Estimation of CO_2 Emission Reduction by a PV Power Backup System in Equatorial Climate

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Abstract

Solar photovoltaic (PV) power systems provide affordable, reliable, clean and sustainable source of electricity for all consumers (small and large scale) and grant them an opportunity to contribute towards decarbonization of electricity generation at individual level. A PV power system can be used as a substitute for a stand-by diesel generator, which is used widely by entrepreneurs and institutions in Kenya to supply electricity during power outages. In addition, resorting to PV backup power system will enable individual consumers to contribute towards achieving SDG Goal 7, and hence supplement government efforts to achieve its set targets before the lapse of the fast-approaching 2030 deadline. PV system is modular, hence can be sized to meet both load and cost demand of each consumer, and has little running cost. In this study, estimation of CO_2 reduction by using a 780 Wp PV power backup system installed at a learning institution in Nandi County is presented. Outdoor performance evaluation on the backup system was done for a period of one year in 2020. Homer Pro software was utilized for the environmental and economic evaluations of the system. Simulation results gave CO_2 mitigation rate of 0.459 tCO_2/year and environmental cost parameter of $4.10/annum. This shows that PV backup systems can contribute significantly to the mitigation of CO_2 emissions, and has the potential to drive the current energy transition crisis from diesel generator backup systems in the energy sector.

Keywords: PV system, backup systems, CO_2 mitigation, environmental cost