Assumptions for the Long-Term Distributed Solar Generation and Battery Forecast

- Again this year, S&P Global will provide the distributed solar forecast and a battery forecast to be used in the 2024 load forecast.
- PJM intends to foster open dialogue in the stakeholder process regarding the major assumptions in the long-term distributed solar and battery forecast
- Any federal or state policy assumptions discussed herein are based on currently mandated and funded policies
- Note that changes from assumptions last year are highlighted in teal.

PJM Solar Forecast 2023: Key Assumptions

Solar forecast scenario overview

Assumptions	Scenario 2: "Base case"
Federal policy support	Current ITC schedule (post-IRA)
NEM policies and retail rate structures	From 2023 to 2026, utilities adopt (and regulators approve) changes to NEM and retail rate structures, which result in a more cost-based approach to customer-sited solar compensation; current detailed state NEM policy.
Solar costs ($/kW)	Solar costs decline by 11–24% in nominal terms from 2023 to 2039 (37–45% in real terms).
State policy support	Current RPS policies and state-level incentives are maintained.
Power demand	Base-case demand

Note: DG = distributed generation. ITC = investment tax credit. PUCs = public utility commissions. DERs = distributed energy resources.

Source: S&P Global

Investment Tax Credit

US renewable energy tax credit availability, reflecting changes made in August 2022 following passage of the IRA

			Start of construction†				
			2006–19	2020–21	2022	2023–33	2034 and beyond
ITC	**Base rate** (project does not meet labor requirements*)	Base credit	30%	26%	6%	6%	Tax credits begin to phase out starting in the later of 2034 or the first year when annual US-level greenhouse has emissions fall 75% below 2022 levels. During the phase-out, tax credits decline to 75% of their full value in the first year, 50% in the second year and 0% in the third year. For the purposes of our modeling the tax credits are assumed to continue beyond the horizon of our outlook.
		Domestic content**				+2%	
		Energy community***				+2%	
	Full rate (project meets labor requirements)	Base credit			30%	30%	
		Domestic content				+10%	
		Energy community				+10%	
PTC for 10 years (2022 $/MWh)††	**Base rate** (project does not meet labor requirements)	Base credit	$26	$15	$5	$5	
		Domestic content				+$1	
		Energy community				+$1	
	Full rate (project meets labor requirements)	Base credit			$27.5	$26	
		Domestic content				+$3	
		Energy community				+$3	

Data compiled July 2023.
* Labor bonus requires developers to meet prevailing wage and apprenticeship requirements.
** Domestic content bonus requires a certain percentage (rising over time) of components to be made domestically.
*** Energy community bonus requires projects to be sited in census tracts that formerly hosted coal plants or had a significant amount of employment from fossil fuel industries.
† Start of construction is defined as having incurred 5% of final qualifying project costs or having completed "physical work of significant nature". Both definitions require that projects make continuous progress toward completion once construction has begun and be placed into service within four years of starting construction to qualify for tax credits.
†† Technology eligibility rules have been relaxed under the IRA, meaning solar photovoltaic (PV) and geothermal are eligible for the PTC, and standalone storage is eligible for the ITC.
Source: S&P Global Commodity Insights.

RPS and NEM policy assumptions by state

Detailed RPS policy assumptions

State	RPS target (percentage of retail sales)*	Solar carve-out (percentage of retail sales)*/Distributed carve-outs
DE	25% by 2025, 28% by 2030, 40% by 2035	3.5% by 2025, 5% by 2030, 10% by 2035
DC	100% by 2032	2.85% by 2023, 5.50% by 2032, 10% by 2041
MD	50% by 2030	14.5% by 2030
NJ	50% by 2030*	5.1% by 2021, gradually reduced to 1.1% by 2031
OH	8.5% by 2026	0.5% of total electricity sypply in 2026 and thereafter
PA	18% by 2021	0.5% by 2021
WV	-	-
IN	10% by 2025 (voluntary)	-
IL	40% by 2030, 50% by 2040**	1.5% by 2025
KY	-	-
MI	15% by 2021***	
NC	12.5% by 2021****	0.2% by 2020****
VA	100% by 2045*****	1,100 MW by 2035 (Dominion only) - nameplate capacity between 50kW-3 MW. Of the 1,100 MW, 35% of capacity procured shall be from the from solar facilities owned by persons other than a utility. Dominion is required to meet 1% of RPS requirements from DG sources less than 1 MW, no more than 3 MW in one single location. No less than 25% of such 1% shall be composed of low-income qualifying projects.
TN	-	-

