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Smart Solar Charge Station for Battery-Super Capacitor Hybrid Devices: Recent Progress and Future Prospect

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The shortage supply of fossil fuels in addition to the excess demand of low pollution environmental enhances the needs of renewable energy sources. Typical examples of renewable energy sources are wind, wave and solar power. These energy sources have the common problems:

a. It is only available in certain non uniform time intervals.

b. The generated power is not regulated and needs electronic circuits to be adapted for customer utilization.

c. To insure permanent energy availability, the concept of uninterrupted power supply is applied where reliable energy storage systems such as batteries are used. Different battery types such as traditional lead–acid, Ni–Cd, Ni–MH, lithium ion batteries (LIBs) and (super capacitors) SCs, various advanced batteries such as lithium–air/–sulfur, sodium/aluminum ion batteries and aqueous metal ion batteries have been emerging and great efforts have been devoted to optimize their overall performance for future practical applications. Building better energy storage devices not only depends on the micro-/nanostructure design of electrode materials but more crucially relies on the device's configuration engineering. The availability of solar power in the middle area makes the investment in solar-powered electric vehicle charging station.

This review first addresses the fundamental of different battery types while focusing on the recent advances on various existing and emerging BSHs. Furthermore, recent progresses in BSH devices with specific functionalities of flexibility and transparency, etc. will be highlighted.

The article will also introduce the design procedure and new trends for constructing Cost Effective Smart Solar Charge Station for EV (Electric Vehicle) application.

Different photovoltaic charging station architectures will be present with some comparative analysis. The architecture includes a combination of charge controller based on the smart battery charging algorithms with the unidirectional PWM technique based on the grid to vehicle strategy in Smart Grid. Power quality, running EV power consumption and cost analysis will be considered for a given design of smart charge station. Future research trends in both B-SCs and smart charging algorithms will be also covered.

Biography:

Mohamed Abouelela received the B.Sc., M.Sc. from Ain Shams University, Egypt in 1978, 1982 respectively and PhD degree from Clude Bernard University, Lyon, France in 1987, all in electrical engineering. He joined the EE Dept. Fac. of Eng., Ain Shams University since 1978 as an instructor. He got the positions of assistant professor, associated professor and full professor in 1987, 1994 and 2000 respectively in the same department. His research area covers PLL, frequency synthesizers, PV systems, computer interfacing, M2M and embedded systems. His current position is full professor at King Saud University, Riyadh, Saudi Arabia.