

# What's next for batteries

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Most battery-powered devices, from smartphones and tablets to electric vehicles and energy storage systems, rely on lithium-ion battery technology. Because lithium-ion batteries are able to store a significant amount of energy in such a small package, charge quickly and last long, they became the battery of choice for new devices.

Many of these new battery technologies aren't necessarily reinventing the wheel when it comes to powering devices or storing energy. They work much like lithium-ion batteries do, just with different materials.

While lithium-ion batteries have come a long way in the past few years, especially when it comes to extending the life of a smartphone on full charge or how far an electric car can travel on a single charge, they're not without their problems. The biggest concerns -- and major motivation for researchers and startups to focus on new battery technologies -- are related to safety, specifically fire risk, and the sustainability of the materials used in the production of lithium-ion batteries, namely cobalt, nickel and magnesium.

Following its announcement that it would test solid-state batteries, BMW received its first batch in November of 2023 from Solid Power and has continued to work on prototypes. However, the company won't be able to produce solid-state battery-powered cars until after 2030. Meanwhile, Toyota could launch solid-state battery-powered cars as soon as 2026. Solid-state batteries are already being used in pacemakers and some smartwatches, and devices like smartphones and tablets could soon follow.

Compared to lithium-ion batteries, solid-state batteries are more efficient, packing more power with the same size battery. As a result, EV batteries could become more compact, charge faster and weigh less, which could increase range. Solid-state batteries are believed to last longer -- with up to seven times more recharges during their lifetime, according to CAR Magazine. They're also believed to be safer, because the solid electrolyte material is fireproof, unlike lithium-ion batteries, which are known to pose a fire risk.

Currently, the one drawback to solid-state batteries is how difficult it is to scale a technology in its early stage for widespread use, given testing and limited production capabilities. In addition, it takes time to engineer and verify the performance of solid-state batteries, contributing to delayed release dates for some companies.

Companies like Conamix, an electric vehicle battery manufacturer, are working to make lithium-sulfur batteries a reality, aiming to have them commercially available by 2028, according to the clean energy news site, CleanTechnica. There's even hope lithium-sulfur batteries could be used to power aircraft and trains, along with energy storage, according to Electrek.

Lithium-sulfur batteries are believed to be more efficient than lithium-ion batteries, which could increase the range and storage capacity of electric vehicles. Additionally, sulfur is affordable and abundant, which could

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mean lower costs. And since the manufacturing process for these batteries is like the one used for lithium-ion batteries, the same facilities could also be used for production. Advancements in lithium-sulfur batteries have also resulted in ultra-fast charging and made them useful for raising the storage capacity of renewable energy technologies.

One of the major drawbacks of this new battery technology is corrosion, though new designs are in the works to curb it. Another disadvantage is that these batteries don't last as long as lithium-ion batteries.

These batteries could be used in any device powered by a lithium-ion battery, but much of the focus is on developing cobalt-free batteries for electric vehicles. Currently being used by Tesla in some electric vehicle models, cobalt-free lithium-ion batteries could soon become a staple of Lamborghini's models since the company has patented MIT's new battery technology.

The main advantage of cobalt-free batteries is that they don't contain cobalt. Cobalt is incredibly expensive, and the mining of it is associated with human rights abuses. The United States Department of Energy is hoping to end the use of cobalt in lithium batteries by 2030.

But alternatives to cobalt come with their own flaws as well. The process for mining and extracting cobalt can be toxic and dangerous, and another cobalt alternative known as TAQ is still new and requires more testing. For these reasons, companies may continue to rely on cobalt until they can establish other options.

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