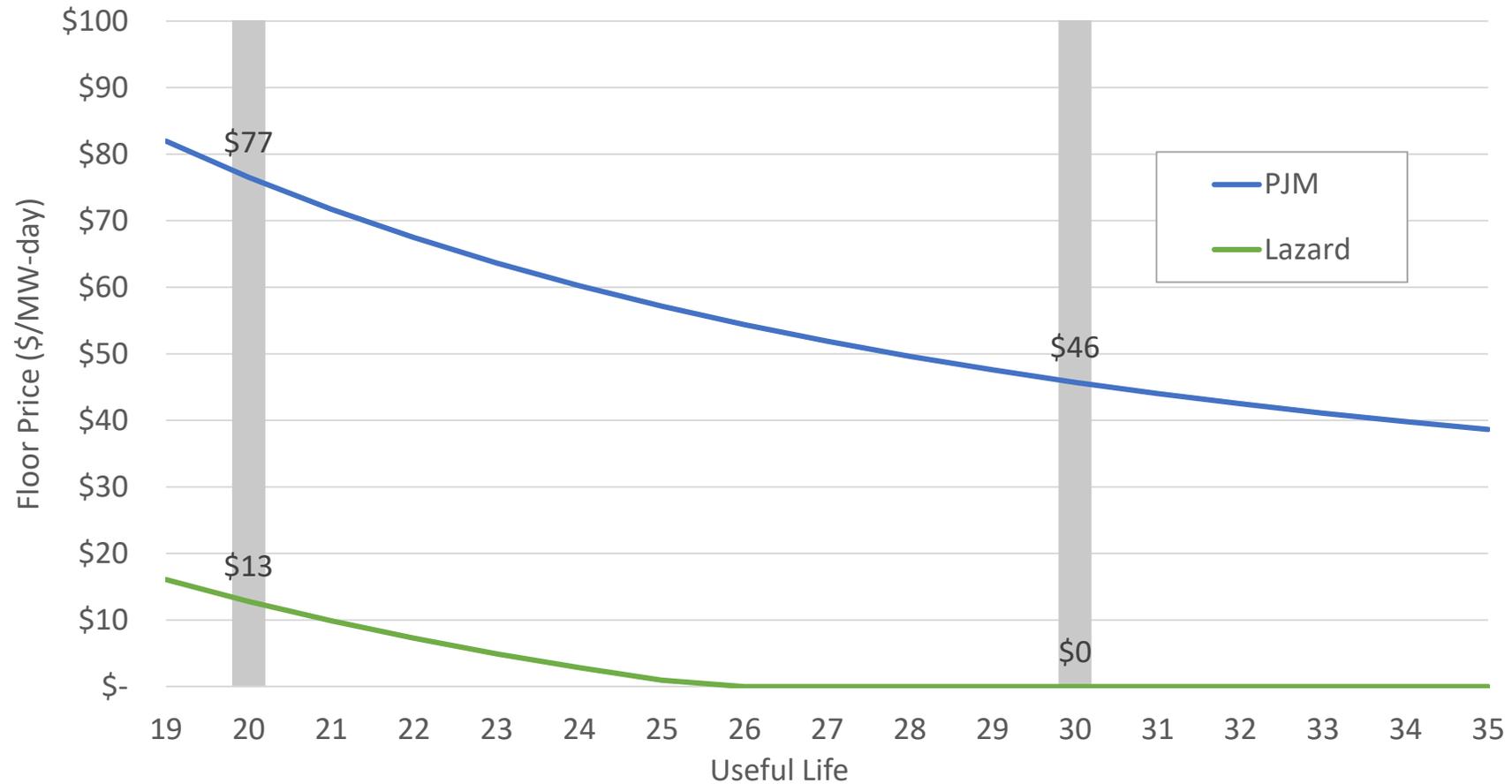
### Impact of PJM Assumptions on MOPR Floor Prices



# Floor Price by LMP



# Floor Price by Useful Life



# Floor Price by Cost of Debt

