Mackenzie Greenchip Team

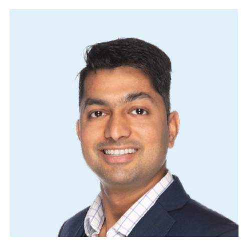
Grid level storage: The fastest growing clean technology.

As global wind and solar industries mature, large-scale installations of advanced batteries are being added to the global electricity grid. Energy storage systems (ESS) have taken the baton as the fastest growing energy technology. We see three main growth drivers:

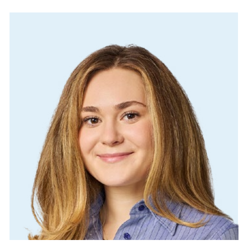
- Soaring global electricity demand.
- Transition to more intermittent renewables.
- Improving battery prices.

In the following interview, the Mackenzie Greenchip Team's analysts expand on this opportunity and myriad ways investors can gain exposure to this dynamic sector.

Johnathan Prestwich
Senior Investment Analyst



Rohit Bhalgat
Senior Investment Analyst



Ileana Chintea
Investment Analyst

Q: Ileana, you've written a research paper on advanced batteries. Can you help us understand what a battery cell for storage looks and feels like?

IC: These batteries come in all shapes and sizes, but most battery cells used in energy storage systems have a capacity of about 1 kWh and are roughly the size of a 2-liter milk carton. A milk carton that would be surprisingly heavy — approximately fifteen kilograms.

Q: Rohit, as a materials analyst, could you explain what's inside these cells?

RB: Inside, you would find layered films made from highly processed metals and polymers, folded repeatedly within a rectangular cell container. The entire structure is then soaked in a liquid electrolyte solution. Most cells used in grid storage today use lithium iron phosphate (LFP) chemistry, which is also prevalent in most Chinese electric vehicles (EVs). By contrast, EVs produced in the West typically use more expensive and slightly more energy dense nickel-based chemistries. LFP is about 20% cheaper than nickel-based alternatives, and since weight is less of a concern for grid storage, it is the preferred option. Looking ahead, an even cheaper chemistry for ESS, based on sodium, is on the horizon.

Q: Johnathan, as an industrials/utilities analyst, help us understand how these battery cells are assembled and what a grid installation looks like?

JP: One of our holdings, Northland Power, is developing a 250 MW/1 GWh installation called Oneida on the North Shore of Lake Erie. The site is approximately 7.5 football fields in size, covered in industrial containers. Each container has thousands of the battery cells like the ones Ileana described, amounting to roughly 3.9 MWh of storage each. For a project of this scale, over 250 containers are required, with the total project costing about $800 million (CAD) to build. Once fully charged, this facility could deliver the output equal to the power generated by a quarter of a nuclear plant running for about four hours.

Q: Ileana, the growth in ESS over the past decade is staggering, yet data on global installations seems inconsistent. How would you assess this?

IC: Estimating total global ESS capacity is complex. There are several variables that influence how data is measured and interpreted, which leads to the mixed reports we see. Some reports track ESS shipments while others track actual operational installations, and there's often a one-to-two-year lag between when the systems are shipped and when they are fully deployed and connected to the grid.

Metrics can also differ. Some reporting methods may measure capacity in power output (GW) while others measure it in total energy storage (GWh). On top of that, the scope of reporting can vary depending on which ESS end markets are included (examples include utilities, grid operators, data centres, residential storage etc.).

Despite these inconsistencies, we're still seeing one clear trend: growth. In 2024 alone, global ESS installations reached an estimated record 130-200 GWh, roughly equivalent to the combined capacity added over the last three or four years. That's nearly double the volume of ESS installed in 2023, and equal to around 150 to 200 of those large-scale facilities Johnathan described. Based on our current cost estimates, total global investment in ESS for 2024 likely ranged from $20 billion to $40 billion (USD), marking a staggering 50-fold increase compared to a decade ago.

Q: Rohit, your focus on supply and demand for several electric metals and resources requires a long-term outlook. What are you seeing?

RB: For 2030, I estimate 435 GWh of batteries will be going to ESS, four times more than in 2024, but this is a very conservative estimate.[1] For context, I see total battery demand, including EVs and plug-in hybrid electric vehicles (PHEVs) will reach approximately 2.4 TWh.

Q: Will we have the resources to meet this demand?

