

Super-efficient solar cells: 10 Breakthrough Technologies 2024



In November 2023, a buzzy solar technology broke yet another world record for efficiency. The previous record had existed for only about five months—and it likely won't be long before it too is obsolete. This astonishing acceleration in efficiency gains comes from a special breed of next-generation solar technology: perovskite tandem solar cells. These cells layer the traditional silicon with materials that share a unique crystal structure.

In the decade that scientists have been toying with [perovskite solar technology](#), it has continued to best its own efficiency records, which measure how much of the sunlight that hits the cell is converted into electricity. Perovskites absorb different wavelengths of light from those absorbed by silicon cells, which account for 95% of the solar market today. When silicon and perovskites work together in tandem solar cells, they can utilize more of the solar spectrum, producing more electricity per cell.

Technical efficiency levels for silicon-based cells top out below 30%, while perovskite-only cells have reached experimental efficiencies of around 26%. But perovskite tandem cells have already exceeded 33% efficiency in the lab. That is the technology's tantalizing promise: if deployed on a significant scale, perovskite

tandem cells could produce more electricity than the legacy solar cells at a lower cost.