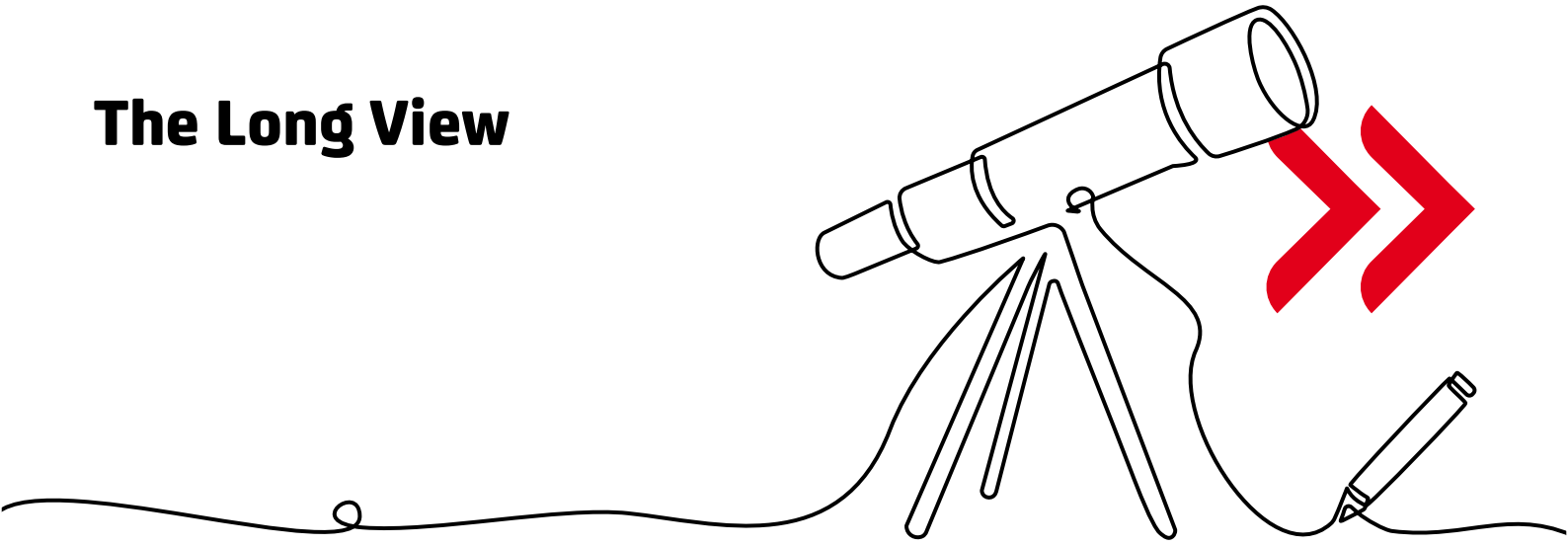
The Investment Institute
by UniCredit

The Long View



The Long View offers insights on key global issues that will shape tomorrow's world.

Energy transition: battery storage to unlock the next phase of renewables growth

19 October 2026

Investment in energy storage is set to help electricity grids accommodate a growing share of renewable power generation, but the technology's limitations mean it can only provide a partial solution to the broader energy transition.

1. As power-grid modernisation continues, wind and solar power generation is at the heart of the energy transition. Investment in battery energy storage systems (BESS) is accelerating rapidly as it complements and stabilises renewable power generation.
2. As renewable power expands, the intermittent nature of its output presents growing technological and economic challenges. Battery storage can improve returns on renewable power projects and help unlock the next phase of investment.
3. Despite these benefits, the limited storage capacity of BESS means they cannot cover prolonged periods of low renewables generation on their own. A fully modernised grid therefore needs other dispatchable power sources during such periods.
4. China's dominant position within battery supply chains introduces geopolitical challenges that could slow BESS investment and deployment. Supporting an alternative ecosystem of local producers and service providers is crucial to preventing geopolitics from slowing the energy transition.

