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Nanoscience by the megaton: Scalable technologies for a sustainable future

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The US uses on average 3 TW of power, which is the average solar insolation on 10,000 km2 of desert. To harvest the solar spectrum, or its energy converted into wind, wave, and rain, we will have to develop a range of linked energy technologies for efficient generation, storage, transmission, and use. These provide many research targets for new materials and processes, where physics dictates we must control electrons on the nanoscale so as to reach acceptable performance levels, and cost requires manufacturing by the square mile. Perhaps with the exception of metal wires, we have no experience in developing functional materials technologies on the scale needed. With an eye on the pairing of photovoltaics and electrical storage, I will outline some of the challenges and the long-term efforts that will be needed to resolve them.