**EMERGING REVOLUTIONARY ROLE OF PHOTOVOLTAICS (PV) IN THE ENERGY SECTOR AND R &D DIRECTIONS FOR FURTHER COST REDUCTION OF ELECTRICITY GENERATED BY PV SYSTEMS**

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**ABSTRACT:** With the advent of low-cost silicon solar panels and our ability to generate, store and use electrical energy locally without the need for long-range transmission, the world is about to witness transformational changes in electricity infrastructure. The use of PV as source of direct current (DC) power reduces the cost and improves the reliability of PV system. DC microgrid and DC nanogrid based on PV and battery storage can provide sustainable electric power to all human beings in equitable fashion. The electricity industry in developed economies is on the cusp of a dramatic transformation. Over 90 % of PV market share consists of non-concentrator bulk silicon solar cells. The maximum experimental efficiency of silicon solar cells is 25.6 % measured at standard conditions of AM 1.5 global spectrum. Although the observed efficiency of silicon solar cells is below the Shockley and Queisser (SQ) upper limit, marginal efficiency improvements are expected in future. For increasing the efficiency of single-junction cells beyond the Shockley–Queisser limit, several approaches based on concepts such as multiple exciton generation, carrier multiplication, hot-carrier extraction, etc., have been proposed; however, these are not commercially viable. Since both bulk-silicon and thin-film solar cells remain as the only two commercially viable options for terrestrial PV applications, a new device architecture (<http://ieeexplore.ieee.org/xpl/articleDetails.jsp?arnumber=6589128>) appears promising for inexpensive PV electricity generation with efficiency exceeding the currently feasible 26% limit. The key objective of this talk is to highlight the specific research areas in device design, materials, processing and manufacturing of photovoltaic devices and systems that have further transformational capabilities of reducing power generated by PV systems.

**BIOGRAPHY:** Rajendra Singhis the D. Houser Banks Professor of Electrical and Computer Engineering and Director of Center for Silicon Nanoelectronics at Clemson University, Clemson, USA. During the energy crisis of 1973, he decided to do his Ph.D. dissertation in the area of Silicon Solar Cells. In the last 42 years, he has witnessed and contributed to the growth of photovoltaic industry. With proven success in operations, project/program leadership, R&D, product/process commercialization, and start-ups, Dr. Singh is a leading photovoltaics (PV) and semiconductor expert with over 35 years of industrial and academic experience of photovoltaic and semiconductor industries. From solar cells to integrated circuits, he has led the work on semiconductor and photovoltaic device materials and processing by manufacturable innovation and defining critical path. One of his current focus is to eradicate global energy poverty by using photovoltaics electricity based on DC microgrid and batteries. He is recipient of a number of International awards. Photovoltaics World (October 2010) selected him as one of the 10 Global “Champions of Photovoltaic Technology”. Dr. Singh is 2014 recipient of the SPIE Technology Achievement Award. On April 17, 2014 President Obama honored him as “Champion of Change” for Solar Deployment. He is Fellow of IEEE, SPIE, AAAS and ASM.