

# Novel Approach for Harnessing Maximum Energy from PV Systems using Supercapacitors

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**Abstract—** Typical standalone solar photovoltaic (PV) systems use battery bank as the energy storage device. The battery bank is charged by using a solar charge controller connected to a solar array. For similar PV systems, charging efficiency mostly depends on the efficiency of DC-DC converter available inside the charge controller. However, considerable amount of usable energy will be wasted during the charging process. In this work, a method is proposed to utilize this wasted energy while enhancing the end to end efficiency of standalone PV systems. When an empty capacitor is charged by an external source, it stores only a half of the energy delivered by the source as compared to the case of an electrochemical battery. As a result, 50% of useful energy is lost in the charging loop of a capacitor. If a useful resistive load is connected to this loop, some amount of energy can be utilized by doing a beneficial work. In this study, a DC-DC converter and battery bank has been chosen as the useful load in the capacitor charging loop, and a supercapacitor (SC) bank is used replacing the conventional capacitor. Therefore, total energy loss can be minimized by storing energy in both battery and SC bank. The energy stored in the SCs could be used for driving loads with required electronics. Consequently, it leads to an improvement of end to end efficiency of the PV system.

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**<http://dx.doi.org/10.1109/R10-HTC.2018.8629801>**