

Global Energy Storage

Global Energy Storage: Why is ESS demand booming?



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China's booming ESS demand growth is fueled by low battery prices and favorable ESS policies. China's ESS battery prices have fallen by 50% since 2023 to RMB0.54/Wh (USD76/kWh) year-to-date. Recent prices have fallen further to RMB0.47/Wh (USD66/kWh) or RMB1.00 (USD140/kWh) including EPC costs. While lower battery prices are a primary driver for ESS growth, increasing renewable penetration, ongoing power price reform, and local government ESS incentives have all been supportive.

Since 2023, the levelized cost of electricity (LCOE) for solar and storage (4-hrs) has fallen by 25% to \$68/MWh. We have modeled a 1GW/4GWh solar plus storage project based on Xinjiang's solar irradiation profile, assuming current solar cost of USD600/kW and ESS cost of USD140/kWh. At an IRR of 8%, the LCOE for the project is estimated to be \$68/MWh.

Local governments' capacity compensation schemes further enhance the returns on ESS investments. Assuming capacity compensation of RMB0.16/kWh (USD22/MWh) per charge, then this reduces the solar and storage LCOE to \$60/MWh. Many provinces have introduced relevant policies to give capacity compensation for new ESS capacity, and it is expected that nearly 20 provinces will follow up with such policies by the end of the year.

China's solar and storage costs are increasingly competitive across China.

China's wholesale benchmark prices based on coal-fired power generation ranges from USD35-65/MWh. In comparison, solar plus storage projects offer compelling economics, with costs around \$43/MWh for a 2-hour storage system and \$57/MWh for a 4-hour system. This cost advantage highlights significant growth potential.

Falling battery prices have enabled longer-duration storage solutions. Assuming electricity price of \$50/MWh, solar and storage projects with 3-4 hours of batteries can achieve 8% IRR at current ESS cost of \$140/kWh. Just a year ago, a project with similar return would only be competitive at 2-3 hours of storage.

We forecast global ESS demand to increase 93% to 581GWh in 2025 and reach 1588GWh by 2030 (23% CAGR). Our estimates are now 60% higher than initial estimates at the start of the year. With the integration of large-scale solar and wind power system, the grid will require more storage to maintain stability and for power shifting. We expect solar and wind capacity will grow from 3.3TW in 2024 to 8.5TW by 2030, representing 54% of total power capacity globally. We expect ESS capacity will reach 10% of renewable capacity in 2026 (from 1% four years ago) and rise to 19% by 2030. We also expect the storage duration to increase from 2.5 hours currently to 3.0 hours by 2030.

CATL and Sungrow stands as key beneficiaries of the ESS demand boom. Both companies are industry leaders with strong technological capabilities and robust market positions, well-positioned to capitalize on the accelerating demand for ESS. Among our coverage, CATL remains our top pick in the battery sector and leads with top ESS battery cells globally.

BERNSTEIN TICKER TABLE

Ticker	Rating	Cur	30 Sep 2025		TTM	Reported EPS				Reported P/E (x)		
			Closing	Price								
			Price	Target	Rel. Perf.	Cur	2024A	2025E	2026E	2024A	2025E	2026E
300750.CH (CATL)	O	CNY	402.00	420.00	18.3%	CNY	11.52	15.43	19.66	34.9	26.1	20.5
247540.KS (EcoPro BM)	U	KRW	116,300	88,000	(56.5)%	KRW	(991.00)	(80.00)	405.00	(117.4)	N/M	287.2
051910.KS (LG Chem)	M	KRW	277,500	280,000	(39.9)%	KRW	(8,826.00)	(2,351.79)	14,663	(31.4)	(118.0)	18.9
373220.KS (LGES)	M	KRW	399,000	335,000	(25.4)%	KRW	(4,353.59)	(246.62)	5,579.25	(91.6)	N/M	71.5
003670.KS (Posco Future M)	U	KRW	146,500	110,000	(58.3)%	KRW	(2,740.96)	158.93	1,353.97	(53.4)	921.8	108.2
006400.KS (SDI)	M	KRW	206,500	200,000	(59.9)%	KRW	8,916.68	(4,552.19)	11,665	23.2	(45.4)	17.7
300274.CH	M	RMB	161.98	121.00	19.1%	RMB	5.31	6.19	6.91	30.5	26.2	23.4
002466.CH (Tianqi Lithium)	O	CNY	47.57	44.00	6.1%	CNY	(4.82)	0.60	1.76	(9.9)	79.0	27.0
9696.HK (Tianqi Lithium)	O	HKD	48.44	41.00	53.8%	CNY	(4.82)	0.60	1.76	(9.2)	73.6	25.1
ASIAx			1,615.89									

O - Outperform, M - Market-Perform, U - Underperform, NR - Not Rated, CS - Coverage Suspended

Source: Bloomberg, Bernstein estimates and analysis.

INVESTMENT IMPLICATIONS

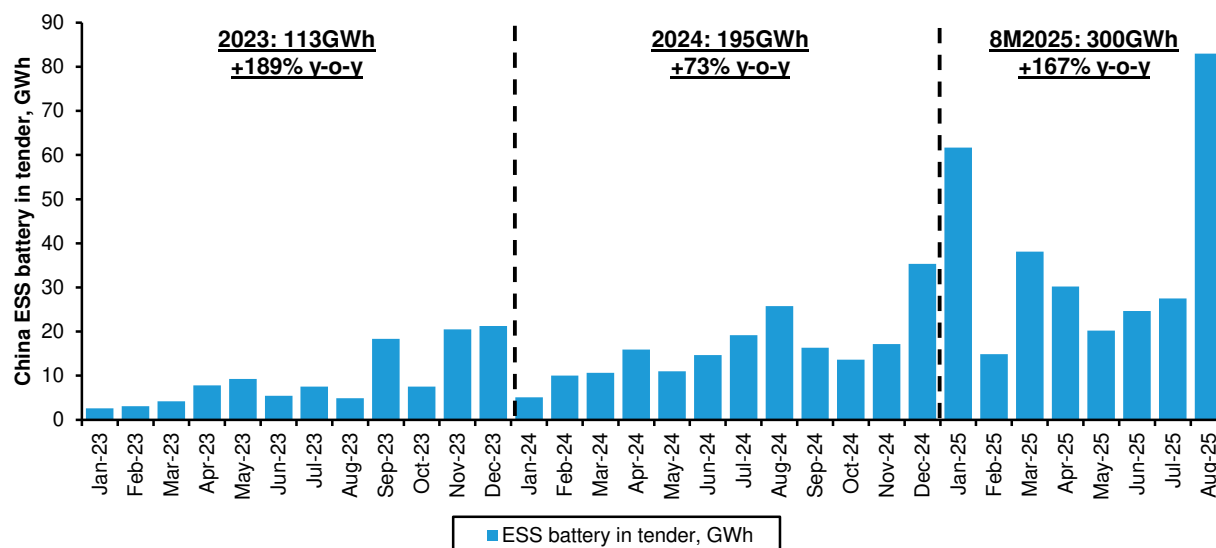
ESS demand is growing much quicker than we expected as the cost of solar and storage have come down significantly. As power consumption continues to grow rapidly on data centers, EVs, air-conditioning, demand for energy storage will only increase. Moreover, the substitution of base load power (coal) with renewable energy will also likely increase for solar plus storage. Given the more positive view on energy storage, we have revised up our global 2030 ESS demand by 60% since the start of the year. CATL (rated Outperform) remains our top pick in the sector. Sungrow (rated Market-Perform) is also another way to invest in this theme.

DETAILS

WHAT'S DRIVING CHINA'S ESS DEMAND GROWTH?

China's ESS demand remains robust despite concerns following the release of Policy Document No. 136, which planned to remove the ESS mandate for renewable projects after May. Battery tenders is a leading indicator of battery installations. YTD, ESS tenders grew significantly by 167% y-o-y. According to S&E Consulting's tracking data, in August 2025, China's energy storage market completed tenders for a total of 25.8GW / 69.4GWh of ESS and EPC (including equipment) general contracting. Additionally, 13.3GWh of energy storage cells and DC-side procurement were finalized. The Inner Mongolia market showed particularly strong demand, completing 18.5GWh of ESS project procurement.