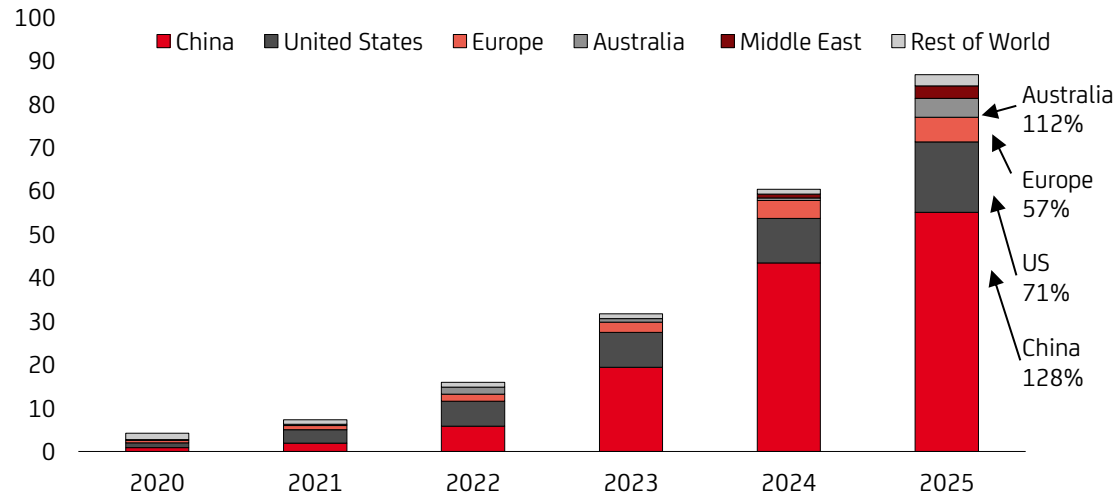
The importance of energy storage in the grid of the future

Building the power grid of the future is one of the most vital and complex societal priorities of the coming decades. Rising levels of electrification will create more demand for power, as will new use cases, such as data centres, that will put increasing strain on power grids. Demand growth for electricity also comes with the challenge of using renewable energy to replace the fossil fuels that have powered society since the start of the industrial age. After years of accelerated investment, especially since the beginning of the Ukraine conflict in 2022, Europe is undertaking a massive build-out of renewable energy sources. As of 2025, the EU generated 47% of its electricity from renewable sources, with nuclear accounting for a further 23%. African and Asian countries are also making major investments in the energy transition, in part because geopolitical turmoil has repeatedly exposed the risks of relying on fossil fuels.

As countries scale up renewable energy capacity, the first wave of investment has understandably been in the power generating assets, mainly wind and solar power. However, the intermittent nature of renewables makes storage systems increasingly important to the overall energy network: they store electricity when renewable output is high and release it when output is low. It is this new wave of investment that is gathering momentum now and is taking utility-scale battery deployment from very low levels a few years ago to an increasingly significant scale. China has been the leader in BESS deployment and manufacturing and is expected to remain so for the foreseeable future. However, other regions are also installing increasing battery capacity and are developing their own technologies as part of overall grid modernisation programmes.

CHINA IS THE LEADER IN BESS DEPLOYMENT, WHILE OTHER REGIONS ALSO SEE RAPID GROWTH

GW OF BESS INSTALLATIONS (CAGR AS PERCENTAGE)