Note: RPS includes solar carve-outs. *New Jersey RPS target only includes Class I renewable technologies and the solar carve-out. **Illinois solar carve-out requires that 50% of the solar procurements must be from distributed/community solar. RPS mandates at least 75% of the standard come from wind and solar. Climate and Equitable Jobs Act invests $580 million a year to increase Illinois's clean energy from 9% to 50% by 2040 ***Utilities in Michigan have agreed to 25% by 2030. ****RPS compliance in North Carolina can be achieved through energy efficiency and renewable energy credits (RECs) from any state. *****Phase 1 utilities are required to achieve 14% by 2025, 30% by 2030, 65% by 2040, and 100% by 2050 while Phase II utilities are required to achieve 26% by 2025, 41% by 2030, and 100% by 2045. The primary drivers for solar development include existing Public Utility Regulatory Policies Act (PURPA) policy, planned requests for proposal (RFPs), solar resources, solar costs, and the previous state tax credit.

Source: S&P Global

RPS and NEM policy assumptions by state (continued)

State net energy metering assumptions			
State	**Utility/territory**	**NEM cap**	**NEM system size limits (MW)**
DE	All utilities	8% of the capacity needed to meet the electric utility's average Delaware transmission peak demand for the preceding 3 years	0.025 (residential), 2 (Delmarva nonresidential), 0.5 (DEC, DEMEC nonresidential)
DC	Potomac Electric Power Co (Pepco)	N/A	For 2021, no more than 140% of the customer's historical 12-month usage, increasing 20% every year until 2024
MD	All utilities	1,500 MW	2 or 200% of customer load
NJ	Investor-owned utilities (IOUs), electric suppliers	None****	100% of customer load
OH	IOUs	N/A	Not to exceed 120% of customer annual average load
PA	IOUs	N/A	0.050 (residential), 3 (nonresidential), 5 (microgrids)
WV	All utilities	3% of peak demand during previous year	0.025 (residential), 2 (industrial for large IOUs), 0.500 (commercial for large IOUs), 0.050 (C&I for small IOUs)
IN	IOUs	1.5% of utility's summer peak load or by July 2022 *******	1
IL	IOUs, retail suppliers	Removed the NEM cap, but included a cap date of December 31, 2024 or whenever new compensation values are approved, whichever is sooner	2
KY	IOUs, electric cooperatives except TVA	1% of utility's peak load in prior year	0.045
MI	All utilities	1% of utility's average of the previous 5-year peak load. Voluntary cap increase by Consumers Energy and UPPCO to 2%.	0.15
NC	IOUs, electric suppliers	N/A	2 (residential customer-owned systems), 1 (commercial systems up to 200% of contract demand)
VA	IOUs, electric cooperatives	6% of load, 1% are reserved for low-income customers	0.025 (residential), 3 (nonresidential)
TN	N/A	N/A	N/A

Note: *NEM remuneration is a tariff structure under which the utility pays customers for excess generation, up to a given amount. The most common arrangement is "full retail rate NEM," in which excess generation is paid the same volumetric price that the customer pays for electricity; so, exports are effectively netted against grid consumption over a given period (typically one year). **NEG over that period is sometimes paid at a lower rate, often based on the utility's avoided cost. ***Total remaining excess kWh at the end of the calendar year (valued at the generation rate) that amounts to greater than $25 will be refunded as a check to the customer, if less than $25 it will be given as a credit. ****While no mandatory cap exists, it as at the discretion of the NJBPU to cap at 5.8% of retail sales. *****TREC = transition renewable energy credits. ******Virtual meter aggregation is limited to the account holder's meters and only those within two miles of the POI. *******As of July 2022, the Indiana Utility Regulatory Commission has approved four utilities in Indiana to transition from net metering to a new lower rate known as "excess distribution generation" and proposed to instantaneous netting rather than monthly net metering.