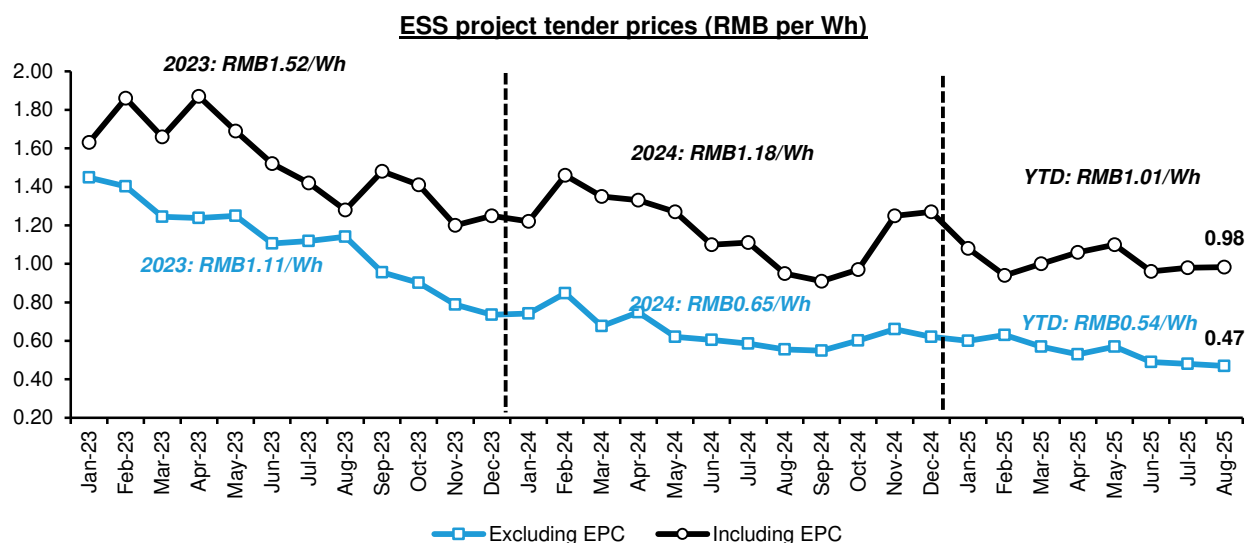
EXHIBIT 1: China's ESS tenders grew by 167% y-o-y to 300GWh which will drive higher installations over the next 12M



Source: S&E Consulting, Bernstein analysis

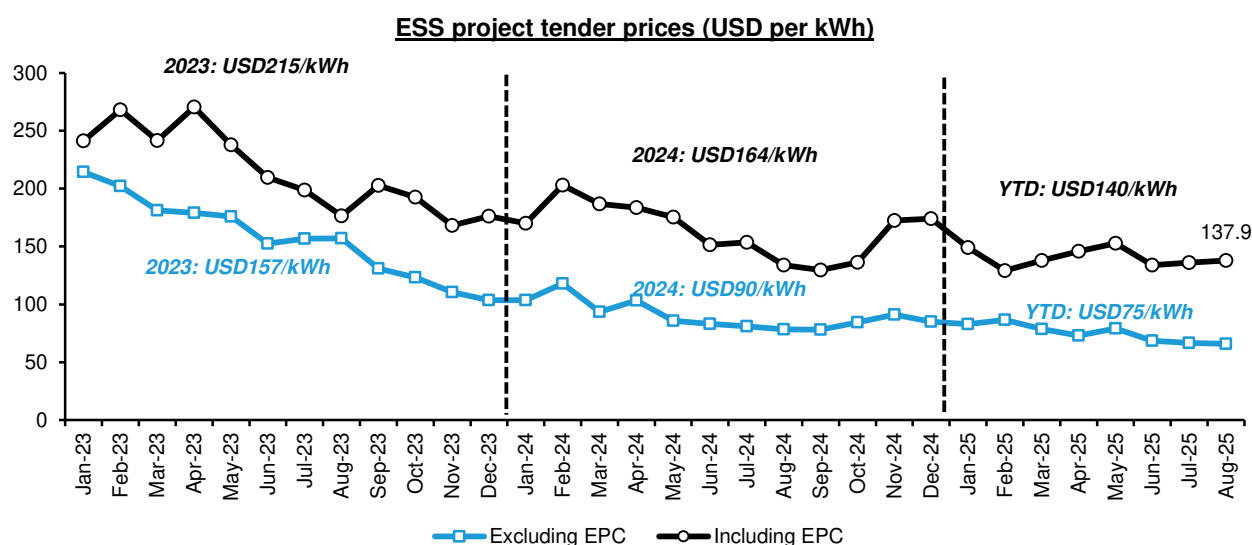
China is experiencing a significant surge in demand for ESS, and this growth is mainly fueled by the substantial reduction in battery costs combined with a range of supportive policies aimed at promoting ESS adoption. Since 2023, the prices of ESS batteries in China have decreased dramatically by approximately 50%, reaching an average cost of RMB0.54/Wh (USD76/kWh). Recent market data indicates that ESS prices have further dropped to RMB0.47/Wh (USD 66/kWh), and when including EPC costs, the total price amounts to about RMB1.00/Wh (USD140/kWh). This notable decline in battery prices serves as the primary catalyst for the rapid expansion of the ESS market in China, making energy storage solutions more financially accessible and attractive for various applications. However, the growth is not solely attributable to cost reductions.

EXHIBIT 2: Since 2023, the prices of ESS batteries in China have declined by 50%. Recent market data indicates that ESS prices have further dropped to RMB0.47/Wh or RMB1.00/Wh including EPC costs



Source: SMM, Bernstein analysis

EXHIBIT 3: In USD terms, ESS tender prices are at USD75/kWh or USD140/kWh including EPC



Source: SMM, Bernstein analysis

With Policy Document No. 136 being introduced in 2025, energy storage revenues are diversifying. Following this, some local governments have introduced capacity compensation schemes, creating alternative revenue streams for these projects. Additionally, gains from energy arbitrage are becoming increasingly significant in certain regions. In summary, China's ESS projects can generate revenue through three main channels: capacity-based revenue, energy arbitrage, and ancillary services.

- Capacity-based revenue:** Capacity-based revenues guarantee the baseline income for ESS projects by ensuring its capacity availability during specific time periods. ESS projects operator can generate revenue based on either capacity leasing or capacity compensation. For **capacity leasing**, renewable projects used to be required to include a certain proportion of storage. Instead of building their own storage, project developers may lease required capacity from shared ESS stations. This provides the energy storage facility with long-term, stable contractual revenue. For **capacity compensation**,

similar to the compensation paid to conventional thermal reserve units, the grid pays for the “availability” of storage assets to ensure capacity is ready when required. This mechanism provides a guaranteed baseline income for ESS projects.

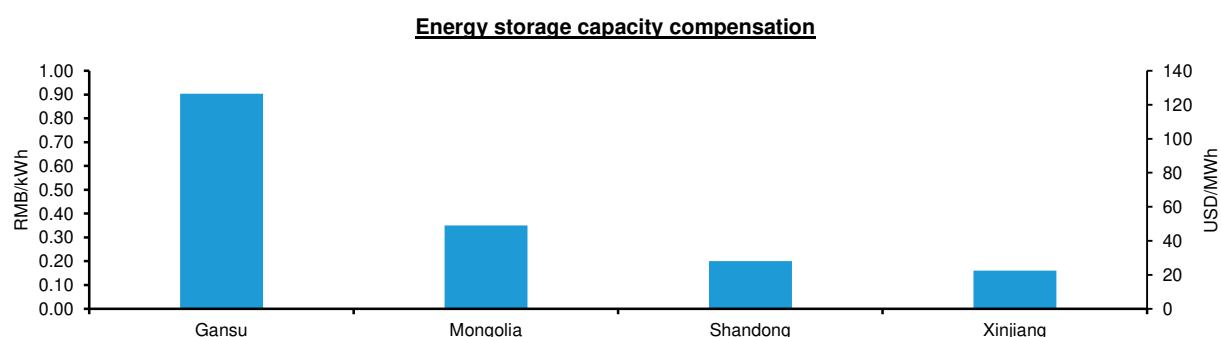
- **Energy arbitrage:** Energy arbitrage is the most fundamental and core profit-generating method for ESS projects, typically in two forms as well. **Peak - valley arbitrage** exploits the time-of-use (TOU) electricity pricing mechanism set by the government, charging when prices are low (off-peak or flat periods) and discharging when prices are high (peak or super-peak hours). **Spot market arbitrage** is a more dynamic model with higher potential returns. In regions where electricity spot markets are established, ESS projects can arbitrage real-time price fluctuations caused by supply and demand imbalances (especially those exacerbated by renewable energy intermittency).
- **Ancillary services:** ESS projects can also monetize their technical advantages of fast responses and generate substantial revenue in the ancillary services market, including both **frequency regulation** (stabilize grid frequency) and **peaking service** (address intra-day load peaks and valleys).

