

# Overcoming the great disconnect in the battery storage supply chain

**Supply chain** | The rising demand for lithium-ion batteries far outstrips the available supply, even as investments into materials extraction and manufacturing ramp up like never before. But what does the situation really look like and when will it ease up? Andy Colthorpe investigates.

It's no secret there's a tightness constricting the energy storage supply chain. A few weeks ago, on *Energy-Storage.news*, we heard from a specialist on procurement, lawyer Adam Walters at Stoel Rives, that lithium carbonate price rises in particular are at "crisis point".

Rising demand for batteries, largely coming from the electric vehicle (EV) sector, means raw materials prices continue to be volatile. Cell supplier contracts are moving to shorter and shorter term pricing. With terms changing over periods as short as a week, it becomes more difficult to get them signed off.

Fluence noted in its Q1 2022 financial results that while the company's US\$1.6 billion backlog of energy storage orders has been hedged with fixed price contracts, future contracting will be based on raw material indexed pricing to minimise exposure to fluctuations. The system integrator is not alone in this.

"Historically, it was possible to do off-take agreements at fixed price, that's no longer the case. Certainly now, all new agreements use index referenced pricing. You're not going to be effectively getting a stable price. Fixed price contracts, very common up until this year in lithium, don't really exist anymore," says Caspar Rawles, chief data officer at lithium battery supply chain information provider Benchmark Mineral Intelligence.

The demand situation has been exacerbated by the COVID-19 pandemic, which has thrown logistical headaches into the mix for over two years. Fluence CEO Manuel Perez Dubuc said at the end of 2021 that supply chain issues caused by logistics largely represent a "bump in the road" for the clean energy transition, likely to normalise by the end of this year.

The two-level problem comprises logistical problems arising as a knock-on effect of the pandemic — made worse by China's lockdowns — alongside the



Image: Fluence.

ongoing demand-driven undercurrent of raw material prices soaring.

Factor in that the thirst for economic recovery is leading politicians, particularly in Europe, to place that within a 'green recovery' agenda. That's undoubtedly a positive thing, says Rawles, but puts more strain on already-constrained supply.

Russia's invasion of Ukraine is also bringing energy security issues to the fore, alerting Europe to its dependency on Russian gas, driving higher sales and awareness of battery storage and EVs as well as exerting pressure on nickel prices.

"It's an unprecedented time in the energy storage industry. Customers have had the expectation set over the last five to 10 years that batteries will always be on a declining cost scale," Danny Lu, executive VP at US energy storage system manufacturer Powin Energy says.

The last few months show that the industry can never get too comfortable, Lu says, and Powin has had to be "ready and dynamic enough" to help customer projects remain viable. This has meant leveraging relationships and leveraging the vendor pool to provide "the most competitive solutions".

**Like many others in the industry, Fluence has moved away from fixed price contracts in recent months.**

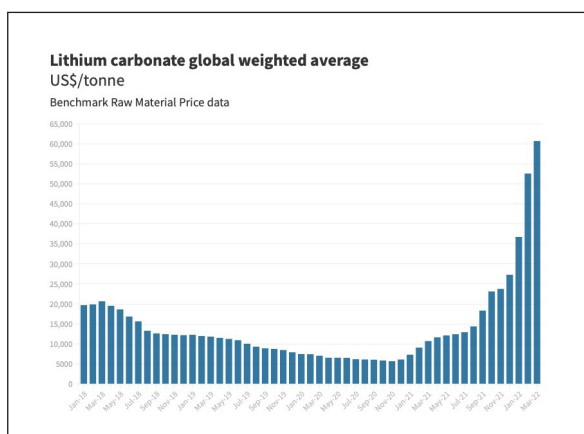
Joseph Johnson, market and data analyst with solar and storage market intelligence group Clean Energy Associates (CEA), says dramatic increases in pricing not just for lithium, but also cobalt, nickel and other materials affects the stationary storage market "very much".

But — and it's important to note this — many EV manufacturers are also switching to lithium iron phosphate (LFP) chemistries instead of nickel manganese cobalt (NCM) or nickel cobalt aluminium (NCA) to reduce their exposure to cobalt and nickel price rises.

The supply chain has "struggled to keep up and that's resulted in rapidly accelerating prices," Caspar Rawles says.

"The rise in the price of lithium is particularly important for ESS because the majority of people are using LFP, or aiming to use LFP cells, which are essentially a bit of a proxy for the lithium price — the biggest component of the cathode cost by a long way."

"The challenge that we've seen since late 2020, after the first wave of the pandemic, is that [rising] demand for battery minerals. It's all battery minerals, but lithium is the one that's having the



**The rapid rise in cost of lithium carbonate. Based on data provided courtesy of Benchmark Mineral Intelligence.**

biggest challenge,” Rawles says.

Both Benchmark and CEA have noted about a 500% increase since early 2021 in the cost of battery grade lithium carbonate from China, which translates to prices going up ten-fold in dollar values, from about US\$8 per kilogram to more like US\$80.

