

Advanced energy storage

Using a combination of ultracapacitors and batteries in vehicle energy storage architectures can help reduce emissions and increase cost savings

▶ Auto makers' attempts to comply with stricter CO₂ emission standards have sparked increasing demand for vehicle electrification. While 48V system architectures are slowly emerging to meet these standards, 12V architectures should not be overlooked. There is an opportunity to expand on 12V systems' existing applications, and to add new features that will help auto makers achieve these goals, without nearing the cost required for a 48V system.

Auto makers are testing system architectures to their limits by adding new power-hungry features to achieve vehicle electrification. As a result, 12V architectures are increasingly being designed to enable high-power boardnet loads such as electro-turbocharging, electric anti-roll control and electric power steering. Because these features require such high power, the demands on a vehicle's energy storage system are considerable. Traditionally, auto makers have relied on lead-acid batteries as the main energy storage device; however, batteries have their own limitations. It's not feasible to expect a purely battery-based energy storage system to handle all of these capabilities without experiencing performance limitations. While batteries can store large amounts of energy over long periods of time, they must be discharged at low discharge rates to avoid premature aging and are not ideal for the quick bursts of power required by these features. Plus, batteries do not perform well in extreme temperatures because they produce and store energy by means of a chemical reaction, which is slowed in cold temperatures.

Car makers are looking into hybrid energy storage systems that can rely on alternative energy



Pairing ultracapacitors with batteries can yield reliable performance and cost efficient benefits

A hybrid ultracapacitor-battery system can enable the use of high-power vehicle features such as stop/start functionality

storage to complement batteries and improve their overall performance. Because a system needs to provide both reliable electrical performance across a wide temperature range and boast cost-efficiency benefits, auto makers need to choose a durable and cost-saving energy storage technology. Auto makers should consider pairing a standard 12V lead-acid battery with an ultracapacitor module as they continue to optimize electrical performance. Ultracapacitors are energy storage devices that offer nearly instantaneous power bursts during periods of peak power demand and, compared with batteries, can store and discharge energy with high power quickly and effectively. A hybrid ultracapacitor-battery system can enable ideal

cranking performance in temperatures as cold as -40°C and as high as 65°C. This combination enables the addition of high-power features such as stop/start, active suspension, electric power steering and electro-turbocharging, even in lower temperatures.

Car manufacturers can create a hybrid energy storage system by developing a standard battery-sized box, using a smaller-sized lead-acid battery and filling the empty space with ultracapacitors. This reduces the size of the battery and also enables up to a 40% overall weight reduction, resulting in cost savings. Additionally, auto makers receive credits for vehicles that achieve specific fuel-efficiency standards based on grams of CO₂ emitted per kilometer. The addition of ultracapacitors also helps improve

battery life, by taking stress off the battery, and improves overall charge acceptance. This means batteries need not be replaced as frequently, and require less maintenance.

It's possible to increase electrification at the 12V level with a hybrid energy storage system and auto makers are evaluating this solution for future vehicle platforms. Enhanced 12V systems that use a combination of ultracapacitors and batteries can help auto makers achieve reduced emissions and increased cost-savings, without the level of investment needed in a 48V system. ☺

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