EXHIBIT 4: Several provinces have introduced policies supporting capacity compensation mechanisms, spot market arbitrage, and ancillary services, enhancing the attractiveness and returns of ESS projects in China

Revenue channels	Capacity based revenue		Energy Arbitrage		Ancillary Services	
	Capacity leasing	Capacity compensation mechanisms	Peak–valley price-spread arbitrage	Spot market arbitrage	Peaking service and compensation	Frequency regulation and compensation
% (based on 2023 Shandong project)	50%	15%	35%			
Document 136 (Feb-25)	X					
Selective provinces with ESS and electricity trading mechanisms:						
Shandong		+	+	+		
Shanxi		+	+	+	+	
Gansu		+	+	+	+	
Hebei	+	+	+		+	
Inner Mongolia		+	+			
Jiangsu	+		+	+	+	
Ningxia	+		+	+	+	
Yunnan	+	+	+		+	

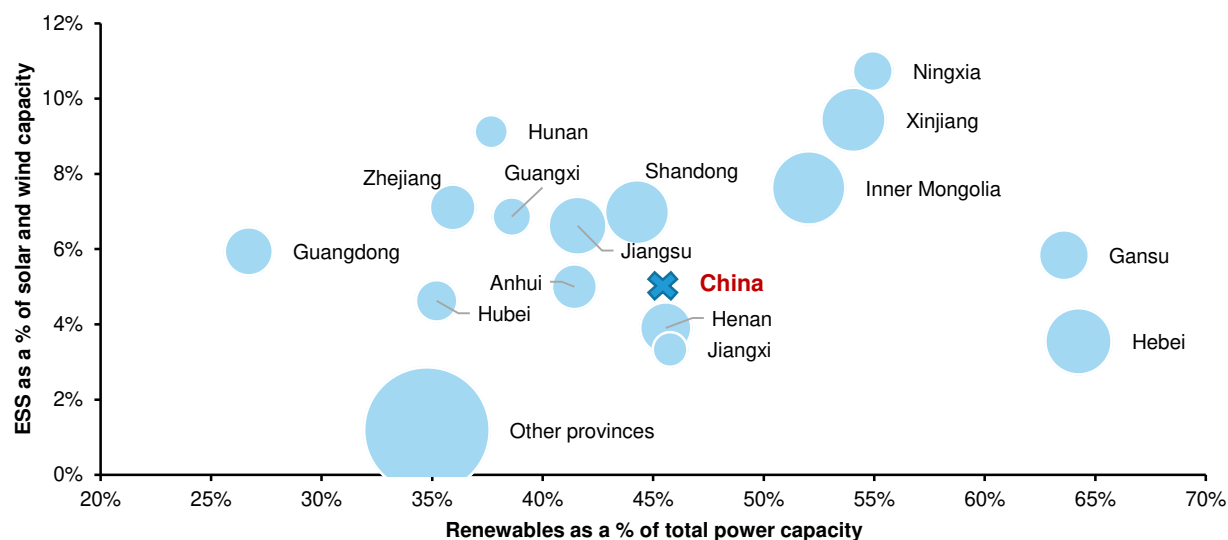
Source: Government websites, Storage Discovery, S&E Consulting, Bernstein analysis

In March 2025, Inner Mongolia announced its capacity compensation policy for standalone ESS projects, which provides compensation for electricity discharged to the grid. For projects commissioned in 2025 or earlier, the compensation rate is set at RMB0.35/kWh. The compensation standard is valid for 10 years, with the rate for the following year updated every September. For a 100MW/400MWh ESS project, assuming a daily discharge amount equal to 60% of rated capacity (240MWh) and 250 operating days per year, the annual electricity generation would be 60MM kWh, corresponding to capacity compensation revenue of RMB21MM. Considering a total investment of RMB300MM (equivalent to a capital cost of US\$100/kWh), the annual baseline income from capacity compensation accounts for about 7% of the total investment. While this is a significant contribution, most provinces are lower with Xinjiang at RMB0.16/kWh and Shandong at RMB0.20/kWh. Besides this, the project can earn additional revenue from energy arbitrage and ancillary services. The capacity compensation method may vary by region. For example, under new regulations issued in July 2025 in Gansu Province, eligible projects can receive a capacity compensation of RMB330 per kW per year. For the same 100MW/400MWh energy storage station, this corresponds to an annual capacity compensation income of RMB33MM, which represents about 10% of the total investment. In addition to this, in terms of energy arbitrage, we observe that more provinces are leading electricity price reforms towards greater market orientation. In 2025, Shandong Province not only introduced a “five-segment” time-of-use pricing policy but also clearly designated three months within the year as prime operational windows for “two charges and two discharges”. All these changes could lead to a better return of ESS projects.

EXHIBIT 5: **Capacity compensation based on discharge from ESS is a key driver of economics**

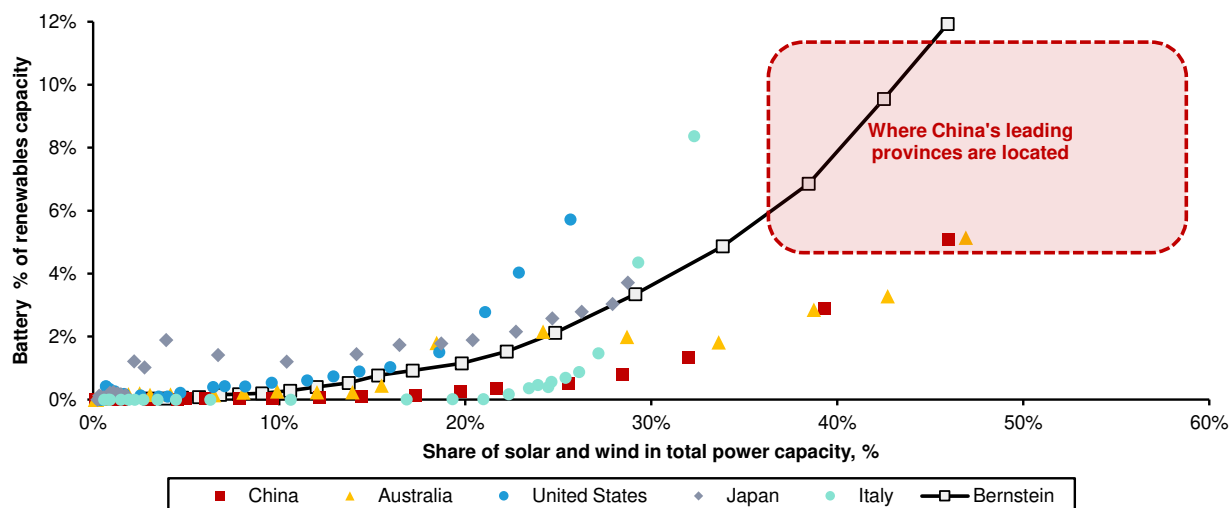
Source: Government data, Bernstein analysis

Provinces with higher penetration of renewables and ESS have been the first to establish ESS and electricity market mechanisms. As of 2024, in China renewables accounted for 45% of total power capacity, with around 5% supported by ESS projects. Leading provinces such as Xinjiang, Ningxia, and Inner Mongolia installed 55% of renewable capacity, with approximately 10% backed by ESS, mainly driven by energy storage mandate policies in our view. Equally important are other provinces where renewables make up about 35% of power capacity, but only 1-2% are supported by ESS projects.

EXHIBIT 6: **Provinces with higher penetration of renewables and ESS have been the first to establish ESS and electricity market mechanisms (2024)**

Source: Government websites, Bloomberg, Bernstein analysis

While these provinces have relatively high penetration of both ESS and renewable power, their levels remain below those of developed countries. With new ESS installations continuing to grow and tender volumes increasing even faster (which will be reflected into the new installations next 12M), we believe the ESS share will rise further and follow the trajectory of developed economies.

