THE CHARGE OF THE Ultracapacitors

Nanotechnology takes energy storage beyond batteries

BY JOEL SCHINDALL

IN 1995, A SMALL FLEET of innovative electric buses began running along 15-minute routes through a park at the northern end of Moscow. A decade later, a few dozen seaport cranes in Asia, a couple of light-rail trains in Europe, and a battalion of garbage trucks in the United States have joined their high-tech ranks.

A smattering of mass-transit vehicles and industrial machines may seem like one wimpy revolution, but revolutionary they are. Unlike most of their electric relatives, these vehicles all share one key attribute: they don't run on batteries. Instead, they are powered by ultracapacitors, which are souped-up versions of that tried-and-true workhorse of electrical engineering, the capacitor.

A bank of ultracapacitors releases a burst of energy to help a crane heave its load aloft; they then capture energy released during the descent to recharge. Buses, trams, and garbage trucks powered by the devices all run for short stretches before stopping, and it's during braking that the ultracapacitors can partially recharge themselves from the energy that's normally wasted, giving the vehicles much of the juice they need to get to their next destinations.

Because no chemical reaction is involved, ultracapacitors—also known as supercapacitors and double-layer capacitors—are much more effective at rapid, regenerative energy storage than chemical batteries are. What's more, rechargeable batteries usually degrade within a few thousand charge-discharge cycles. In a given year, a light-rail vehicle might go through as many as 300 000 charging cycles, which is far more than a battery can handle. (Although flywheel energy-storage systems can be used to get around that difficulty, a heavy and complicated transmission system is needed to transfer the energy.)

The synergy between batteries and capacitors—two of the sturdiest and oldest components of electrical engineering—has been growing, to the point where ultracapacitors may soon be almost as indispensable to portable electricity as batteries are now.

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