Source: S&P Global

RPS and NEM policy assumptions by state (continued)

State net energy metering assumptions

State	NEM remuneration for on-site use or export generation*	NEG remuneration**	Community solar
DE	Retail (For commission-regulated utilities, retail does not include the societal benefits charges)	Monthly carryover. At the end of the annualized billing period, excess kWh credits shall revert to the electric distribution company and are not reimbursed, credited or otherwise remunerated. Excess kWh credits do not include charges for the societal benefits program	Virtual net metering
DC	Retail	Carries over at retail rate indefinitely, at generation rate for systems over 100 kW***	Virtual net metering (less than 5 MW)
MD	Retail	Credited to customer's next bill at retail rate; reconciled annually in April at the commodity energy supply rate	Pilot program
NJ	Base $152 TREC price ($0.152/kWh), non-residential rooftop receives full TREC and ground mount receives 60%; residential rooftop, groundmount and carport receive 60%*****	Fixed $152 TREC price ($0.152/kWh)	85% of TREC Price ($0.12920/kWh)
OH	Less than retail	Credited to next bill at unbundled generation rate (includes energy component but excludes capacity-related compensation	None
PA	Retail	Credited at retail rate for a year, then any leftover excess is credited at generation and transmission portion of the retail rate, but not the distribution	Virtual meter aggregation******
WV	Retail (credits cannot reduce monthly bills below the fixed monthly charge)	Retail	Virtual net metering
IN	Full retail through 2047 for net metering facilities installed through 2017 and through 2032 for those installed through 2022; 125% of average energy market price for facilities installed after 2022 or 1.5% cap is met. Per SB 309, retail rate net metering has been phased out by July 2022. As of July 2022, the Indiana Utility Regulatory Commission approved proposals from four utilities for a net billing system with instantaneous netting.	Full retail through 2047 for net metering facilities installed through 2017 and through 2032 for those installed through 2022; 125% of average energy market price for facilities installed after 2022 or 1.5% cap is met. As of July 2022, the Indiana Utility Regulatory Commission approved proposals from four utilities for a net billing system with instantaneous netting.	None
IL	Retail (TOU for customers paying TOU rates)	Credited to next bill at retail rate, excess at end of year is granted to utility	Virtual net metering
KY	Less than retail	Utility will purchase all electricity produced at the rate set by the PSC, instead of the retail rate	Utility-run program
MI	Aprox. 50% of retail	Less than retail	None
NC	Retail, for existing. Starting on October 1, 2023 current NEM rider replaced with Residential Solar Choice (Rider RSC) and Net Meetering Bridge (Rider NMB). Rider RSC requires TOU Pricing , minimum monthly bills, non-bypassable charges, and grid access fees for systems above 15kW-ac. Rider NMB will be available for a limited number of new customers annually for three years and will not require TOU rates. Customers on Rider NMB can stay on that rate for 15 years, before switching to Rider RSC. Exsiting net meetering customers will be switched to Rider NMB on January 1, 2027.	Carries over at retail rate, granted to utility at beginning of summer billing period. Starting October 1, 2023 customers on the new Riders net exports will be credited at the utilities avoided cost rate on a monthly basis	Utility-run program
VA	Retail	Retail	Utility-run program
TN	N/A	Retail	None