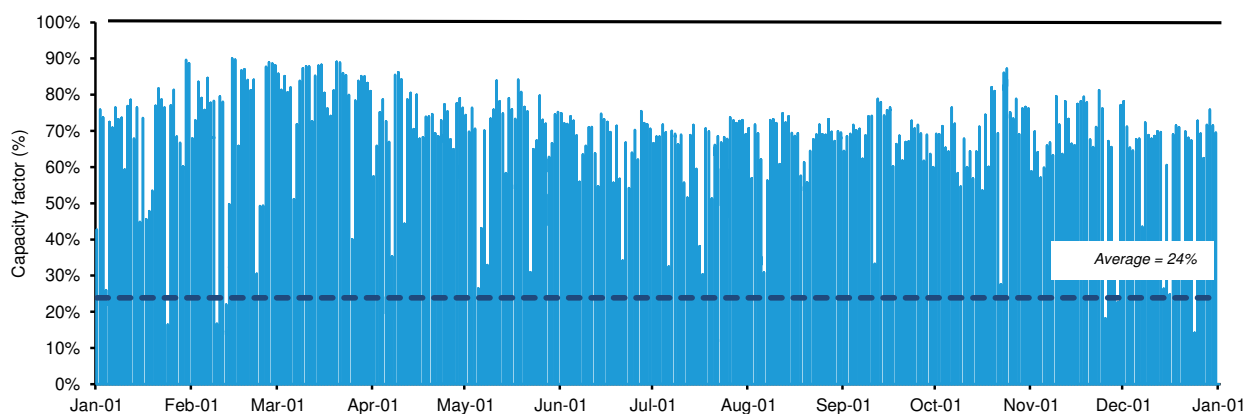
EXHIBIT 7: The higher % of interruptible power, the higher demand for ESS

Source: BNEF, Bernstein analysis and estimates

ECONOMICS OF CHINA'S SOLAR AND STORAGE PROJECT

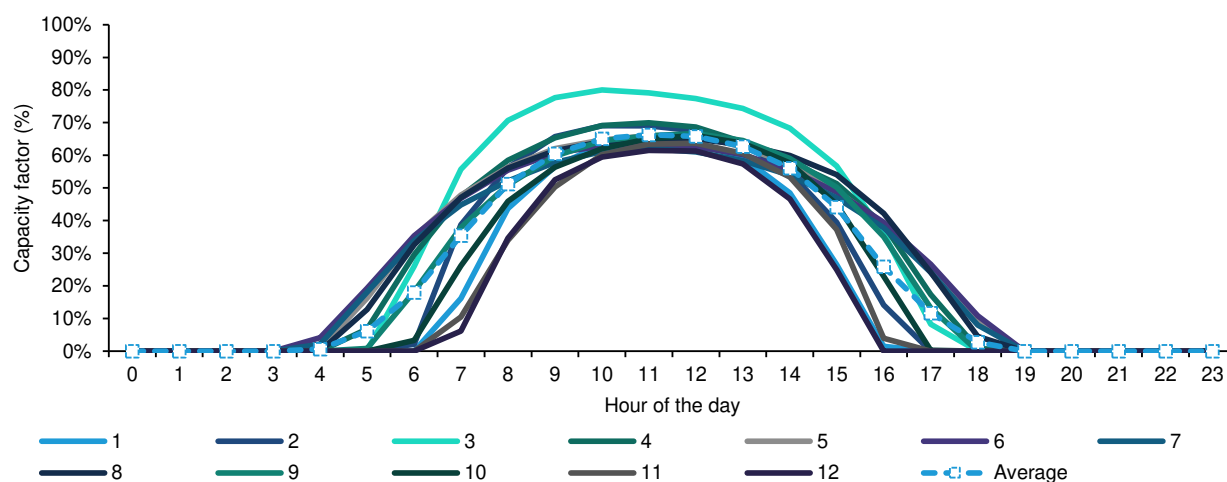
We have carried out an analysis of what the economics would look like for a solar and storage development in Xinjiang, China. Building solar capacity in Xinjiang offers significant advantages due to the region's abundant solar resources, characterized by high solar irradiance and vast available land, enabling large-scale, cost-effective solar power generation. Additionally, favorable government policy and expanding transmission infrastructure support export of electricity.

In our theoretical development, we assume a 1GW solar project. We have used Renewables Ninja to generate the load curve for the project with a 1-axis tilt and azimuth. On average, the annual capacity factor is approximately 24% assuming no curtailment.

EXHIBIT 8: We have modeled a 1GW solar project in Xinjiang. The solar farm can achieve an average capacity factor of 24% assuming no curtailment

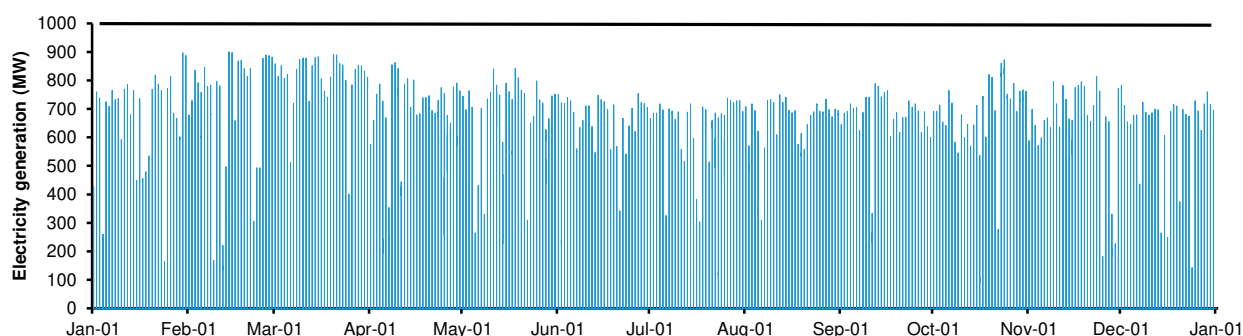
Source: Renewables Ninja, Bernstein analysis

Solar has significant variability in capacity factor by months and hours of the day. Capacity factors are generally higher in summer months with longer daylight hours and stronger solar irradiance. Solar power generation are typically between 6am to 5pm with peak generation between 10am to 1pm where the sun's ray strikes the panels most directly.

EXHIBIT 9: Solar power is generated between 6am to 5pm with peak generation between 10am to 1pm

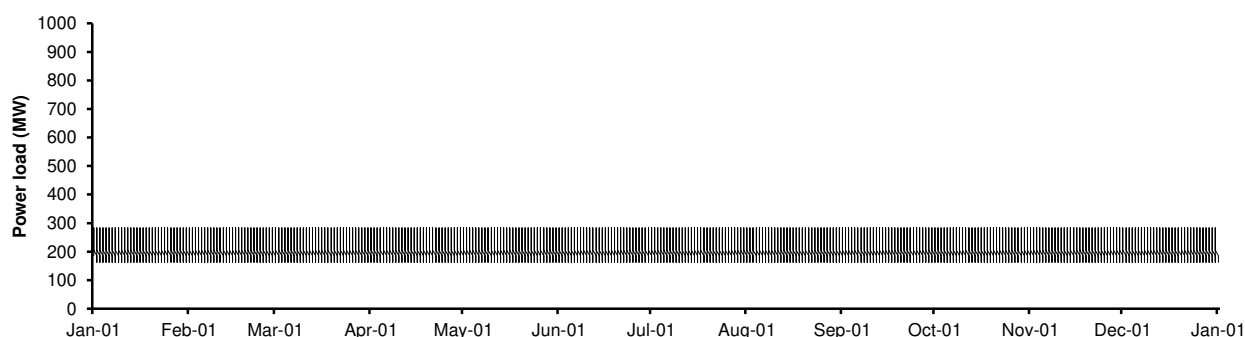
Source: Renewables Ninja, Bernstein analysis

The hourly generation profile below illustrates significant volatility in electricity generation without storage. Power generation drops to zero during peak evening hours. For a 1GW solar farm, the solar project can generate 2.1TWh of electricity annually.