As the graph below illustrates, courtesy of Benchmark’s data, the lithium carbonate price has been rising and rising. There have been price fluctuations before, notably between 2016 and 2018, but prices “didn’t get anywhere near as high as they are now,” around US\$20,000 to US\$25,000 per tonne. They are about four times that amount today.

In that earlier timeframe, excitement around EVs drove that short-term price increase, but was a short-lived rally that perhaps jumped the gun a little bit, Rawles says. From 2018 to the end of 2020, there were essentially three years of falling prices, which meant hardly anyone was investing in new supply.

“Despite companies like Benchmark saying ‘this is coming, we can see the numbers and we know what’s going to be needed, and we know how long it takes to bring this new supply online,’ there was a lack of supply chain investment. It was already on the horizon that we were pretty much there with lithium, the market was going to get very tight. Then the pandemic hit. Following the pandemic, it has amplified demand.”

Catalysts included renewed EV subsidies from China and European governments, but at the same time the supply side of the market for Europe and the US still remained largely uninvested into.

### A situation some saw coming

Lindsay Gorrill, CEO of US-based cell and systems manufacturer KORE Power, was

previously head of a company selling feedstock for lithium battery electrolyte. From working in the supply chain for 20 years, Gorrill says he understood that creating upstream and downstream capabilities in the US would be the only way to solve the problems that he too saw coming.

KORE Power has 2GWh of manufacturing in China, which it is expanding to 6GWh in 2023 as well as developing a 12GWh plant in Arizona, US, on which it plans to break ground later this year. Helping solve those long-term supply chain issues was what drove the CEO to found the company in the first place, he says.

“That whole process was in my head even six years ago. I was saying, ‘If we don’t start bringing supply all the way through upstream to downstream to the United States or near the United States, there’ll be a problem,’ because before anybody was even talking about supply chain problems, there was already a shortage in late 2019.”

“It was already coming before the pandemic — the pandemic just basically magnified it 30 times over!”

KORE Power makes both LFP and NMC cells, making a conscious effort to supply to the underserved ESS market as well as EVs. That makes the company a rare example in the US — and in the wider world — where the EV segment’s far greater current and projected demand accounts for the vast, vast majority of planned capacity additions.

Pricing dynamics are changing the conventional wisdom of NMC for EVs, LFP for ESS, Gorrill says.

“It’s funny — if you roll back three years, NMC was by far the dominant chemistry. LFP was still coming along. LFP is a good technology but doesn’t have as much [energy] density as NMC,” he says.

For an outdoor ESS, or for large footprint transportation applications like buses, that doesn’t matter so much and the rising cost of cobalt drove customers towards LFP, even for EVs.

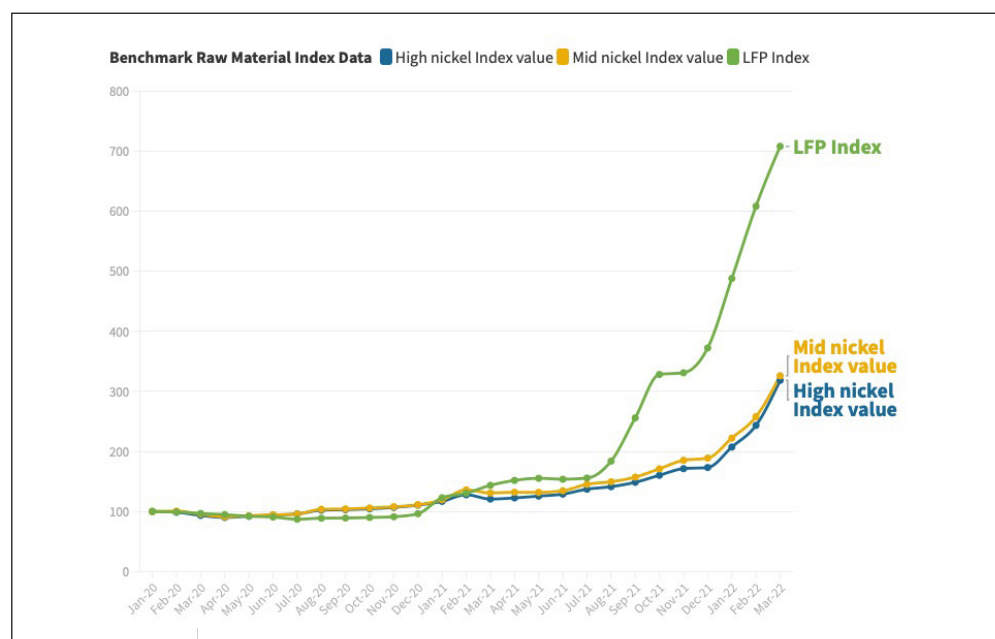
Over the next few years, cost may remain the biggest determinant of cell chemistry choice and the chart below shows just how much that differential has driven up the cost of LFP. One customer in Europe KORE Power has been speaking with was looking to switch over to LFP, but is now going back to NMC.

