

## research highlights

### PEROVSKITE PHOTOVOLTAICS

#### Manufacturing costs

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Reducing manufacturing costs is one of the motivations to develop novel materials for photovoltaics, such as halide perovskites. But in the early stages of a technology, when material and processing methods are still being developed and assessed, costs are difficult to evaluate quantitatively. In particular, much of the device research still focuses on the solar cell scale, but the scale-up to modules, which are ensembles of (large-area) connected cells, typically requires different processes and leads to lower efficiencies. Now, Anita Ho-Baillie from the University of South Wales and colleagues in Australia and the United States have calculated that a process that combines already demonstrated methods to prepare perovskite photovoltaic modules would have manufacturing costs of US\$87–140 per square metre, similar to those of commercial crystalline silicon and cadmium telluride photovoltaic technologies.

The researchers identify key cost drivers for different processing sequences, including for example the material cost of the metal electrode (usually gold) and the patterning processes. Importantly, a manufacturing-cost-uncertainty analysis pinpoints the areas where the understanding of costs could be improved and/or where lower cost alternatives are needed. Extreme low-cost limits are also presented, where the cost of the active layers and rear electrode are reduced to zero, or alternatively where the entire cost of the module is set to zero. Even in these extreme limits, in order to reach the 2020 SunShot targets set by the US Department of Energy for the levelized cost of solar electricity (which includes additional costs compared with manufacturing costs only), the analysis shows that a module efficiency of 18% and a lifetime of 20 years are required. □

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