

Innovation needed as electric vehicle batteries pack on the pounds

A diet may be in order if automakers are to produce profitable battery electric vehicles, writes Freddie Holmes

🕒 September 4, 2020

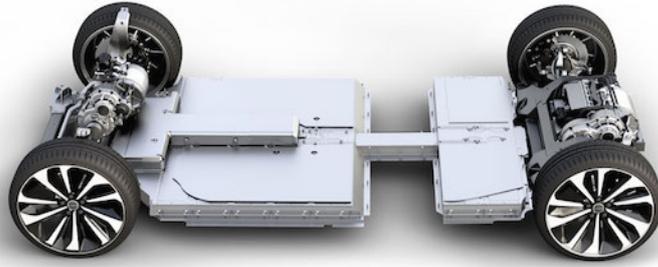
Figures vary, but the lithium-ion battery propulsion system can account for as much as half the total cost of an electric vehicle (EV) today.

The results should not be surprising: automakers are seeing slim profit margins at best, and retail prices for new EVs are far higher than comparable diesel or gasoline models. Range anxiety and charging convenience aside, this may be the most significant factor that has prevented a universal transition to electric.

If the automotive industry is to reclaim the investments made in battery electric propulsion and reshape the future of mobility, affordable battery solutions must be found sooner rather than later.

Digging into the matter

Part of the reason why EV batteries are so expensive today is the inclusion of rare earth metals such as nickel and cobalt, both of which contribute to high prices for a finished battery pack. However, [many automakers are investigating alternative chemistries](#) that replace or reduce the use of these metals.



Bigger batteries may not be the answer to profitable EVs (Source: Lucid Motors)

In June 2018, the price of cobalt hovered around US\$80,000 per tonne, but has since plummeted to between US\$33,000 and US\$35,000. By comparison, aluminium is around US\$1,800 per tonne. As of August 2020, nickel hit just under US\$15,000 per tonne, up by more than 30% since March. Shipping those materials around the world and integrating them within the final energy storage system only ramps up costs further. The fact that battery pack production is dominated by China and South Korea means that manufacturers have little option but to pay the going rate, but efforts to localise production in North America and Europe are underway.

Battery packs may be expensive, but costs are falling. Analysis from Bloomberg New Energy Finance has found that the price of a lithium-ion battery pack fell by 87% between 2010 and 2019. The fall is attributed to an increase in EV volumes and the availability of new chemistries. Prices must continue to slide, but it is important to underline that automakers cannot procure anything other

than the best materials available. The consequences of procuring cheap alternatives to high quality, ethically-sourced and traceable materials could be severe. That's according to Benedikt Sobotka, Co-chair of the Global Battery Alliance (GBA), a multi-sector initiative that aims to create a 'circular and responsible' battery value chain.

The vast majority of cobalt is not sourced directly from cobalt mines, but as a by-product of other mining activities. However, artisanal mines—primarily in the Democratic Republic of the Congo—have been shown to rely on child labour and have even led to the decimation of entire towns in pursuit of the metal at low cost.

Sobotka described the push to produce EV batteries en masse as “the biggest purchase order in the history of the automotive industry,” but advised that automakers cannot look to cut costs by sourcing cheaper materials. “Why do companies buy materials that are not compliant? Because it's cheaper,” he told *Automotive World*. “There are producers that break the laws, cut corners, pollute the environment and use informal labour in their supply chain. Maybe for a year an automaker might make more profit from buying these cheaper materials, but it is not a sustainable business model in the long term.”

Solving the technology challenge

There are other opportunities to reduce the cost of producing an EV battery pack aside from addressing the way in which raw materials are used and sourced.



Affordable EVs rely on cheaper battery packs (Source: Audi)

InoBat Auto is a Slovakia-based start-up that is focused on battery R&D and production. In July, the company secured €10m (US\$11.83m) in private funding, and is in the process of constructing a European gigafactory. Jonathan Carrier, Head of Business Development, believes gains can be made to make battery technology more competitive.