Note: *NEM remuneration is a tariff structure under which the utility pays customers for excess generation, up to a given amount. The most common arrangement is "full retail rate NEM," in which excess generation is paid the same volumetric price that the customer pays for electricity; so, exports are effectively netted against grid consumption over a given period (typically one year). **NEG over that period is sometimes paid at a lower rate, often based on the utility's avoided cost. ***Total remaining excess kWh at the end of the calendar year (valued at the generation rate) that amounts to greater than $25 will be refunded as a check to the customer, if less than $25 it will be given as a credit. ****While no mandatory cap exists, it as at the discretion of the NJBPU to cap at 5.8% of retail sales. *****TREC = transition renewable energy credits. ******Virtual meter aggregation is limited to the account holder's meters and only those within two miles of the POI. *******As of July 2022, the Indiana Utility Regulatory Commission has approved four utilities in Indiana to transition from net metering to a new lower rate known as "excess distribution generation" and proposed to instantaneous netting rather than monthly net metering.

Source: S&P Global

RPS and NEM policy assumptions by state (continued)

State C&I procurement assumptions				
State	**Unbundled energy attribute certificates**	**Virtual power purchasing allowed**	**Renewable energy offerings from utilities or electric suppliers/green tariff**	**Production for self-consumption—net metering**
DE	Allowed	Allowed	Retail choice	Up to 2 MW
DC	Allowed	Allowed	Retail choice	Up to 1 MW
MD	Allowed	Allowed	Retail choice	Up to 2 MW
NJ	Allowed	Allowed	Retail choice	Cannot exceed on-site load
OH	Allowed	Allowed	Retail choice	No size limit
PA	Allowed	Allowed	Retail choice	Up to 3 MW, 5 MW for microgrids
WV	-	Allowed	-	Up to 2 MW
IN	-	-	Green tariff enabled to guarantee sufficient RECS; does not require new build	No size limit under green tariff
IL	Allowed	Allowed	Retail choice	Up to 2 MW
KY	Voluntary	-	Green tariff enabled	Up to 45 kW
MI	Allowed	-	-	1 MW
NC	Allowed	Alllowed*	Green tariff in development	Up to 1 MW
VA	Allowed	Allowed**	Green tariff enabled	Up to 1 MW
TN	-		-	-

Note: Green tariffs only include programs where utilities build new renewables on behalf of corporate customers. *In specific utilities **for agricultural sites and school districts up to 10 MW

Source: S&P Global

Federal and regional energy storage policy assumptions

Federal and regional energy storge policy assumptions		
Category	**Policy**	**Base case**
Federal	Investment Tax Credit (ITC)	Battery developers have until the end of 2032 to qualify for a 30% ITC, after which is phases down to 26% in 2033, 22% in 2034, and 0% thereafter. If the US CO2 emissions are not 75% below 2022 levels in 2032, the incentives are extended until such a time US emissions meet the threshold, at which point the incentives will begin the two year phase out.
Regional	PJM capacity market (as applicable to battery)	Assume Minimum Offer Price Rule (MOPR) is revised All other existing market rules, including draft ELCC values, remain in place over forecast period
State/city	Energy storage targets	Remain in current form
State	Tax credits	Remain or expire as currently scheduled
State	Incentives (e.g., rebates)	Assume VA and NJ utilities roll out an incentive program for BTM batteries in effort to comply with state target. Other states remain unchanged