EXHIBIT 10: Hourly output of a 1GW solar farm in Xinjiang. Annually, the project could generate 2.1TWh of electricity. Without storage, output drops to zero during peak evening hours

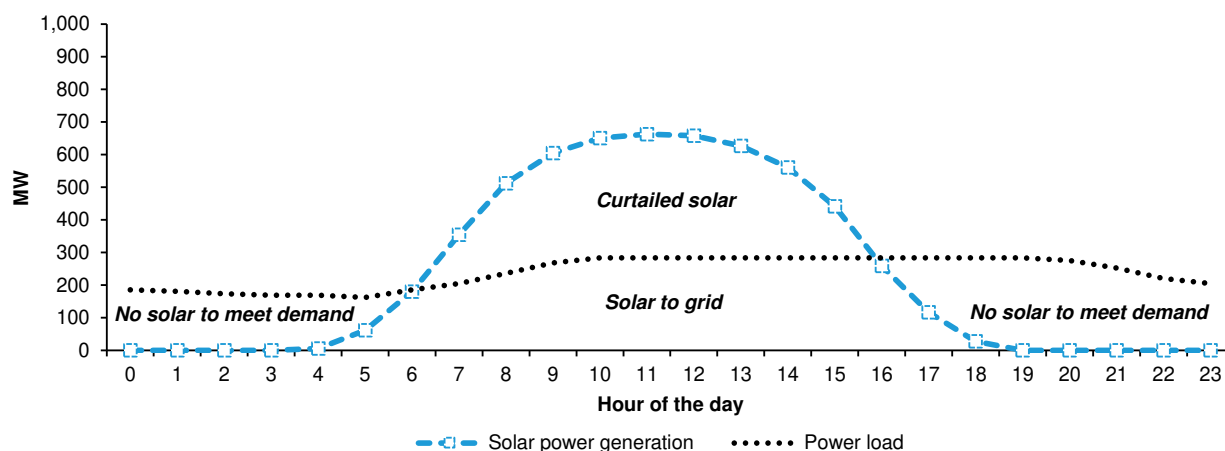
Source: Renewables Ninja, NDRC, Bernstein analysis

While the solar project can theoretically achieve 24% capacity factor, realistically utilization is lower due to curtailment due to mismatch in supply and demand. The power load curve shows the electricity demand throughout a day. Generally, the load curve peaks during the morning and early evening hours when residential, commercial, and industrial activities are at their highest, while it troughs during late night and early morning hours when demand is minimal. We model the power load curve of China's Eastern provinces to assess solar's economics.

EXHIBIT 11: **We model the power load curve of China's Eastern provinces to assess solar's economics**

Source: NDRC, Renewables Ninja, Bernstein analysis

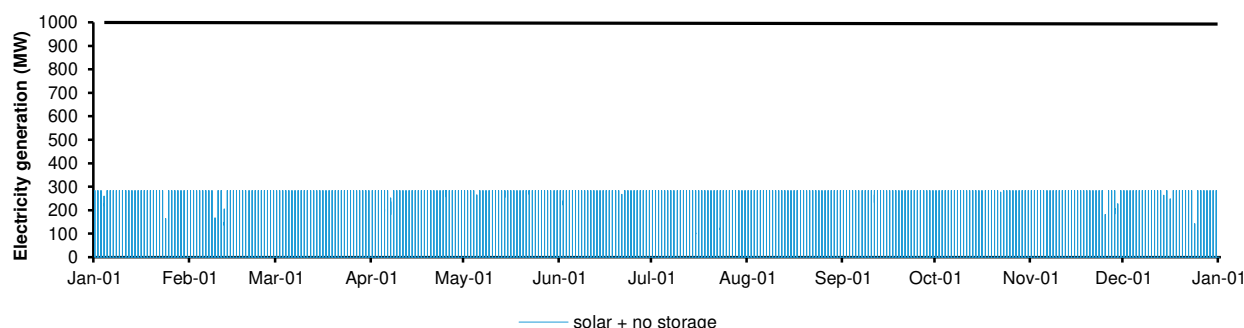
Solar power generation is often curtailed when its peak production, typically around midday, exceeds the electricity demand as shown by the power load curve. This mismatch leads to intentional reduction of solar output to maintain grid stability and prevent overloads. Curtailment results from limited grid flexibility and insufficient storage.

EXHIBIT 12: **While the solar project can theoretically achieve 24% capacity factor, realistically utilization is lower due to curtailment during midday**

Source: NDRC, Renewables Ninja, Bernstein analysis

After factoring in curtailment, the actual solar power generation from the project is effectively reduced to match the power load during midday. As a result, the generation profile shows lower output during periods when the grid cannot absorb all the solar energy produced. This means the net generation curve is clipped or flattened at these times. Consequently, the curtailment results in lower project revenue and efficiency metrics. After factoring in the curtailment, capacity factor for the system falls to 11%.

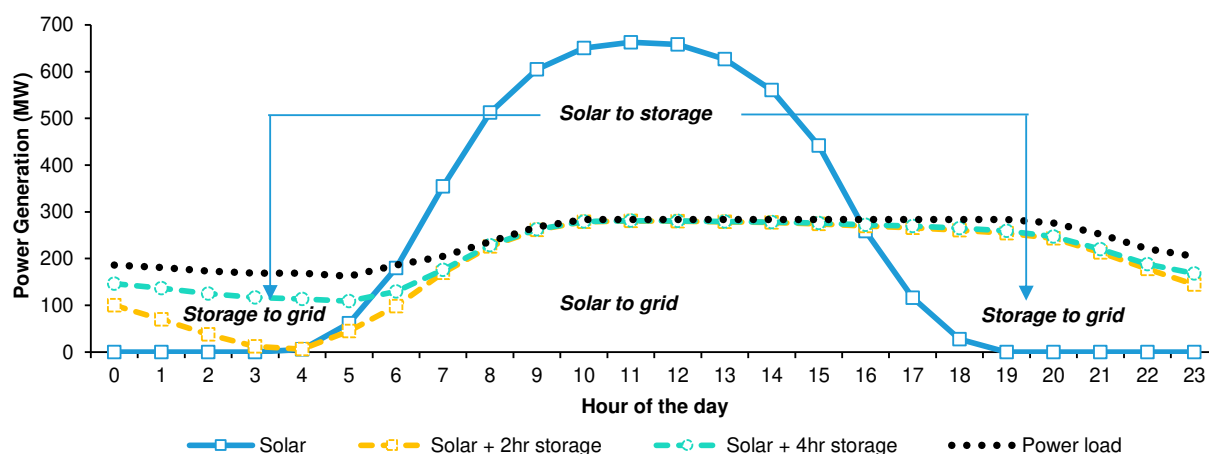
EXHIBIT 13: Actual solar power generation is effectively reduced to match the power load during midday. After factoring the curtailment, capacity factor for the system falls to 11%



Source: NDRC, Renewables Ninja, Bernstein analysis

Batteries help to store excess power and discharge during higher power load in the morning and evening. Sizing battery storage alongside solar requires a detailed analysis of solar generation and load demand profiles to optimize system performance and cost-efficiency. Key factors include understanding the timing and magnitude of solar output and electricity consumption, determining the required storage duration for balancing supply and demand, and accounting for battery characteristics such as depth of discharge and efficiency. The sizing strategy aims to maximize consumption and ensure reliability during periods of low solar generation. A well-established system prevents power shortfalls and excessive capital investment, enhancing the overall value proposition of solar-plus-storage projects.

