World Academy of Science, Engineering and Technology
International Journal of Electrical and Computer Engineering
Vol:16, No:11, 2022

Modeling and Simulation Analysis and Design of Components of the Microgrid Prototype System

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Abstract : The demand for electric power in Saudi Arabia is steadily increasing with economic growth. More power plants should be installed to increase generation capacity and meet demand. Electricity in Saudi Arabia is mainly dependent on fossil fuels, which are a major problem as they deplete natural resources and increase CO_2 emissions. In this research work, performance and techno-economic analyzes are conducted to evaluate a microgrid system based on hybrid PV/wind diesel power sources as a stand-alone system for rural electrification in Saudi Arabia. The total power flow, maximum power point tracking (MPPT) efficiency, effectiveness of the proposed control strategy, and total harmonic distortion (THD) are analyzed in MATLAB/Simulink environment. Various simulation studies have been carried out under different irradiation conditions. The sizing, optimization, and economic feasibility analysis were performed using Homer energy software.

Keywords : WIND, solar, microgrid, energy
Conference Title : ICREEEA 2022 : International Conference on Renewable Energy and Electrical Engineering Applications
Conference Location : Venice, Italy
Conference Dates : November 10-11, 2022

Open Science Index, Electrical and Computer Engineering Vol:16, No:11, 2022 publications.waset.org/abstracts/156602.pdf