Source: IEA, The Investment Institute by UniCredit

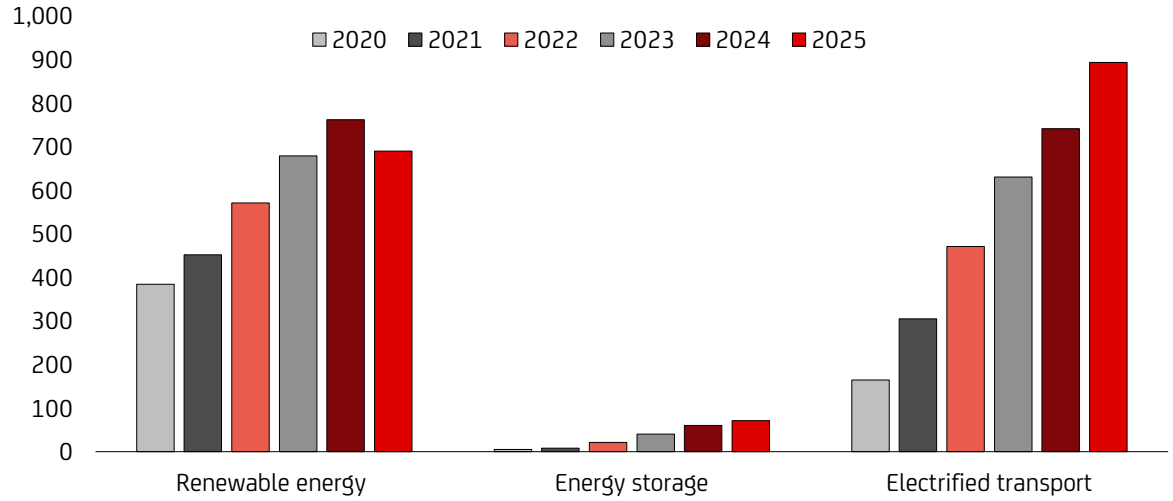
Although BESS are becoming increasingly important to the energy transition, investment in utility-scale batteries still lags investment in generating assets, such as the solar and wind farms that form the basis of a renewables-driven power network. The limitations of focusing investment on power generating assets without complementing this infrastructure with BESS facilities are becoming increasingly apparent. Since storage improves grid performance and economics, BESS investment is likely to grow in the coming years, benefitting businesses across the value chain, from raw materials to support services. Bloomberg NEF (BNEF) expects annual global gross energy storage additions to rise from 92GW in 2025 to 243GW in 2035 and for storage capacity to increase 17-fold to 3.8TW by 2050, indicating that BESS will play a growing role as a pillar of the energy transition over the coming decades.

Investment in energy storage systems is still relatively small within the broader context of investment in the energy transition. BNEF estimates that global investment in energy storage amounted to USD 71bn in 2025, compared with USD 690bn in renewable energy and USD 893bn in electrified transport. However, BESS investment has grown faster in recent years than in those more established sectors. This has several important implications for the further development of the technology. First, as BESS investment rises, it takes up a larger share of the resources necessary for battery production and increasingly competes for those materials with batteries used for EVs.

Second, given the much greater demand volume for batteries for EV production and the greater scale of resources necessary for their production, BESS is unlikely to become the main driver of pricing in the broader battery market, even if it continues to grow rapidly due to overlapping resource bases and often production facilities. However, rapid growth of BESS deployment will increasingly influence the industry's economics as they gain scale. Based on IEA data, BESS deployment measured in GWh rose from around 10% of EV battery deployment in 2020 to 20% by 2025.

GLOBAL INVESTMENT IN STORAGE IS SMALLER THAN RENEWABLES AND TRANSPORT BUT IS RISING QUICKLY

ENERGY INVESTMENT IN USD BN



Source: Bloomberg NEF, The Investment Institute by UniCredit

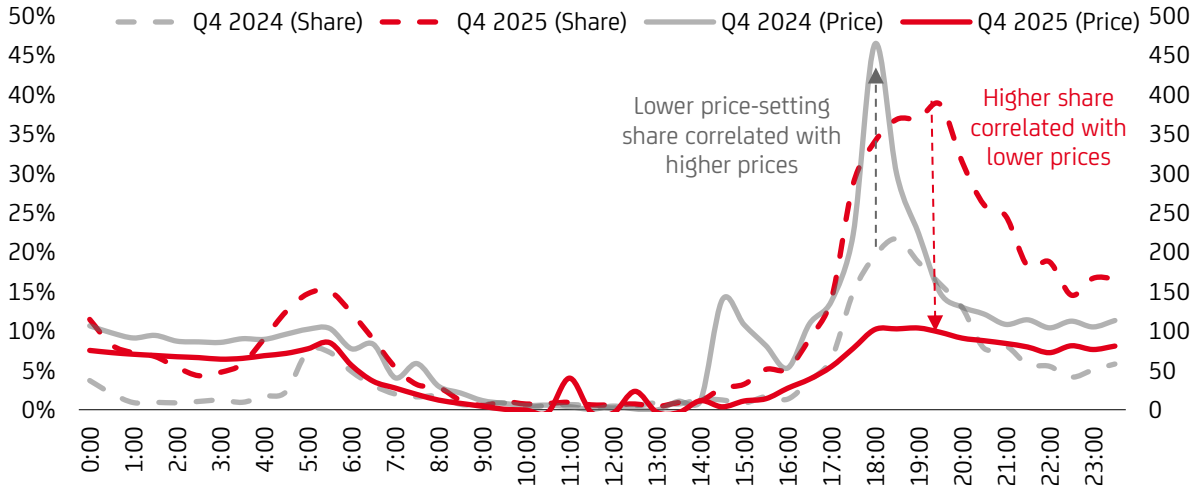
As the chart above shows, investment in renewable energy fell in 2025 for the first time in years. While market reform in China and a retrenchment of energy investment favouring fossil fuels in the US were factors in this decline, there has also been a growing recognition in the EU that renewable energy has in some cases expanded faster than the grid can absorb it. This does not imply that investment in renewables is set to stagnate but that higher growth in battery deployment is necessary to support investment growth in wind and solar assets by making them more productive.