Source: S&P Global

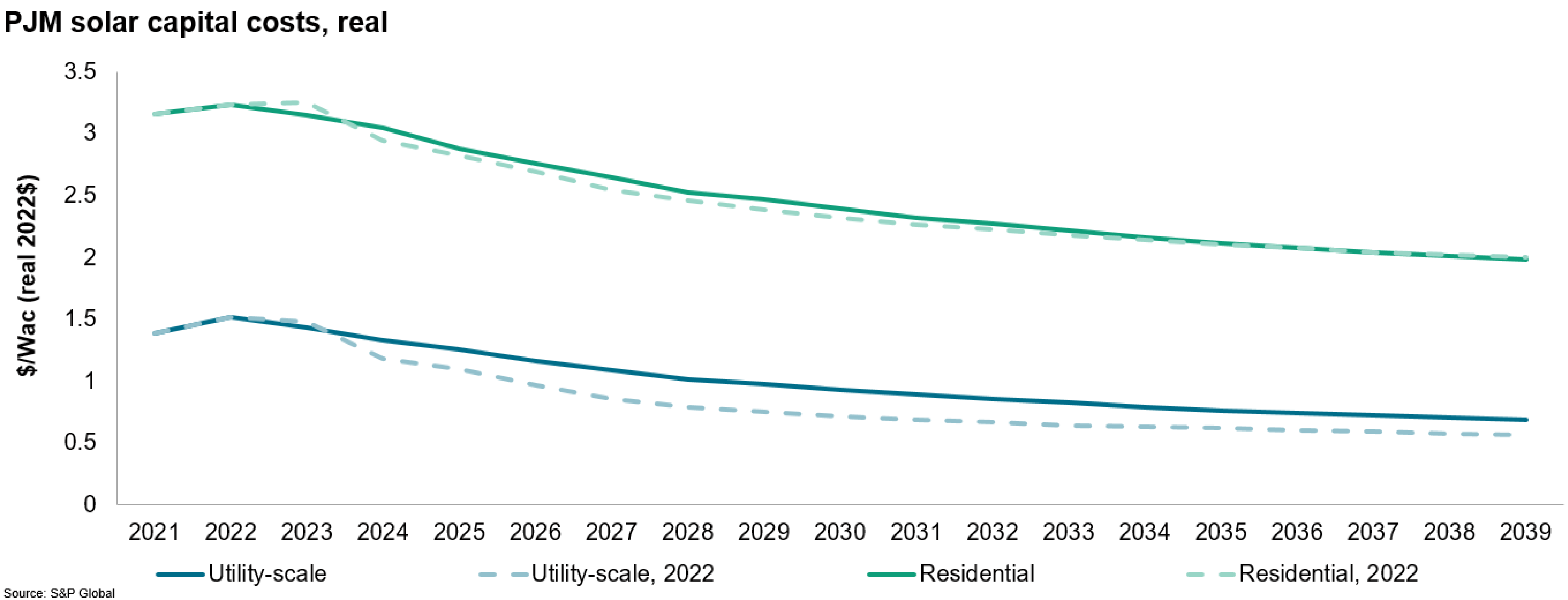
Battery policies by state

Detailed state energy storage policy assumptions		
State	**Energy Storage Target (MW)**	**Tax Credits**
DE		
DC		
MD	Two 5 MW and 15 MWh pilots by 2022	30%**
NJ	2 GW by 2030	
OH		
PA		
WV		
IN		
IL		
KY		
MI	1 GW by 2025, 4 GW by 2040	
NC		
VA	2.7 GW by 2035 (Dominion), 400 MW by 2035 (APCo)	Energy storage systems greater than 5 MW and less than 150 MW are exempt from sales tax.
TN	2.4 GW by 2028 and 5.3 GW by 2038 (Tennessee Valley Authority)	

Note: *Maryland's "Energy Storage Pilot Project Act"solicition offers for IOUs at least two energy storage projects with a cumulative size of at least 5 MW and 15 MWh. **Maryland Energy Administration (MEA) 2018 Energy Storage Tax Credit Program offered 30% tax credit of the total installation costs (up to $5,000 for a residential project and $75,000 for commercial). *** In May 2018, lawmakers passed legislation (S 2314/A 3723) to implement energy storage targets of 600 MW by 2021 and 2 GW by 2030 and requires the BPU to establish a process and mechanism for achieving these targets. ****The regulations instruct APCo and Dominion to construct or acquire 400 MW and 2,700 MW, respectively, of FTM energy storage resources by 2035. ***Indianapolis Power & Light's (IPL) 2019 IRP proposes replacing coal power with renewables and storage, amounting to approximately 240 MW based on an assumed installed capacity of 3 GW.

