Proceedings of the 2015 International Conference on Operations Excellence and Service Engineering
Orlando, Florida, USA, September 10-11, 2015

Component Rating Optimization Methodology for the Protection of Photovoltaic Solar Power System Components from Shading Effect

Mohamed Amin
Department of Electrical Engineering
Faculty of Engineering, Cairo University
Giza, Egypt
eng_m.amin@hotmail.com

Ayman H. El Hakea
Department of Construction and Architectural Engineering
American University in Cairo
AUC Avenue, P.O. Box 74, New Cairo 11835, Egypt
.ayman.elhakea@aucegypt.edu

Abstract

Photovoltaic (PV) solar power systems are widely utilized in various large and medium-scale commercial and residential applications. A major operational issue affecting the quality of power supply is shading and partial shading of the PV modules. This phenomenon is largely attributed to moving clouds and shadows of nearby buildings or obstacles, which causes the shading of the PV arrays, hence resulting in reducing the output power below the required power. While the majority of previous research concentrated around using bypass diodes to mitigate power inefficiency due to shading, few work addressed the side effects of this technique on system components. Such side effects are best understood in view of the inaccurate selection of the required power inverter with Maximum Power Point Tracking (MPPT). This research investigates the selection of inverter and module optimum ratings, with the aim to reach maximum protection of the system power components. This process is done using a developed system for commercial buildings. The investigation is performed using computer software simulation of changing the PV solar power system components ratings, while using a bypass diode, and then examining the efficiency performance. Results of the optimum ratings are then analyzed.

Keywords
Photovoltaic, Solar Power, Inverter, Optimization, Power Efficiency.

Mohamed Amin is an electrical engineering specialist based in Cairo, Egypt. He is currently completing his Master of Science degree at the Electrical Engineering Department, Faculty of Engineering, Cairo University, Egypt. His field of specialization is the investigation of the commercial use of photovoltaic solar power systems in Egypt. He is currently holding the position of Senior Electromechanical Estimator at Dorra Group, a large-scale construction company based in Cairo, Egypt.

Ayman H. El Hakea is a construction engineering professional and academic researcher. He completed his Master of Science degree in Construction Engineering from the Construction and Architectural Engineering Department of the American University in Cairo, Egypt, in 2015. He has published various papers in his field of specialization; infrastructure asset management and multi-objective optimization techniques. He has also combined his academic record with practical civil and infrastructure engineering work exposure in Egypt, Morocco, the GCC countries, and the UK.