How BESS improves the economics of renewables

Australia provides an interesting case study in how investments in battery technology improve the overall economics of renewable power for utilities. Australia made major investments in batteries to complement an already significant renewable generation capacity that drove renewable energy supply above 50% of total production in 4Q25. Following a 2024 programme to support battery investment, Australia added enough battery capacity in 2025 to shift 53% of the output from that year's new solar capacity to later hours, according to Ember. This means that solar capacity can be shifted from the midday hours when the power is generated to the evening. During evening peak hours in 4Q25, batteries set Australia's wholesale power prices 36% of the time, up from 18% a year earlier. In doing so, they displaced gas and hydro as the price-setting sources during those hours and consequently helped lower prices and price volatility.

AUSTRALIA'S INVESTMENT IN ENERGY STORAGE LEADS TO LOWER AVERAGE PRICES AND VOLATILITY

SHARE OF HOURS THAT BATTERIES SET ELECTRICITY PRICES (LS), AUD/MWH (RS)

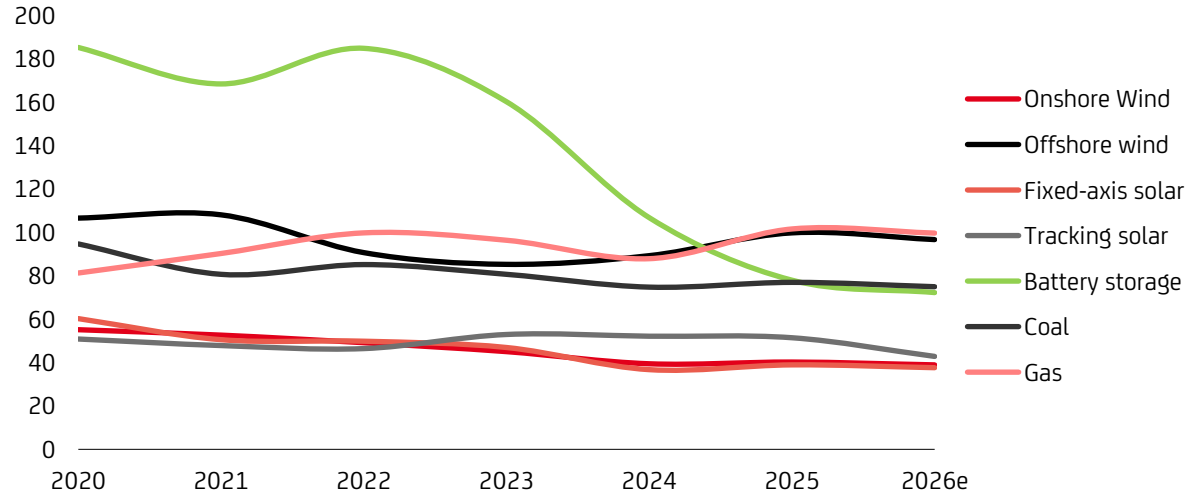


Source: Australian Energy Market Operator, The Investment Institute by UniCredit

Investments in utility-scale batteries have also become increasingly attractive as battery pack prices continue to fall. On BNEF's levelised cost estimates, four-hour battery storage now costs less per megawatt-hour than gas-fired generation and is roughly on a par with coal. BNEF estimates that the cost of four-hour battery storage fell by 58% per megawatt hour between 2020 and 2025, outpacing cost declines in other energy sources. This largely reflects technological advances and economies of scale in Chinese battery manufacturing. These advancements have helped lower battery prices even as demand has risen. Raw material price trends have also been mostly benign in recent years, as new supply of key critical battery minerals has outpaced demand. Although storage is fundamentally different from other energy sources as it does not generate power, falling battery costs have made storage increasingly competitive as a source of dispatchable power capacity and grid-balancing services.

