

## Economic viability of a hybrid off-grid Solar PV-Wind Turbine Micro-grid for rural Electrification in Zimbabwe

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### Abstract

The diminishing factor in the availability of fossil fuels has led to failure of traditional grids to meet the ever-growing load demand. This study will be addressing how to improve electricity access to rural areas in Zimbabwe. This paper presents the design of an off-grid hybrid micro-grid that is powered by solar and wind energy sources, designed for an isolated rural location in Zimbabwe called Kagoro village in Mhondoro. This location was chosen as the case study of the research study due to its lack of electricity access and the challenges that energy poverty has imposed upon its residents. The proposed designed model of the hybrid system showed that a Photovoltaic-Wind-Diesel-Storage system with no tracking system has the lowest Levelized cost of electricity (LCOE) and net present cost (NPC) with highest renewable energy fraction (RF) of 97.7%. The proposed micro-grid system could supply electricity to the target community at \$0.223/kWh with a NPC of \$1,607,150 and payback period of 5.6 years. Comparative analysis was made with the existing grid tariff of Zimbabwe to investigate the feasibility of the system. This study has shown that it is possible to have a self-sufficient off-grid renewable energy system for Kagoro village.

**Keywords:** Renewable energy, Photovoltaic (PV), Wind turbines, Hybrid micro-grid, HOMER.

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