



Clean energy's next trillion-dollar business

Grid-scale batteries are taking off at last

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Decarbonising the world's electricity supply will take more than solar panels and wind turbines, which rely on sunshine and a steady breeze to generate power. Grid-scale storage offers a solution to this intermittency problem, but there is too little of it about. The International Energy Agency (IEA), an official forecaster, reckons that the global installed capacity of battery storage will need to rise from less than 200 gigawatts (GW) last year to more than a terawatt (TW) by the end of the decade, and nearly 5TW by 2050, if the world is to stay on course for net-zero emissions (see chart 1). Fortunately, though, the business of storing energy on the grid is at last being turbocharged.

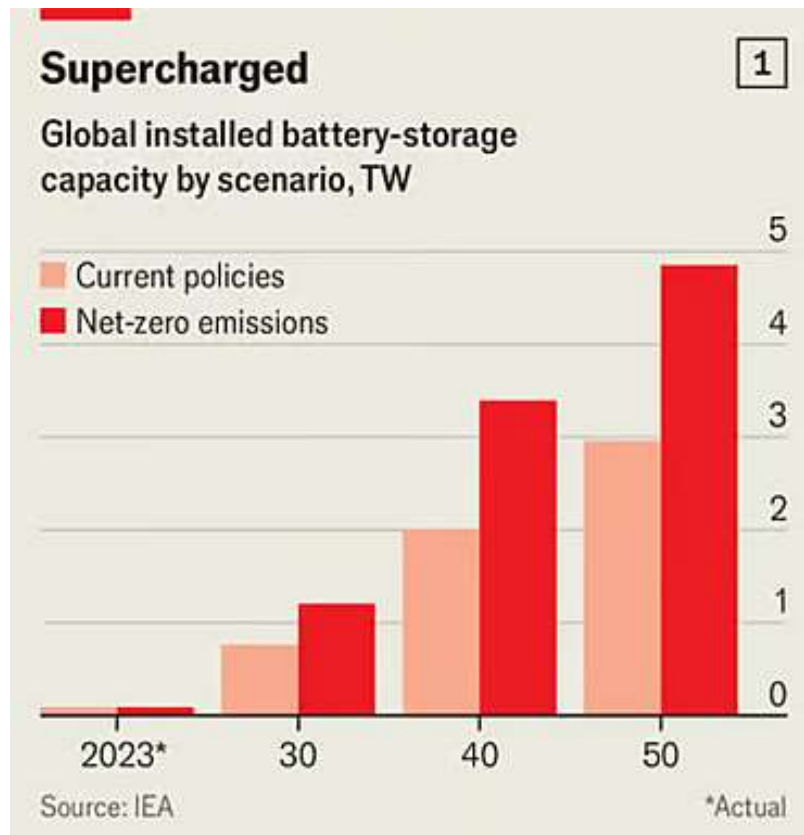


Chart: The Economist



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Grid-scale storage traditionally relied on hydroelectric systems that moved water between reservoirs at the top and bottom of a slope. These days giant batteries stacked in rows of sheds are increasingly the method of choice. According to the IEA, 90GW of battery storage was installed globally last year, double the amount in 2022, of which roughly two-thirds was for the grid and the remainder for other applications such as residential solar. Prices are falling and new chemistries are being developed. **Bain**, a consultancy, estimates that the market for grid-scale storage could expand from around \$15bn in 2023 to between \$200bn and \$700bn by 2030, and \$1trn-3trn by 2040.

A plunge in the price of lithium batteries is fuelling their adoption on the grid. According to BloombergNEF, a research group, the average price of stationary lithium batteries per kilowatt-hour of storage fell by around 40% between 2019 and 2023. A global deceleration in the adoption of electric vehicles (EVs), which run on similar technology, has led battery manufacturers to take a keener interest in grid storage. In 2019 stationary lithium batteries were almost 50% more expensive than those used in EVs; that difference has fallen to less than 20% as producers have piled in (see chart 2).

