nature OUTLOOK

BATTERIES

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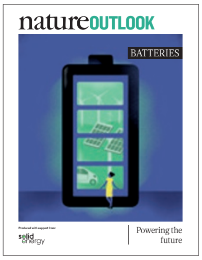

Cover art: Sébastien Thibault

The ability to chemically store energy that can be accessed on demand has transformed the way we power our world, driving us to develop ever-smaller, more powerful and portable electronic devices, and freeing us from being tethered to a grid by wires.

An even greater revolution may be in store, allowing us to substitute intermittent renewable-energy sources for fossil fuels, and bringing more electric vehicles to the roads. For this to happen, scientists will need to radically increase batteries' energy density, reliability and safety (see page S92). Lithium-ion batteries have led the way for the past 30 years, and may be reaching the limits of their abilities. But researchers have not given up on them yet, seeking out new chemical configurations to squeeze more power out of the cells (page S93).

One hope is that solid materials can replace the liquid electrolyte in many batteries, including some lithium ones, to make them safer, more flexible and more powerful (page S96). Going in the other direction, flow batteries replace solid electrodes with liquids; this approach makes it easy to increase energy capacity by adding larger tanks, which can be swapped out for rapid recharging (page S98).

As the number of batteries rises, we will need to find ways to deal with them as they reach the end of their lives. Methods to recycle batteries, and the political and economic will to make the practice widespread, are sorely needed (page S100). Batteries can also be avoided entirely. With smarter, connected management of energy use, the electricity grids of the future could accommodate fickle sources of power such as solar and wind without having to store any of it in a battery (page S102).

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Brian Owens
Contributing Editor

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