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## Nano green energy: Harvesting and storage

Nanoscience and nanotechnology allow the building blocks of basic structures can be designed, created and assembled at the molecular or nanometer scales, thereby providing an unprecedented avenue to engineer novel science concepts into practical devices for optimal energy efficiencies. Research breakthroughs in the nano-arena recently have found innovative applications in emerging technologies for high efficiency harvesting and ultrahigh density storage of green energy. A review will be presented of the recent progress in nanoscience and nanotechnology with an emphasis on engineering systems for nanostructure-based, high efficiency generation and high-density storage of solar energy and wind power. Many nanostructures such as quantum dots, structured nanoparticles, and optically tuned nanogratings, photonic crystals and multi-layered nanotextures are known for their enhancement of energy extraction and conversion through interactions between photon and electrons or between nanostructures and flow patterns. The use of a single type of nanostructures or a mixture of various nanostructures as a nanostructure group to design complex structures is presented for solar energy extraction and wind power generation is discussed with various examples and prototype devices. The fundamental science and quantum effects that drive the photo-electron interaction or interaction of nanostrcutres underlying the superb performance of the nano energy devices will be illustrated in reference to specific applications. Three-dimensional, nanostructured, ultrahigh density energy storage devices also will be discussed. These devices are built as conforming topological nanostructures taking a full advantage of a combination of nanoscaled effects such as nanosize effect, nanodimension effect, and nanostructure and have the potential to transform the way the energy is stored. Nanotechnology is a highly dynamic research area in which creative and engineering wonders emerge almost daily from nanostructured features. The novel application of nanoscience in designing and developing integrated engineering devices for ultrahigh efficiency extraction and high capacity storage undoubtedly is shaping an even brighter future for green energy harvesting and utilization.

### Biography

Ben Q. Li completed his Ph.D. from University of California at Berkeley and subsequently worked as a research associate at Massachusetts Institute of Technology. Currently, he is Professor and Chair, Department of Mechanical Engineering, University of Michigan, Dearborn. His expertise area includes the theoretical and experimental study of nanoscale photo-electron interaction in energy extraction and storage and in biomedical systems. He has authored/co-authored 4 monographs and over 200 technical papers and served as associate editor for the ASME journal of heat transfer. He is an ASME fellow.

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