“Not all batteries are made equal. There are many different variables at a cell level—such as chemistry and format—and at a system level that drive overall performance, cost and efficiency,” he told *Automotive World*. “Given the battery accounts for between 40% to 50% of the cost of an EV, the path towards profitability lies in a combination of engineering design, manufacturing scale and application of technological innovation at a cell level.”

The automotive industry, he says, is at an inflexion point, and “technology-led development” will be the only way to produce safer, less expensive and denser batteries at greater scale. Perhaps the ideal solution would be to

reduce the lead-time for innovation. “The real challenge is to shorten the time it takes develop and commercialise new battery innovations from several years to months,” explained Carrier. Through what the company describes as an ‘AI-based research process’ and a ‘discovery to delivery platform’, InoBat says it has been able to commercialise battery cells ten times faster than standard research processes, while continuing to reduce costs and increase performance.

“Our technology-led approach is able to deliver greater differentiation of battery cells, which will drive profitability,” affirmed Carrier. “Automakers need different batteries to serve different applications and price points, even within the same model lineup—as with engines today. High-power, high-performance batteries, alongside lower-cost entry-level batteries, are essential to generate vehicle line profitability.”

Watch your weight

Michel Forissier, Chief Technical Officer at Valeo Powertrain Systems, agrees that the technology aspect is crucial—advances must be made in terms of energy density, for example—but he notes that the size of the battery itself is also paramount. Valeo does not produce EV batteries, but is a core supplier of vital power electronics such as inverters, chargers, electric motors and converters.

It might seem obvious, but larger batteries are more expensive to source and integrate within the vehicle, and naturally ramp up the ticket price at the dealership. Smaller batteries, he suggested, could be a form of quick

fix for some automakers. “Size may be more important than technology in this respect,” Forissier told *Automotive World*.



Large SUVs may not be the ideal platform for mass market electrification

In order to use smaller batteries, automakers must also look to develop smaller vehicles. A three-tonne SUV, for example, has exceptionally poor energy efficiency compared to a sleek compact vehicle, which is not only lighter but also more aerodynamic. Providing a large SUV with an electric driving range of up to 250 miles would cost “a hell of a lot of money,” mused Forissier. “If you want to make an affordable EV, you need to make it light; a battery that is half the size of the one in the SUV could still achieve the same kind of electric driving range, and will be far cheaper.”

He agrees that technological advances will also be crucial. Incremental improvements to existing solutions should not be sniffed at, but he suggested that leaps in technology are needed. “We often hear about battery breakthroughs in the

press, but all EVs typically use the same lithium-ion battery pack today that cost within the US\$120/kWh to US\$150/kWh price range. Halving that cost could take five to ten years,” he suggested. “There are promising technologies in development, but it takes quite some time to perform validation in terms of range, charging, thermal management and crash safety.”

That being said, Forissier does expect to see significant cost reductions in coming years, perhaps falling below US\$100/kWh by 2025, and around US\$80/kWh by 2030. Achieving a cost of US\$50/kWh will clearly take “far longer,” he said.

The time is now

There are numerous ways in which EV batteries can be made more affordable. The choice of raw materials and how they are sourced plays a big part, and finding innovative ways to increase energy-density will be key. This means that more range can be achieved from a smaller system.

The speed of innovation must also increase if profitable EVs are to hit the road in meaningful volumes ahead of [upcoming emissions targets](#). The notion of designing smaller EVs could be pivotal, and could perhaps serve as a quick-fix for automakers looking to avoid regulatory penalties.

However, the automotive industry’s love affair with larger vehicles looks likely to continue, with SUVs and pick-ups typically the most profitable vehicles in an automaker’s portfolio. Only time will tell whether [the move to produce](#)

electric 'beasts of burden' pays off, but for now, technology developers will continue to scout new approaches to cost-efficient battery technologies.

