

Sun is an inexhaustible source of energy capable of fulfilling all the energy needs of humankind. Furthermore, a comprehensive list of future potential research directions in the field of direct and indirect electricity generation from solar energy is proposed. Electricity generation from concentrated solar technologies has a promising future as well, especially the CSP, because of its high capacity, efficiency, and energy storage capability. Electricity can be generated from solar energy either directly using photovoltaic (PV) cells or indirectly using concentrated solar power (CSP) technology. The most exciting possibility for solar energy is satellite power station that will be transmitting electrical energy from the solar panels in space to Earth via microwave beams. Progress has been made to raise the efficiency of the PV solar cells that can now reach up to approximately 34.1% in multi-junction PV cells. The biggest challenge however facing the solar energy future is its unavailability all-round the year, coupled with its high capital cost and scarcity of the materials for PV cells. These challenges can be met by developing an efficient energy storage system and developing cheap, efficient, and abundant PV solar cells. This article discusses the solar energy system as a whole and provides a comprehensive review on the direct and the indirect ways to produce electricity from solar energy and the direct uses of solar energy. The state-of-the-art procedures being employed for PV characterization and performance rating have been summarized. Moreover, the technical, economic, environmental, and storage-related challenges are discussed with possible solutions.