# What progressive solar technologies exist

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More efficient solar cells mean each solar panel can generate more electricity, saving on materials and the land needed. Manufacturing silicon solar cells is also an energy-intensive process. Experts warn that renewable power capacity must triple by 2030 to limit global warming to 1.5°C, and solar is predicted to play a major role, so the ...

But how can we tell that new solar technologies will stand the test of time? I''m fascinated by the challenge of predicting how new materials will hold up in decades of tough conditions. That''s been especially tricky for one emerging technology in particular: perovskites. They''re a class of materials that developers are increasingly interested in incorporating into solar panels because of their high efficiency and low cost.

The problem is, perovskites are notorious for degrading when exposed to high temperatures, moisture, and bright light ... all the things they''ll need to withstand to make it in the real world. And it''s not as if we can sit around for decades, testing out different cells in the field for the expected lifetime of a solar panel--climate change is an urgent problem. The good news: researchers have made progress in both stretching out the lifetime of perovskite materials and working out how to predict which materials will be winners in the long run.

There''s almost constant news about perovskite solar materials breaking records. The latest such news comes from Oxford PV--in January, the company announced that one of its panels reached a 25% conversion efficiency, meaning a quarter of the solar energy beaming onto the panel was converted to electricity. Most high-end commercial panels have around a 20% efficiency, with some models topping 23%.

The improvement is somewhat incremental, but it''s significant, and it''s all because of teamwork. Oxford PV and other companies are working to bring tandem solar technology to the market. These panels are basically sandwiches that combine layers of silicon (the material that dominates today''s solar market) and perovskites. Since the two materials soak up different wavelengths of light, they can be stacked together, adding up to a more efficient solar material.

We''re seeing advances in tandem technology, which is why we named super-efficient tandem solar cells one of our 2024 Breakthrough Technologies. But perovskites'' nasty tendency to degrade is a major barrier standing in the way.

Early perovskite solar cells went bad so quickly that researchers had to race across the laboratory to measure their efficiency. In the time it took to get from the area where solar cells were made to the side of the room where the testing equipment was, the materials basically lost their ability to soak up sunlight.

There''s been some real-world testing of new perovskite solar materials, with mixed results. Oxford PV hasn''t published detailed data, though as CTO Chris Case told Nature last year, the company''s outdoor tests show that the best cells lose only about 1% of their efficiency in their first year of operation, a rate that slows down afterwards.

Other testing in more intense conditions has found less positive results, with one academic study finding that perovskite cells in hot and humid Saudi Arabia lost 20% of their efficiency after one year of operation.

Since we don''t have years to test every new material that scientists dream up, researchers often put them through especially punishing conditions in the lab, bumping up the temperature and shining bright lights onto panels to see how quickly they''ll degrade.

This sort of testing is standard for silicon solar panels, which make up over 90% of the commercial solar market today. But researchers are still working out just how well the correlations with known tests will transfer to new materials like perovskites.