### Great raw material disconnect

Supply chain investments are now starting to happen, but the market dynamic is still characterised by what Benchmark Mineral Intelligence has dubbed “the great raw material disconnect” — while new battery factories can be built in timeframes of short as two years in some cases, new material extraction facilities take much, much longer.

As expansion takes place, the market will eventually reach some kind of balance in the latter part of this decade, but the wave of electrification, from transport to heating to the grid and beyond, is on an unprecedented scale.

“This isn’t a demand cycle that’s going to last a couple of years. We’re looking at CAGR rates of over 20% for more



**LFP has been the most affected among commonly used battery chemistries. Based on data provided courtesy of Benchmark Mineral Intelligence.**

than the next decade for lithium. You're essentially asking the market to add a world class operation to the market every year for more than 10 years. That is a big challenge," Caspar Rawles says.

"The market will balance itself out in the coming years, but there's a long tail of investment needed to keep up with forecasted demand growth."

CEA's Joseph Johnson also refers to a "huge disconnect" even between planned manufacturing capacity additions and projected stationary storage installation figures, somewhere between 2x and 4x — albeit mining and refining is the "real limiter that determines how many cells can get produced".

That upstream capacity is starting to come online, but where a battery factory can be built in perhaps two to three years, a new mining operation can take much, much longer, anything from five years at best to decades in extreme cases.

With investments having begun at scale from 2019, that points to 2024 being the earliest the supply chain will start to ease. It'll take at least another couple of years for the material extraction side to really catch up to demand.

CEA believes logistics issues will likely ease over a two-year window, viewing the end of 2023-beginning of 2024 timeframe as when availability of containers, additional vessels and sea lanes to carry freight will improve. Port congestion and backlogs will start to be resolved and worked through.

### Can we Build Back Better?

The battery industry might look very different in the second half of this decade, as today's efforts to correct those mismatches in supply and demand take hold. Joseph Johnson notes that cell manufacturers are pushing to have more upstream control.

Established players like LG and startups like Northvolt alike are moving towards partnerships and investments for long-term materials supply. Upstream involvement can give cell manufacturers more control over their technology roadmaps, better visibility into refining and cathode production.

Policy has a role too of course — the US has identified that its lack of a domestic value chain is a critical weakness, not just in energy policy but in national competitiveness and security.

KORE Power's Lindsay Gorrill, invited onto a US Department of Energy task force

on supply chain issues, says that in the past there hadn't been a realistic attempt to plan for future demand. The government needs to support upstream — and downstream businesses — to get the permits and financing they need, he says. Permitting in particular, can take a "very long time," as things stand, Benchmark Minerals' Caspar Rawles says.

While demand for ESS, or EVs, hasn't been hugely negatively impacted by the supply chain situation, it has led to delays for many ESS projects. As pointed out by Stoel Rives' Adam Walters, we are likely to see many more projects get delayed.

However, Rawles says that a number of ESS providers which have moved into a cost pass-through structure in their contracts are finding it a tough financial hit to bear, eroding "all of the margin". If those companies move into the supply chain, they once again find themselves in competition with the much bigger electric vehicle sector.

All our interviewees say the situation will ease and that actions being taken today can make for a more robust industry and value chain tomorrow. But it will take time, it will take investment, it will take hard work.

### The next chapter

It also represents an opportunity to create a huge industry, a global source of new jobs and of course the very engine of the transition to sustainable energy. How we do that is really important too. The European Union is phasing in regulations over carbon footprint labelling and recycled content in batteries over the next

few years.

Lindsay Gorrill says that building from the ground up has given KORE Power the chance to design its 1.5 million square foot Arizona gigafactory to be net zero — with nothing but solar panels on the roof paired with the company's own battery storage systems.

"We're going to create enough energy with solar and our own storage to run the plant and create extra energy for the grid. So we're looking at this whole thing holistically, how we run the plant and run it effectively and properly."

Recycling will also be a valuable and potentially cleaner source of raw materials. Kunal Phalpher, chief commercial officer at North American battery recycling company Li-Cycle says that more recyclable materials coming on stream throughout this decade can lower battery production costs and improve sustainability.

"Sustainability-wise, the big differences are water production and greenhouse gas (GHG) emissions per tonne of materials produced. On the economic side, because we produce lithium, nickel, cobalt, all in the battery grade in one facility — our feedstocks very different than what you'll find in the ground — the cost is distributed amongst those three raw materials so you can really get towards the bottom of the cost curve on all those materials."

We'll look at some of the ways that the mismatch — or disconnect — can be solved in the next edition of Storage & Smart Power; from upstream investments into recycling and sustainable mining to downstream procurement strategies. ■



German manufacturer Tesvolt said demand for its battery storage has risen nearly 200% year-on-year, likely in response to rising electricity prices and Europe's energy security concerns.

Credit: Tesvolt