

> **Blackstone Resources AG:**

# How the Battery Revolution Could Save Mankind

By James Eagle

It's difficult to imagine, but batteries could help save mankind. Their rise represents the biggest unheard off structural trend of the twenty-first century.

What will accelerate demand is the electric vehicle. Yet it's a journey we should have taken more than a hundred years ago. If we had, then the immense environmental damage caused by the age of oil in the twentieth century would have been avoided.

Believe it or not, the first vehicles on our roads were electric and not powered by gasoline. For instance, the 1912 Baker Electric was an all-electric car used in New York that was served by an extensive network of charging stations. They were driving around New York's streets more than 100 years before the modern-day Tesla.

At the time electric cars were the vehicle of choice because they vibrated less, smelt nicer and were quieter than gasoline cars.

By the 1920s, however, highways were being constructed, linking up cities across the US, while huge petroleum reserve discoveries were made. This made combustion engine cars much cheaper and more appealing: they offered a greater range; they were faster and they were cheaper to build.

Since the emergence of the lithium-ion battery, they are now back in favour. These batteries are being created wider and longer to allow more materials to be packed in. Meanwhile, new cooling technologies are being developed to squeeze in more battery packs at higher densities. There have also been significant improvements in cathode designs, where the battery metal mix has been perfected to create

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the optimal crystalline structures for these batteries to operate.

Battery metals are now in huge demand thanks to the emergence of electric vehicles. Shortages and supply chain breakages are likely to happen in the future, which will push battery metal prices significantly higher. That's why battery metals are now being called the new gold.

We are now seeing the use of graphite anodes to increase energy capacity in lithium batteries, which will also decrease charge times and increase the number of charging cycles. Silicon nanowires are also being inserted into these graphite anodes to further enhance performance, which is an approach Tesla has taken. However, this is still not enough.

First, the cost of manufacturing batteries needs to fall to make building electric cars profitable. Many auto manufacturers are already rolling out their own all-electric vehicles, with Chinese-based BYD and Tesla being the most prolific to date. However, the cost of battery technology will have to fall even more to support this trend.

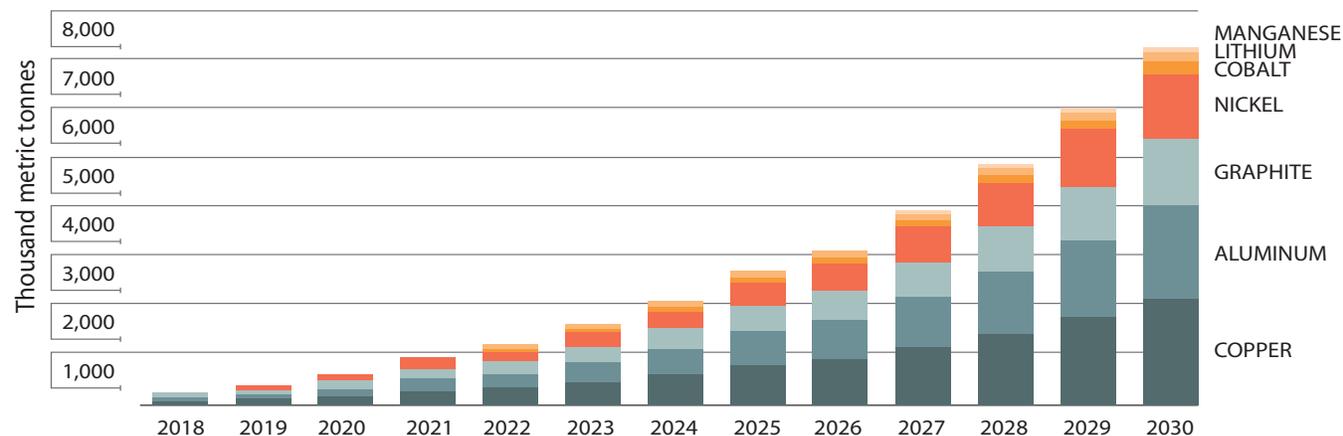
We are now starting to see battery costs fall, thanks to the rapid emergence of lithium-ion

mega-factories. In 2015, there were only three in existence globally. Today, there are over 50 and Tesla has now built a giga-factory. But there is still a long way to go. Battery tech will need to improve even more.

At Blackstone Resources, we expect a radically different technology to succeed and we believe this will be solid-state technology. These are batteries that use a solid electrolyte to regulate the flow of current between the anode and the cathode, rather than the liquid electrolyte that is used in lithium-ion batteries.



1912 Baker Electric. Source: wallpaperup.com



Planned increase of battery production: Metals and materials demand from lithium-ion battery packs in passenger EVs. Source: Electric Vehicle Outlook 2018, Bloomberg New Energy Finance.

By using a solid electrolyte, you can build batteries that are smaller and offer higher energy densities and have longer lifespans.

This technology could also provide even cheaper mass energy-storage in the future.

Although solid-state technology is not in mass production right now, energy-storage infrastructure is being built nonetheless. For instance, this energy storage facility pictured on the bottom left was built by a company called Fluence to enhance regional grid reliability.

The concept of energy-storage is similar to how water companies use reservoirs to ensure there is a constant supply of fresh water, even in droughts. If we can store renewable energy, then we can ensure a constant supply of it, which would remove our reliance on fossil fuels.