RB: It depends on which chemistry will be used and that is hard to predict. Generally, I believe we will have adequate supplies of lithium, iron and nickel. However, phosphate and flake/synthetic graphite may face shortages. My biggest concern is the processing of these materials, which is currently highly concentrated in China.

Q: In a March 2025 interview with the New York Times, John Ketchum, CEO of US giant NextEra Power, warned that "Power companies now must wait up to five years to order new gas turbines as manufacturers keep up with (soaring) global demand. Any new gas projects that aren't already under development are unlikely to come online before 2030. Other nascent technologies like advanced nuclear power are even farther off."[2] Johnathan, how does it affect ESS?

JP: We are seeing the same dynamic. Gas turbine manufacturers like GE Vernova and Siemens Energy are backordered for years. During a recent trip to visit Siemens' gas turbine plant in Germany, I saw firsthand the precision and skill needed to produce these turbines, which will keep supply tight for years. If you read more of Ketchum's quote, he is making the case that soaring electricity demand will mostly be met with new renewables, and ESS, for at least the next five years.

Q: Seeing the same supply issues with high voltage transformers, and consequently tremendous gains created for manufacturers' stock prices over the past few years, where do you see investment opportunities in ESS today?

JP: I think the best risk-adjusted play for ESS is found in developers and utilities.

Q: Can you explain how ESS developers and utilities make money and if the Mackenzie Greenchip funds hold any of these?

JP: There are generally three main ways in which developers and utilities earn returns. Firstly, arbitrage. Simply put, the operator of the battery tries to buy electricity at low prices and sell at high prices to earn a spread. A great example of this is Innergex. They operate a battery storage facility in Chile. During the daytime when solar generation is at its peak, electricity costs drop and approach zero, at this point they buy, then at night when solar is no longer producing, they sell and capture a spread.

The second way: returns are earned through capacity payments. This mechanism already exists in most markets, where the battery owner is paid to have capacity available to send to the grid at any time in case of generation shortfalls.

Finally, batteries can be structured as part of a power purchase agreement or PPA where it is coupled with solar or wind to improve the generation profile. Most of the utilities held by the Mackenzie Greenchip Team, such as EDP, Enel, Innergex and SSE, all develop energy storage systems, not limited to just batteries but also hydro pumped storage as well.

Q: Ileana, do you see the same upside for battery manufacturer's stock prices?

IC: Presently I don't. Not because the demand for ESS isn't there, I agree with Rohit's estimates for demand. Despite growing at an exponential pace, ESS still makes up a relatively small proportion of sales for most lithium-ion battery makers. Slower than expected growth in EV demand and weakness in key regions have created significant headwinds for advanced battery manufacturers. Couple that with fluctuating input costs, trade barriers and oversupply, particularly in China, and the current environment becomes even more challenging. Most of these risks are structural and outside of manufacturers' control. That said, this is a large and fast-growing space, and we are following it closely, always looking for the right entry points.

Q: How can we capitalize on this opportunity then?

IC: We are value managers at our core. While we haven't invested in any of the ESS battery manufacturers directly, we did find a discount in TDK stock a few years ago. They have an interesting partnership with CATL, the world's largest battery manufacturer, to produce polymer separators and battery casings. Last year, TDK announced a promising solid-state coin style battery breakthrough. We also invested in several semiconductor manufacturers that are essential for charging, power inversion and battery management systems.

Q: Rohit, what do you like on the materials side?

RB: I still think the best risk-adjusted opportunity is in copper for electrification broadly, rather than betting on specific battery chemistries. In my view, the world will be very short on copper supply over the next 25 years. Copper is critical to all things electric, which is why the Mackenzie Greenchip Team has invested in three copper miners, Capstone, Hudbay and First Quantum.

Q: Johnathan, how would you summarize the ESS investment opportunity?

JP: For me, ESS is becoming more and more important as a method to maintain the electricity grid. The grid is both the great enabler of the energy transition, yet at the same time it's a pinch point. Utilities are learning that profitable returns from generation must be aligned with adequate grid investment, including ESS — and this is what we're seeing. This is why, we believe, ESS will continue to grow exponentially, at least for a while, offering diverse opportunities for investors.

[1] Source: Mackenzie Greenchip Team estimates
[2] Source: New York Times, Want Cheap Power, Fast? Solar and Wind Firms Have a Suggestion.

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