BESS POWER HAS SHOWN THE LARGEST PRICE DECLINE IN RECENT YEARS RELATIVE TO OTHER SOURCES

INDICATIVE BENCHMARK LCOE, USD/MWH

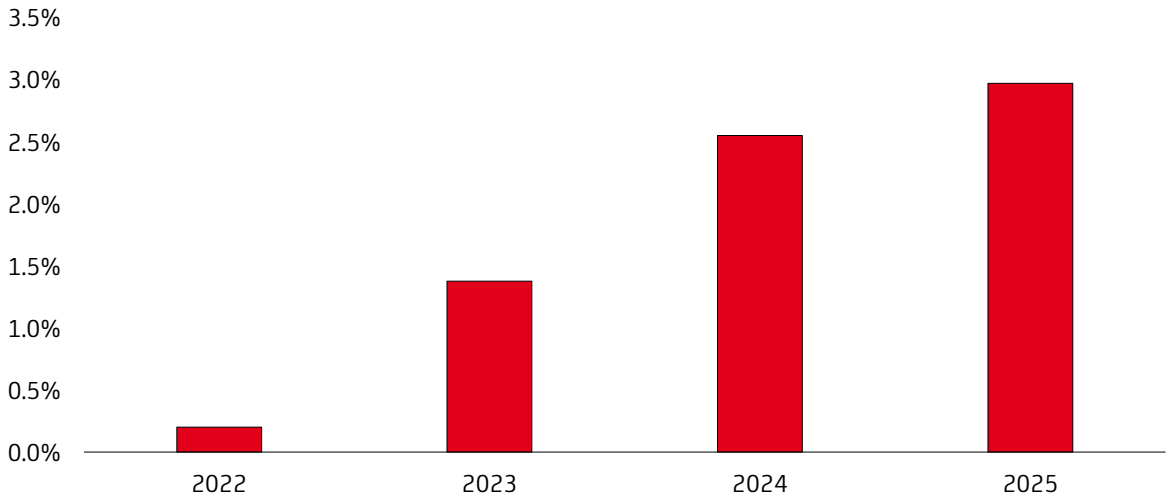


Source: Bloomberg NEF, The Investment Institute by UniCredit

BESS investment can also improve the economic profile of renewable power generation for utilities by reducing the amount of power that is wasted. Europe accelerated investment in renewable power following the breakdown of trade relations with Russia after the war in Ukraine began in 2022. However, the expansion of renewables has led to significant spikes in electricity generation that exceed what the grid can absorb, especially during periods of high solar output. This surplus can overwhelm the grid, forcing operators to curtail generation when supply exceeds demand in a region. It can also lead to negative power pricing when excess energy is produced. Negative pricing also provides a disincentive for utilities to invest in renewables. The percentage of hours priced at negative rates within the EU has risen every year since 2022, due in part to increasing amounts of renewable generation with insufficient storage capacity. BESS allow renewable power operators to store power during these periods of excess generation and sell it when supply is lower and prices rise, earning profits through price arbitrage while reducing curtailment and improving the efficiency of the system. BESS also benefits utilities by reducing congestion and helping them make better use of local grids. Unsurprisingly, European utilities with the strongest renewables profiles tend to have the most ambitious capex plans for BESS installations in the coming years.