It would also make electric vehicles a lot greener than they are today because right now we largely use electricity generated by fossil fuels to power them.

The evolution of the battery industry will bear some similarities to the oil and gas industry. With oil and gas, it was the integrated oil majors that achieved the most success. They invested all the way upstream in exploration and downstream in refining oil and distributing it. This is the path Blackstone Resources plans to take with batteries.

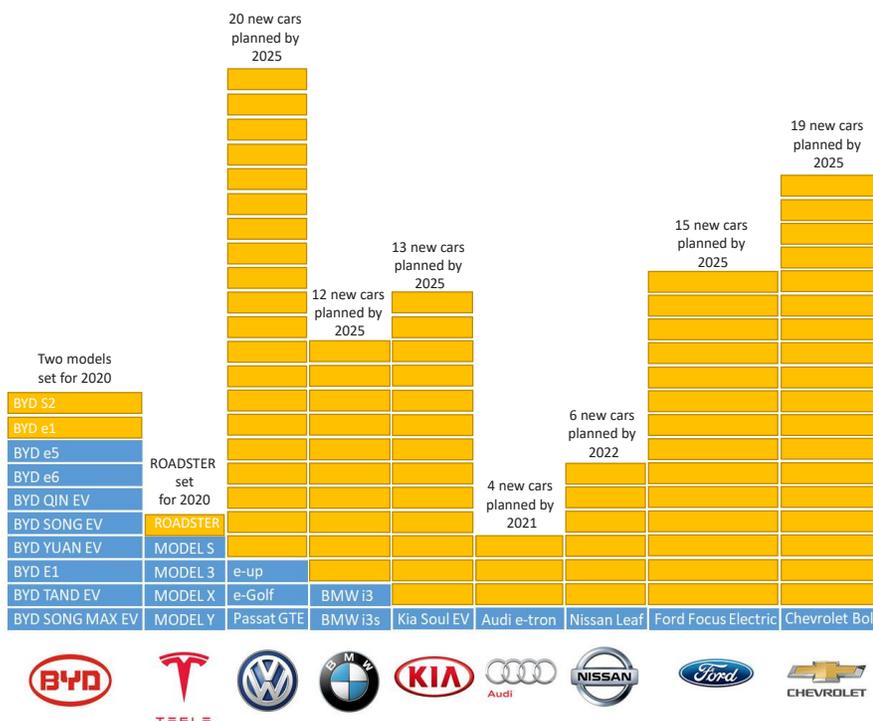
Blackstone Resources has already invested heavily in upstream battery metal mining projects. These include politically secure North American cobalt, rare earths from Norway, manganese in Colombia, molybdenum from Mongolia and lithium from Chile. The mining companies we invest in not only search, develop and extract battery metals, but in some cases have also invested significantly in the refineries that bring these metals to market.

Downstream, Blackstone Resources has long-term plans to invest in battery technology after launching its research and development programme last year. Blackstone Resources is now planning to set up a production facility in Germany, which will be supported by a €200 million investment funded between us, the German state and EU subsidies.

Building a vertically integrated battery-focused company, makes sense to us. Our plan is to source the battery metals ourselves and tap into the manufacturing innovation of Germany. This is a country after all that has been building and pushing auto technological boundaries for more than 100 years.

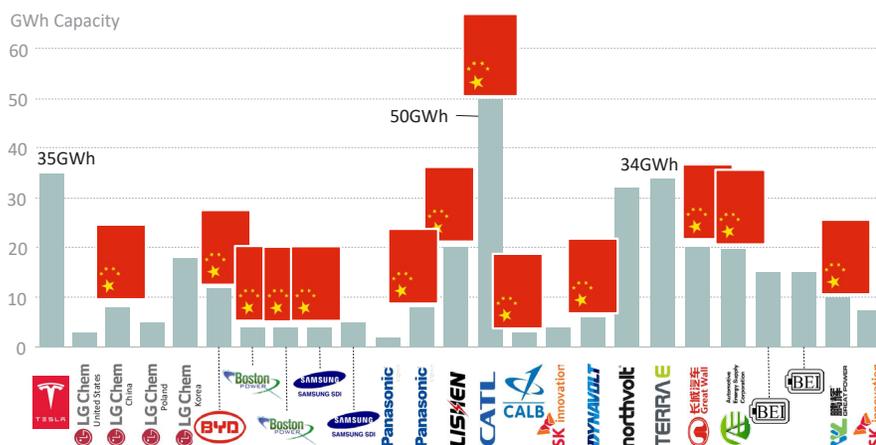
We believe the world has now realised that global warming is happening and this will spark a new wave of unpredictable innovation in renewable energy. I'm sure battery technology and the battery metals it uses, will be an important part of this story.

This is how we believe batteries could one day help save humanity. ❄️



Auto manufacturers have ambitious plans to produce all-electric cars.

Source: Blackstone Resources, BYD, Tesla, VW, BMW, KIA, Audi, Nissan, Ford & Chevrolet, 31/03/2019. Excludes plug in hybrids.



Lithium-Ion Megafactory capacity by 2021. A huge 11-fold increase led by China (30GWh to 372GWh). Source: Blackstone Resources.



30 megawatt storage system that offer a 4 hour duration for San Diego Gas & Electric in Escondido, California. Source: Fluence.

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