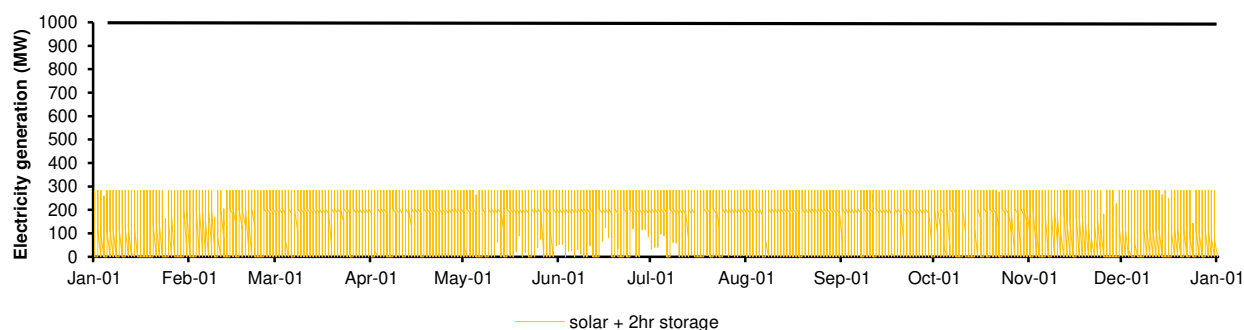
EXHIBIT 14: Two hours can be cost-effective solution for peak shaving but may be insufficient for providing extended backup power and grid resilience during lower sunlight conditions



Source: NDRC, Bernstein analysis

For projects aiming primarily at peak shaving and short-duration grid support, two hours can be a cost-effective solution. Two hours of storage can effectively smooth short-term fluctuations in solar generation and cover peak demand periods immediately following sunset. However, it may be insufficient for providing extended backup power during prolonged low-sunlight conditions or for shifting solar energy to cover late-night or early-morning demand. For greater energy resilience or higher grid independence, longer-duration storage would be necessary.

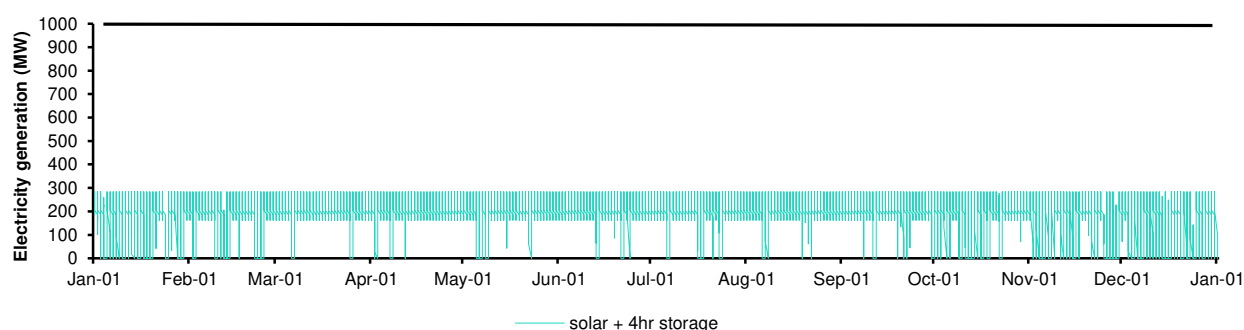
EXHIBIT 15: Two hours of storage can smooth short-term fluctuations and cover peak demand periods immediately following sunset. However, it may be insufficient for providing extended backup power



Source: Renewables Ninja, NDRC, Bernstein analysis

For our analysis, a four-hours battery storage system is a significant improvement for power load balancing but there are still intervals of no power generation especially during the winter months. This highlights the ongoing challenge of limited solar availability during periods of low sunlight, underscoring the need for additional measures to ensure consistent energy supply throughout the year.

EXHIBIT 16: Despite the installation of four hours of battery storage aimed at improving power load balancing, the system continues to experience intervals of no power generation especially during the winter months



Source: Renewables Ninja, NDRC, Bernstein analysis

Below is a summary of the key operating metrics for various solar-plus-storage configurations. Without storage, the solar project's utilization is limited to just 11% due to curtailment, with the system generating power only about 50% of the time. Introducing a 2-hour storage system increases utilization to 19%, as excess midday solar power is stored with the battery reaching a depth of discharge (DoD) of 90%. This also boosts system uptime to nearly 80%. Expanding to a 4-hour storage system further improves utilization to 21%, though the battery DoD decreases to 59%, while uptime rises to 90%. Beyond 4 hours, such as with a 6-hour storage system, gains become marginal, indicating that extending storage duration beyond 4 hours may not be economically justified.

EXHIBIT 17: **Key operating metrics for various solar-plus-storage configurations**

		No ESS	2-hr ESS	4-hr ESS	6-hr ESS
Daily power load	MW	5,725	5,725	5,725	5,725
Solar					
Capacity	MW	1000	1000	1000	1000
Effective utilization	%	11%	19%	21%	22%
Electricity generation	GWh	1,005	1,652	1,866	1,906
Daily generation	MW	2,754	4,527	5,112	5,221
Battery					
Battery size	MWh	0	2,000	4,000	6,000
Duration	hours	0	2	4	6
DoD per day	%	0%	89%	59%	41%
Combined					
Uptime	%	51%	79%	90%	91%

Source: NDRC, Renewables Ninja, Bernstein analysis

Below we show our assumptions for a solar project with 4-hours of storage (1GW/4GWh). On capital cost, we assume a unit capex of \$600/kW for the solar plant which equates to \$600M. The ESS would be \$560M assuming a cost of \$140/kWh. We assume that the solar plant is running at a capacity factor of 21% and assume a 60% depth of discharge for the battery. The charging cost is effectively zero when using excess solar energy that would otherwise be curtailed. Based on the analysis, we estimate the LCOE for the project is \$68/MWh assuming at 8% IRR.

EXHIBIT 18: **Our assumptions for a solar project with 4-hours of storage (1GW/4GWh). We estimate an LCOE of \$68/MWh**

Solar Assumptions	Units	Value
Capacity	MW	1,000
Capacity factor	%	22%
Electricity generation	GWh	1,927
Capital intensity	\$/kW	600
Capital cost	\$M	600
Fixed O&M cost	\$/kW/year	12.0

Energy Storage Assumptions	Units	Value
Energy Storage	MWh	4,000
Capital intensity	\$/kWh	140
Capital cost	\$M	560
DoD Cycles/Day	%	60%
Annual Degradation	%	3%
Efficiency	%	90%
Number of cycles	Times	2190

Economics	Units	Value
IRR	%	8%
LCOE	\$/MWh	68

Source: Bernstein analysis

We compare the LCOE analysis last year to current cost including and excluding government's capacity compensation. Last year a 4hr system would cost \$76/MWh with ESS price at \$185/kWh. With current ESS cost at \$140/kWh, LCOE has fallen by 11% to \$63/MWh. Assuming capacity compensation of RMB0.16/Wh (USD22/MWh) per discharge based on current policy in Xinjiang, then this reduces the LCOE to \$60/MWh. Many provinces have introduced relevant policies to give capacity compensation for new ESS capacity, and it is expected that nearly 20 provinces will follow up with such policies by the end of

the year.

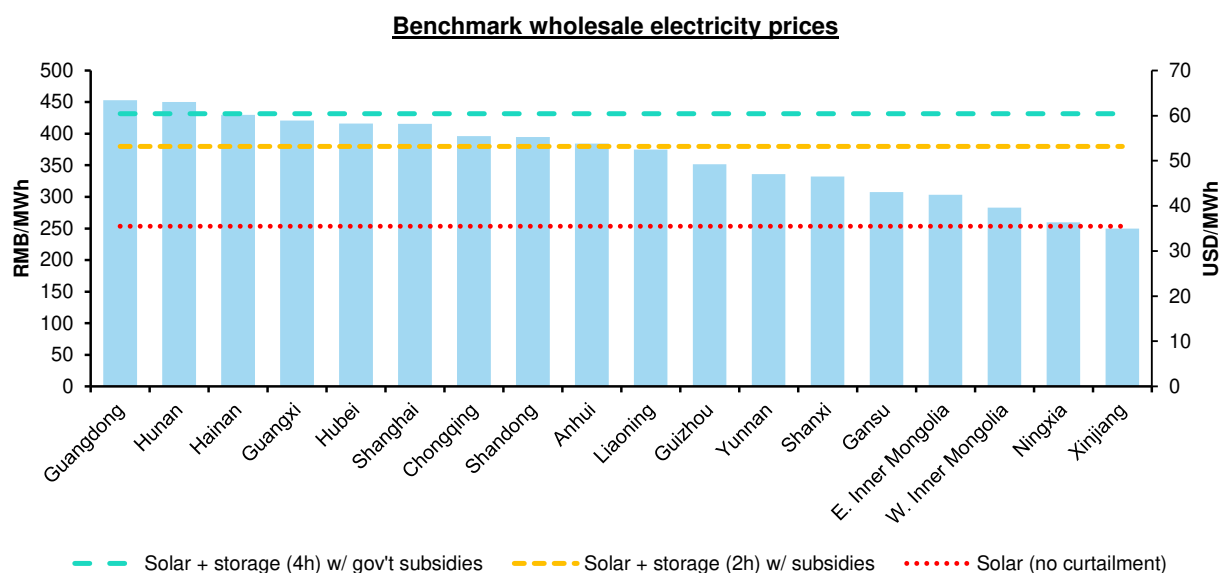
EXHIBIT 19: Assuming capacity compensation of RMB0.16/Wh (USD22/MWh) per discharge, then this reduces the LCOE to \$60/MWh

