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Solar PV Electricity Supply for a Bank Office: Techno-economic and GHG Emissions Analyses

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Abstract

Persisting power supply issues in Nigeria have recently stimulated reliance on hybrid renewable energy systems, especially considering their environmental benefits. Analyses of the power generation, economic and greenhouse gas (GHG) emissions reduction potentials of solar photovoltaic (PV) systems for electricity supply to a bank branch were undertaken in this study, relying on the RETScreen energy analysis tool. A prior evaluation of energy use in the branch revealed that close to 38% of existing energy loads could be avoided by implementing energy efficiency measures. Subsequent analyses investigated the techno-economic implications of deploying solar PV systems to supply either the existing branch energy loads or the energy loads after energy efficiency measures had been implemented. PV supply of between 50% to 100% of the energy loads were considered. The costs of solar PV systems needed to supply current energy loads to the branch: NGN 60 to 80 million (USD 167,000 to 222,000), reduced considerably with the energy efficiency measures – NGN 48 to 57 million (USD 133,000 to 158,000). These were also reflected in the assessments of assets IRR, equity IRR, equity payback, net benefit–cost ratio (BCR) and debt service coverage. Specifically, maximum pay back periods of roughly ten years, positive BCRs greater than 10, and generally positive debt service coverages were obtained in the analysis. The GHG emission analysis showed that the deployment of solar PV systems could provide considerable GHG emission reductions (up to 116 t CO2eq per anuum) by displacing the electricity supplied by fossil fueled grid supply and diesel generators. These results strongly suggest the economic viability of running commercial bank branches on solar PV power supply, and thus greater official focus and support for the adoption of solar PV by the commercial sector is elicited to encourage such deployments.

Keywords: GHG mitigation; Renewable energy; RETScreen; Solar photovoltaics; Technoeconomic analysis

1.0 INTRODUCTION

Reasonably priced electricity is a crucial factor in the industrialization of nations, and the attendant social upliftment and reduction of poverty [1]. Despite a population of about 180 million, the installed electric power generation capacity in Nigeria is less than 12,232 MW. Power generation

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