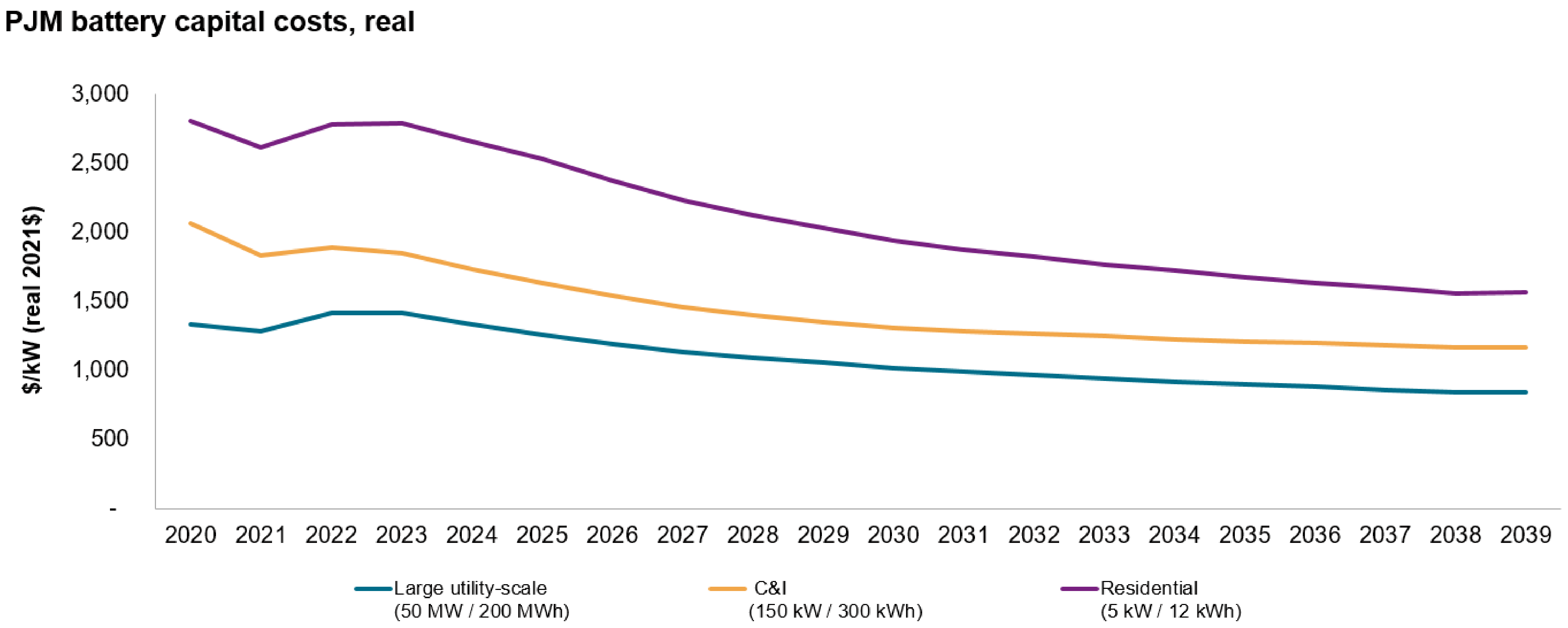
Source: S&P Global

PJM solar capital costs are largely in line with the previous forecast



Source: S&P Global

Battery capital costs (real)



Source: S&P Global

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- Feedback on the assumptions is requested. Please provide by **Friday, September 8, 2023** to Load_Analysis_Team@pjm.com.

- Additional questions and comments are welcome and can be submitted to the Load Analysis Team via this email address: Load_Analysis_Team@pjm.com