HOURS OF NEGATIVE POWER PRICING HAVE BEEN RISING AS RENEWABLE POWER INCREASES

PERCENTAGE OF HOURS IN THE EU WITH NEGATIVE PRICING PER YEAR



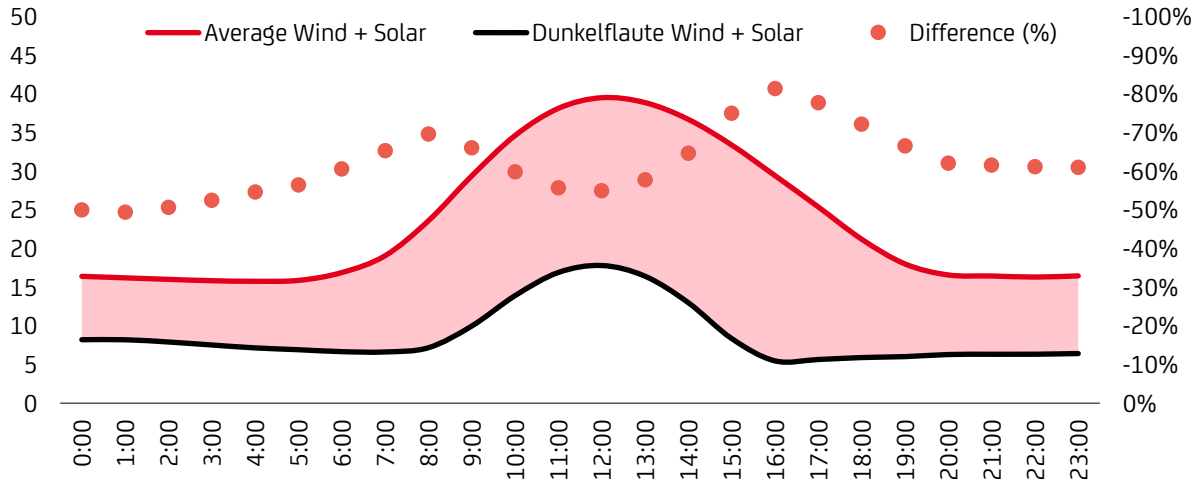
Source: Ember, The Investment Institute by UniCredit

Complications of expanding BESS in the grid of the future

Although BESS expansion has clear potential to improve the economics of a renewable power buildout, it does not solve all challenges of renewable power generation and can only be part of a broader energy transition. One problem that BESS cannot overcome is a “Dunkelflaute” – a prolonged period of low wind and solar generation. In Germany, average daily renewable power generation during the lowest-output seven-day period in 2025 was 63% below the daily average across the year. Since most utility-scale batteries can only provide backup power for 2-4 hours, they cannot sustain supply throughout such periods. While BESS deployment can help utilities smooth the supply of renewable power and improve the economics of renewables, national grids still need dispatchable power sources they can rely on during Dunkelflaute periods. For some countries, nuclear power can provide this. Others that have ruled out nuclear power may need to rely on gas or other fossil fuels while they scale up dispatchable renewable sources, such as geothermal.

