

Science and Technology Challenges in Solar Energy Generation and Energy Storage

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The flux of solar radiation incident on the earth is the greatest source of renewable power and the energy. However, efficiently and economically utilizing solar power has remained elusive and even more elusive has been the storage of energy derived from solar radiation. Converting solar power to electrical power is most desirable, because electrical power is the most useful and efficient power for engines that move machines in modern society.

Economic and sustainable approaches will be discussed to new strategies for converting solar to electrical power as well as for storing solar derived energy. Specific topics include: new strategies for concentrating solar power (solar to thermal to electrical conversion) and its storage as thermal energy; fabricating substantially lower cost photovoltaics and its storage as chemical energy in the form of hydrogen. On demand retrieval of stored energy derived from solar power will be discussed; stored thermal energy as electrical power using magnetic induction generators and hydrogen as electrical power using advanced fuel cells. These strategies are enabled by advanced materials including new heat transfer fluids, reaction media and inorganic and organic composite membranes which are all based on molten salts and ionic liquids.