Title:	Techno-Economic Performance and Sensitivity Analysis of an Off-Grid Renewable Energy-Based Hybrid System: A Case Study of Kuakata, Bangladesh
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Published Journal Name:	Energies
Type of Publication:	Journal
Volume:	17 Issue 6
Publisher:	MDPI
Publication Date:	19/03/2024
ISSN:	1996-1073
DOI:	10.3390/en17061476
URL:	https://www.mdpi.com/1996-1073/17/6/1476
Other Related Info.:	Page 1-28, ISI and Scopus indexed

Abstract:

Hybrid renewable energy sources (HRES) are increasingly being utilized to meet global energy demands, particularly in rural areas that rely on diesel generators and are disconnected from the utility grid, due to their environmental and human health benefits. This study investigates the performance of an off-grid, hybrid PV/diesel generator/battery system for a decentralized power plant in Kuakata, Bangladesh, meeting a load demand of 3000 kWh/day with a 501.61 kW peak load demand. HOMER Pro (hybrid optimization model for electric renewable) software (version 3.11) was used to simulate and optimize system operations utilizing real-time solar radiation and load profile data from that location. This study also includes a sensitivity analysis of the off-grid HRES system under different electrical load demands, project longevity, and derating variables. The results reveal that CO2 emissions have potentially decreased by more than 30% and over 10 tons per year, respectively, when compared to traditional power plants. The optimized system's net present cost (NPC) was determined to be around USD 5.19 million, with a cost of energy (COE) of USD 0.367 per kWh per unit with a 100% renewable component. Furthermore, the current study's findings are compared to previous research that has resulted in an economical hybrid renewable energy system with an affordable COE. The hybrid energy system under consideration might also be applicable to other parts of the world with comparable climate conditions.