DUNKELFLAUTE PERIODS INVOLVE EXTENDED DROPS IN RENEWABLE GENERATION

AVERAGE GERMAN HOURLY POWER GENERATION IN 2025 AND DUNKELFLAUTE PERIODS IN GW

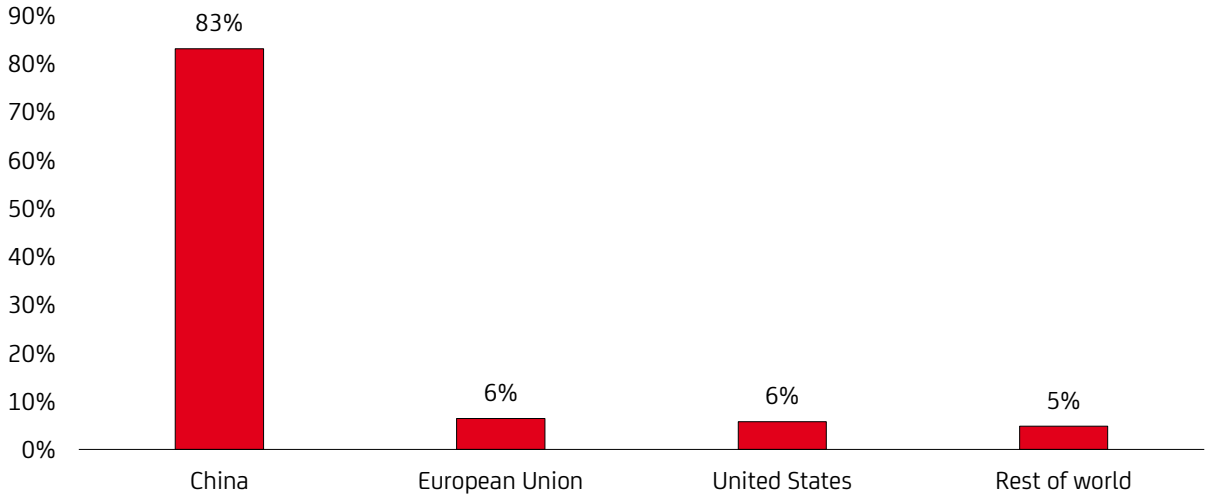


Source: Bundesnetzagentur, The Investment Institute by UniCredit

Another challenge for BESS expansion is China's dominance of battery supply, which presents geopolitical risks for Western utilities. China is home to some of the largest and most efficient battery manufacturers worldwide. Their scale and cost-competitiveness have made it difficult for Western producers to gain a foothold and offer viable alternatives to Chinese production. According to the IEA, China currently produces 83% of the world's lithium-ion battery cells, with no other region accounting for a substantial share.

CHINA DOMINATES GLOBAL BATTERY MANUFACTURING, WITH US AND EU FAR BEHIND

GLOBAL SHARE OF LITHIUM-ION CELL MANUFACTURING CAPACITY IN 2025



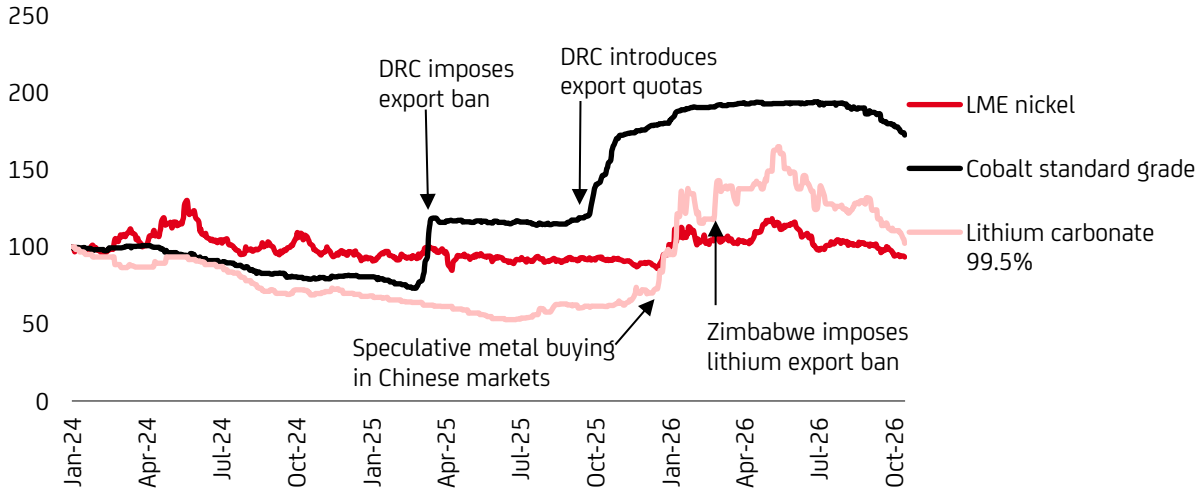
Source: IEA, The Investment Institute by UniCredit

The commercial dominance of China's battery production industry could also become a source of geopolitical leverage over its customers. Unless China's customers build competing industries, they will continue to rely on China for some of their most critical energy infrastructure. Fostering viable domestic battery production would take years of investment and would probably require government support. Until then, that dependence could give China geopolitical leverage during periods of heightened tension.