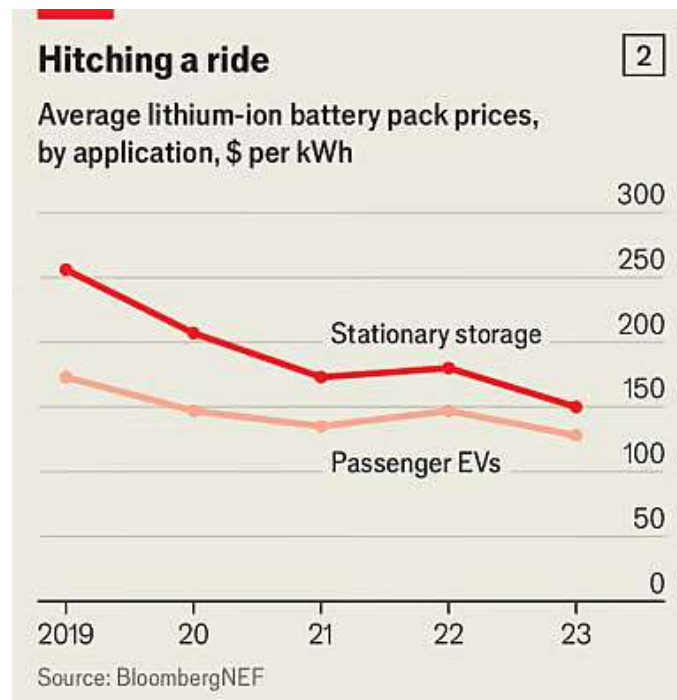


Chart: The Economist



The IEA reckons that solar power combined with batteries is now competitive with coal-fired power in India, and is on track to be cheaper than gas-fired power in America in a few years.

The centre of global battery production is China. It is home to six of the world's ten biggest manufacturers, including CATL and BYD (see chart 3). The share of China's battery production destined for power grids has risen from almost nothing in 2020 to around a fifth last year, overtaking the share used in consumer electronics. Growth has been helped by policies at home mandating that big solar and wind projects also install storage.