LCOE (\$/kWh)	Last year	Current	% Chg	Current	% Chg
Solar	35	35	0%	35	0%
Solar + Storage (2hr)	65	60	-8%	53	-18%
Solar + Storage (4hr)	76	68	-11%	60	-20%
ESS Cost (\$/kWh)	185	140		140	
Capacity compensation (\$/MWh)	0.0	0.0		22.2	

Source: Bernstein analysis

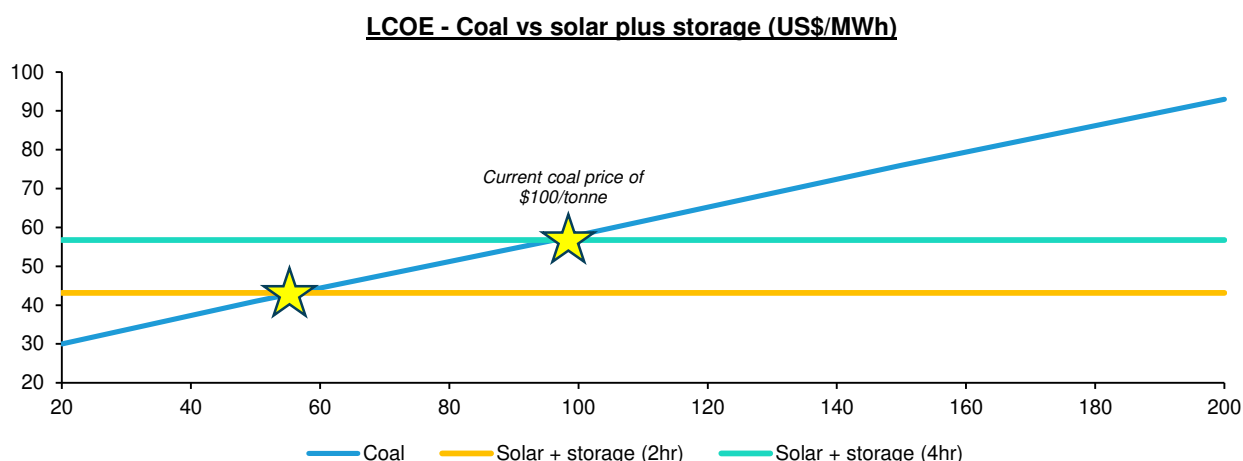
China's solar and storage costs are competitive across China. China's wholesale benchmark prices based on coal-fired power generation ranges from USD35-65/MWh. A 2 to 4-hr system is economically attractive across most key provinces, underscoring their growth potential.

EXHIBIT 20: Current solar and storage projects are competitive across China



Source: State Power Investment Economic Research Institute, Bernstein analysis

The LCOE for solar plus storage has reached a competitive level with that of coal-fired power generation. This cost parity makes solar plus storage an economically viable alternative to coal, enabling more flexible, cleaner, and sustainable energy supply without compromising reliability. Consequently, solar plus storage is increasingly favored in energy markets seeking to reduce carbon emissions while maintaining cost-effectiveness.

EXHIBIT 21: **The LCOE for solar plus storage has reached a competitive level with that of coal-fired power generation**

Source: Bernstein analysis

Falling battery prices have also enabled longer-duration storage solutions. Assuming electricity price of \$50/MWh, a solar plus 4 hours storage project can achieve approximately 8% IRR at current ESS cost of \$140/kWh. Just a year ago, a project with similar return would only be able to install 2-3 hours of storage.

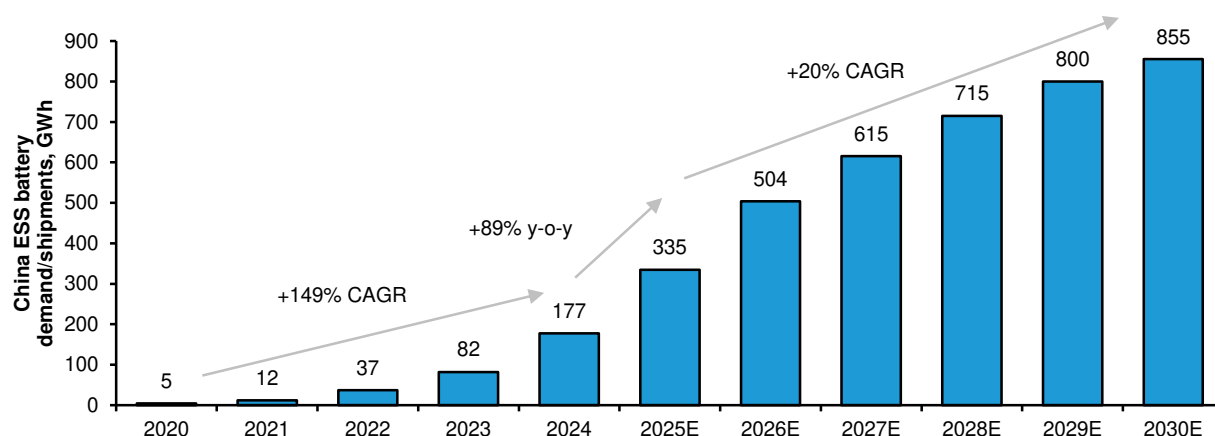
EXHIBIT 22: **IRR sensitivity to battery system prices****IRR sensitivity for solar + storage projects****Assuming: 1GW Solar capacity; Electricity price of \$50/MWh**

	Utilization %	Generation TWh	Battery system price (\$/kWh)									
			60	80	100	120	140	160	180	200	220	240
Solar only (no curtailment)	24%	2.10	16%	16%	16%	16%	16%	16%	16%	16%	16%	16%
Solar only (with curtailment)	12%	1.05	6%	6%	6%	6%	6%	6%	6%	6%	6%	6%
Solar + 2hr storage	19%	1.66	13%	13%	12%	11%	10%	10%	9%	9%	8%	8%
Solar + 4hr storage	22%	1.93	12%	11%	10%	9%	8%	7%	6%	6%	5%	4%

Source: Bernstein analysis

CHINA ESS BATTERY DEMAND OUTLOOK

How much battery storage is needed is dependent on (a) total power demand which drives overall capacity (b) the amount of renewable energy which will be installed for power generation and (c) how much energy storage is required by batteries (versus other forms of energy storage). The greater the penetration of solar and wind in the power mix, the higher the penetration of battery energy storage. At penetration rates of 60-70% of the grid then 15% or more of capacity will have to be backed up by batteries. We forecast ESS demand to rise 89% to 335GWh in 2025 and 855GWh in 2030, reflecting a 20% CAGR.

EXHIBIT 23: We forecast ESS demand to rise 89% to 335GWh in 2025 and 855GWh in 2030, reflecting a 20% CAGR

Source: Government websites, Bloomberg, InfoLink, Bernstein analysis and estimates

Renewables expected to account for 70% of the power capacity mix by 2030. Battery energy storage systems are well suited for short-duration storage (<12hrs) which involves charging and discharging over a span of hours. This makes battery storage highly complementary with wind and solar. The underlying assumption is that over the next five years, the annual addition of new solar and wind capacity will remain at the 2025 level, approximately 500 to 550 GW per year, with 263 GW already added in 1H2025. This growth trajectory will increase total installed renewable capacity to 4,796 GW by 2030, up from 1,569 GW in 2024, representing 70% of the total power capacity in China.

23% of renewables backed up by ESS by 2030. With the integration of large-scale solar and wind power system, the grid will require more storage to deal with undersupply and curtailment of power. Battery storage will help improve the stability of power supply and help with peak regulation and frequency regulation. Based on current tender volumes, which will translate into new ESS installations by 2026, it is relatively clear that ESS capacity will reach 10% of renewable capacity, a significant increase from 1% four years ago. Continuing this trend and with more renewables connecting to the grid, we expect the ESS share to rise to 23% by 2030.