China's position is further enhanced by its dominant role in refining the raw materials necessary to produce batteries. China has a 70% global share of refined lithium production as well as dominant positions in other key minerals for battery production, such as graphite (94% refining share), according to the IEA. Some battery materials will be more affected by growing demand for BESS than others. For example, the lithium iron phosphate (LFP) chemistries that dominate BESS production require substantial amounts of lithium, whereas nickel and cobalt play a negligible role compared to the nickel manganese cobalt (NMC) chemistries that are more common in automobile batteries (although LFP chemistries are making inroads in automotive batteries as well). This is one reason why the long-term demand trend for cobalt is weaker than for other battery metals. After an extended price decline, cobalt's leading producer, the Democratic Republic of Congo (DRC), propped up the price with a quota system in 2025. However, cobalt prices have declined since September as the bottlenecks from the DRC's quota system ease. Despite strong demand for batteries, the lithium market remains well supplied in the short term, keeping prices in check. However, the longer-term prospects for lithium are strong because it is irreplaceable in battery supply chains based on current technologies. While the growing adoption of LFP chemistries has negative implications for nickel prices in the long term, nickel has a wider range of uses in electrification than cobalt, which should keep nickel's demand profile stronger than cobalt's in the coming decades.

BATTERY METAL PRICES HAVE BEEN VOLATILE IN 2026, OFTEN SUPPORTED BY SUPPLY SIDE CONSTRAINTS

INDEXED PRICE CHANGES IN KEY BATTERY METALS (2024=100)



Source: Fastmarkets, The Investment Institute by UniCredit

However, the geopolitical complications of China's dominance in battery production should not be overstated. Geopolitical dependency on China's battery supply chain is quite different from dependency on fossil fuel inputs. Given the typical 10-20 year lifespan of BESS, the nature of a geopolitical crisis would differ markedly from a raw material crisis involving oil and gas flows. Still, China's current market share in battery production is unprecedented in other energy supply chains and could become a hindrance to rising BESS deployment.

Conclusion: speed of investment is a question of priorities

The ongoing electrification of modern societies requires massive investment in grid infrastructure, which will remain a major priority in the coming decades. Expanding BESS in power networks with a growing share of renewables is a crucial part of that investment, but deployment has lagged. Slower deployment of BESS in the West is due in part to China's dominance of global production, although regulatory and permitting challenges are also crucial factors. Some utilities may also be holding out for improved technology as batteries capable of storing several days' worth of electricity are currently in development. Nevertheless, we expect investment in BESS, especially in Europe, to accelerate in the coming years. The main beneficiaries of this rising investment should be:

- Utilities, renewable-power developers, or infrastructure investors with large wind and solar portfolios, as energy storage makes renewable power generation more efficient and profitable
- Grid-equipment manufacturers, especially companies that benefitting from efforts to diversify supply chains away from China
- BESS system integrators and services providers that integrate storage into networks with renewables, nuclear and fossil-fuel generation
- Providers of energy-management software and optimisation platforms that provide support for energy arbitrage and balancing services
- The emerging battery-recycling industry, which could eventually reduce reliance on imported critical minerals in resource-poor regions such as Europe.

European producers should also benefit if legislative initiatives continue to support investment in electrification and grid modernisation. The US will probably lag behind as the Trump administration has worked to counteract the incentives to invest in climate tech from the Inflation Reduction Act that was signed into law in 2022. Whether to accelerate BESS deployment by purchasing China's highly competitive products, as Australia did, or slow it to support less cost-competitive domestic producers will be a key policy question for grid investment in the coming years. Investment in wind and solar power generation will continue as the energy transition proceeds, but BESS capacity will need to grow alongside it. We expect BESS investment to accelerate as societies electrify, particularly in countries seeking to increase the share of renewables in power generation.

Author
Jonathan Schroer CFA, Energy and ESG Strategist (UniCredit, Munich), jonathan.schroer@unicredit.de

Editors
Edoardo Campanella, Director and Chief Editor of The Investment Institute (UniCredit Milan), edoardo.campanella@unicredit.eu
Francesco Maria Di Bella, FI Strategist (UniCredit, Milan), francescomaria.dibella@unicredit.eu

UniCredit S.p.A
The Investment Institute by UniCredit, Piazza Gae Aulenti, 4, I-20154 Milan
www.the-investment-institute.unicredit.eu

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