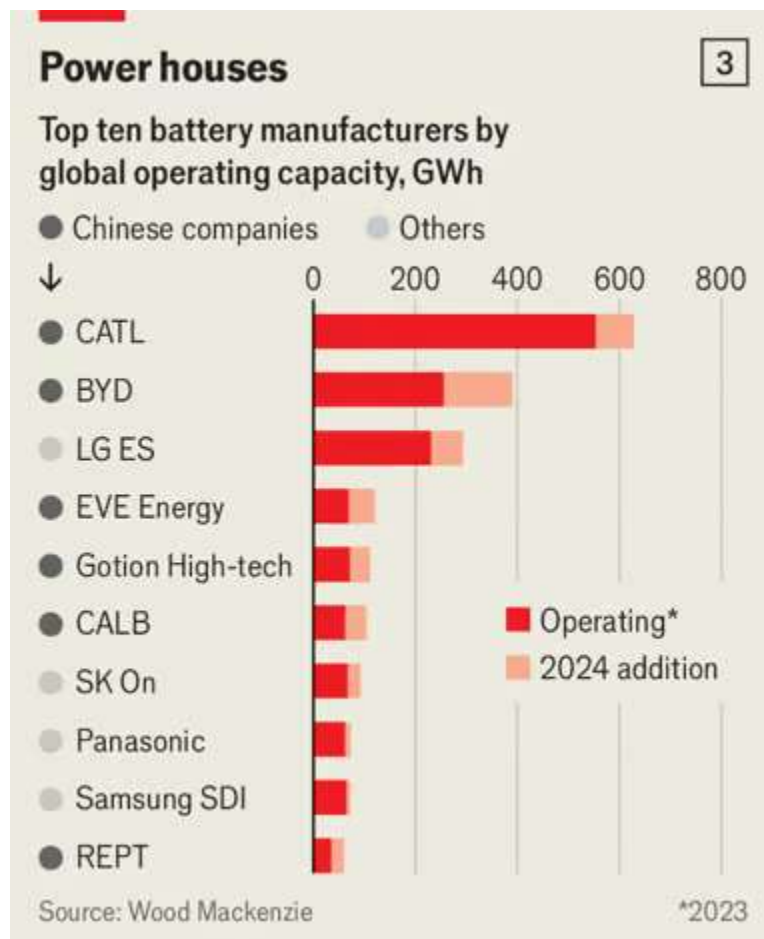


Chart: The Economist

China's battery firms are intensely innovative. CATL has increased its spending on research and development eight-fold since 2018, to \$2.5bn last year. BYD, which has invested heavily in robotics and artificial intelligence, has built a battery plant in the city of Hefei that is almost entirely automated.



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But the industry is also swimming in overcapacity. According to BloombergNEF, China alone already produces enough lithium batteries to satisfy global demand of all types. Its industry has announced plans for a further 5.8 terawatt-hours (TWh) of capacity by 2025, more than double the current global capacity of 2.6TWh.

That will be catastrophic for many firms in the battery industry, including those producing for the grid. According to Benchmark Mineral Intelligence, another research outfit, construction was cancelled or postponed on 19 battery gigafactories in China in the first seven months of 2024. The collapse in prices has also pummeled many Western battery startups. One example is Sweden's Northvolt, seen by some as Europe's answer to China's champions. Last year it reported a loss of \$1.2bn, up from \$285m in 2022. The consequence is likely to be a wave of consolidation, as Robin Zeng, the boss of CATL, predicted earlier this year.

Even so, a bloodbath among battery-makers could help, rather than hurt, the adoption of battery storage. Prices could fall further as the most productive companies take a greater share of the market. Fierce competition is already spurring innovation, as companies seek out new technologies to help them compete. Sodium-ion batteries are one promising alternative. They do not require pricey lithium, and although they offer lower energy density, that is less of a problem for stationary batteries than for those powering EVs.

Incumbents are rushing to develop the technology for the grid, and several startups are betting big on it, too. Natron, an American firm backed by Chevron, an oil giant, is investing \$1.4bn to build a sodium-ion battery factory in North Carolina, which is scheduled to open in 2027. Landon Mossburg, the chief executive of Peak Energy, another sodium-ion startup, says he wants his firm to be "the CATL of America".

Tom Jensen, the boss of Freyr Battery, another startup, thinks the only way that Western battery companies will be able to compete is with new technologies. The list of innovative approaches is growing. EnerVenue, one more startup, is commercialising a nickel-hydrogen battery. The firm has raised over \$400m and will build a plant in Kentucky that it hopes will crank out cheap batteries that can store power for long durations.

It helps that these new technologies are well-suited to meeting the growing demand for energy from data centres, which tech giants are eager to run on



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renewable power. The fact that sodium-ion batteries are less prone to catching fire than lithium-based ones makes them particularly attractive for tech companies, not least because it lowers the cost of insurance, notes Jeff Chamberlain, the boss of Volta Energy Technologies, an investment firm focused on energy storage. Colin Wessels, the co-chief of Natron, notes that his startup plans to supply batteries largely to data centres.

The rapid rollout of data centres is also leading to gaps in the infrastructure used to generate and transmit power, which could be plugged by longer-duration batteries of the type EnerVenue hopes to produce. Aaron Zubaty, the chief executive of Eolian, a renewable-energy developer, predicts a boom in storage solutions of four to eight hours to cope with the growing demand on power grids over the coming decade.

Grid-scale storage, then, is advancing quickly. “Batteries have done in five years what took solar 15 years,” notes a veteran analyst of the solar boom, who now covers the industry. As Fatih Birol, the head of the IEA, sums up, “Batteries are changing the game before our eyes.” ■

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