3-hour duration of ESS by 2030. In China, more grid-scale ESS policies designed for longer-duration energy storage came out over the past year, which will fuel the demand for ESS batteries further. In China, most provinces ruled the storage duration to be at 2 hours, among which regions with rich solar and wind resources, for example Xinjiang and Tibet, required 4 hours. Longer duration energy storage systems are on the rise.

EXHIBIT 24: **China's ESS demand outlook**

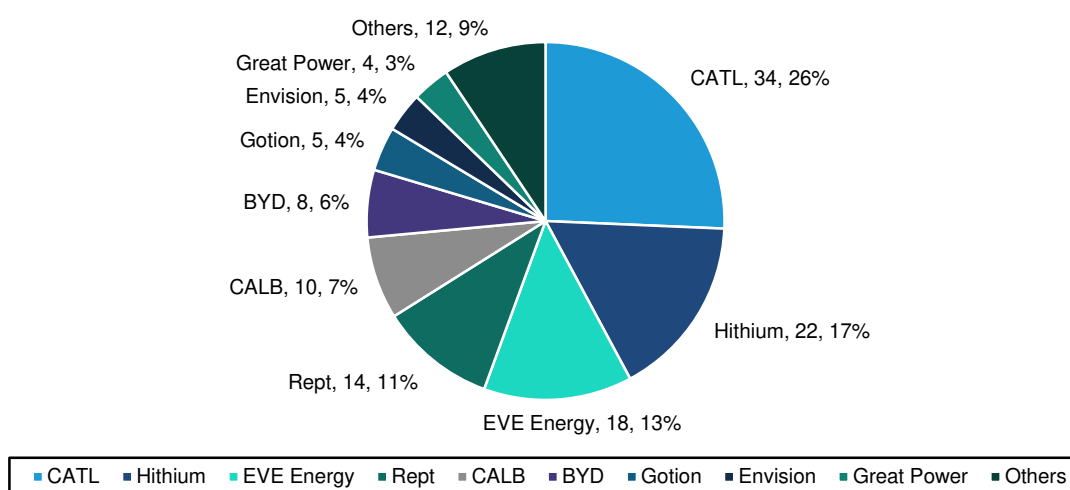
	2020	2021	2022	2023	2024	2025E	2026E	2027E	2028E	2029E	2030E	2050E
Total power capacity (GW)	2,150	2,328	2,518	2,907	3,392	4,031	4,622	5,177	5,736	6,300	6,872	17,976
Total solar and wind capacity (GW)	550	662	807	1,144	1,569	2,074	2,593	3,124	3,669	4,226	4,796	16,196
Share of solar and wind (%)	26%	28%	32%	39%	46%	51%	56%	60%	64%	67%	70%	90%
Net added solar and wind capacity (GW)	125	112	145	337	425	506	519	532	545	558	570	570
y-o-y (%)		-10%	29%	133%	26%	19%	3%	3%	2%	2%	2%	0%
Cumulative ESS capacity (GW)	3	5	11	33	72	139	265	444	650	876	1,114	4,859
As of total capacity (%)	0%	0%	0%	1%	2%	3%	6%	9%	11%	14%	16%	27%
As of solar and wind capacity (%)	1%	1%	1%	3%	5%	7%	10%	14%	18%	21%	23%	30%
Net added ESS capacity (GW)	1	2	6	22	39	67	126	179	206	226	238	202
y-o-y (%)		79%	131%	290%	77%	72%	87%	43%	15%	10%	6%	-1%
Duration (hours)	1.7	1.8	2.0	2.1	2.3	2.5	2.6	2.7	2.8	2.9	3.0	4.5
Cumulative ESS capacity (GWh)	5	10	22	68	167	341	675	1,179	1,795	2,510	3,310	21,865
Annual battery installation (GWh)	2	5	12	47	99	173	335	504	615	715	800	1,221
y-o-y		86%	167%	278%	113%	75%	93%	51%	22%	16%	12%	3%
Annual ESS battery shipment/demand (GWh)	5	12	37	82	177	335	504	615	715	800	855	1,259
y-o-y		167%	201%	122%	116%	89%	51%	22%	16%	12%	7%	3%

Source: Government websites, Bloomberg, InfoLink, Bernstein analysis and estimates

Competition among companies in China's ESS market has intensified. CATL leads as the top ESS battery cell manufacturer in China, holding a 26% market share, followed by Hithium with 17%, EVE Energy at 13%, and Rept at 11%. The companies most exposed to the China ESS battery market include Great Power, Hithium, Rept, and EVE Energy. Within our coverage, CATL derives approximately 10% of its battery sales from the China ESS market and another 10% from overseas. Although the rapid growth in China's ESS battery demand has somewhat been offset by CATL's market share loss, the market-oriented pricing mechanism introduces some positive implications for market leaders, however. Specifically, since capacity compensation is valid for 10 years, projects with longer life cycles yield better returns. Additionally, in leading provinces such as Shandong, where ESS projects benefit from "two charges and two discharges per day" to engage in energy arbitrage, factors like battery longevity and performance characteristics like depth of discharge, are becoming increasingly critical. These factors collectively increase the value placed on battery technology, quality, and brand reputation, ultimately benefiting the industry leaders.

EXHIBIT 25: In China, CATL is the leading ESS battery cell manufacturer with a 26% market share, followed by Hithium at 17%, EVE Energy at 13%, and Rept at 11%

China ESS battery cell shipment (GWh, 1H25)



Source: InfoLink, Bernstein analysis

GLOBAL ESS BATTERY DEMAND OUTLOOK

Since the beginning of the year, we have adopted a more positive outlook on ESS and significantly elevated our forecast to capture the higher ESS penetration driven by improved economics and the critical role of ESS in ensuring grid stability. Since the start of the year, we have revised up 2025 global ESS demand growth from 30% to 93% to 581GWh. Looking further ahead, our long-term expectations for 2030 have also been increased by 60% since initial estimates from 983GWh to 1,588GWh. Overall, the increase in ESS underscores the importance of ESS technologies as economic viability improves and the importance for grid resilience intensifies worldwide.

EXHIBIT 26: **Global ESS battery demand outlook**

	2020	2021	2022	2023	2024	2025E	2026E	2027E	2028E	2029E	2030E	2050E
Total power capacity (GW)	7,681	8,038	8,473	9,137	9,936	10,835	11,789	12,803	13,768	14,762	15,804	34,675
Total solar and wind capacity (GW)	1,522	1,787	2,105	2,663	3,362	4,167	5,012	5,881	6,742	7,628	8,554	30,274
Share of solar and wind (%)	20%	22%	25%	29%	34%	38%	43%	46%	49%	52%	54%	87%
Net added solar and wind capacity (GW)	262	265	318	558	699	805	845	868	861	886	925	1,246
y-o-y (%)		1%	20%	75%	25%	15%	5%	3%	-1%	3%	4%	1%
Cumulative ESS capacity (GW)	18	27	45	89	164	286	479	733	1,010	1,317	1,647	8,327
As of total capacity (%)	0%	0%	1%	1%	2%	3%	4%	6%	7%	9%	10%	24%
As of solar and wind capacity (%)	1%	2%	2%	3%	5%	7%	10%	12%	15%	17%	19%	28%
Net added ESS capacity (GW)	6	10	17	45	74	122	193	254	277	307	330	343
y-o-y (%)		63%	81%	155%	67%	64%	58%	32%	9%	11%	7%	1%
Duration (hours)	2.0	2.1	2.1	2.1	2.3	2.5	2.8	2.9	3.1	3.2	3.3	3.9
Cumulative ESS capacity (GWh)	35	56	93	189	370	725	1,322	2,161	3,116	4,222	5,460	32,149
Annual battery installation (GWh)	12	22	37	96	183	358	612	865	1,020	1,200	1,365	3,526
y-o-y	76%	78%	70%	159%	91%	96%	71%	41%	18%	18%	14%	3%
Annual ESS battery shipment/demand (GWh)	21	44	121	185	301	581	865	1,020	1,200	1,365	1,588	3,632
y-o-y	73%	114%	175%	53%	63%	93%	49%	18%	18%	14%	16%	3%

Source: Government websites, Bloomberg, InfoLink, Bernstein analysis and estimates

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