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Analysis of an optimal hybrid power system for an off-grid community in Nigeria

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Abstract

Purpose

This study aims to analyze the effects of variations in annual real interest rates in the assessment of the techno-economic feasibility of a hybrid renewable energy system (HRES) for an off-grid community.

Design/methodology/approach

Hybrid Optimization of Multiple Energy Resources (HOMER) software is used to propose an HRES for Abadam community in northern Nigeria. The HRES was designed to meet the basic needs of the community over a 25-year project lifespan. Based on the available energy resources in the community, photovoltaic (PV), wind turbine, diesel generator and battery were suggested for integration to serve the load requirements.

Findings

When the annual real interest rates were taken as 10 and 8 per cent, the total amount of total energy fraction from PV, wind turbine and the diesel generator is 28, 57 and 15 per cent, respectively. At these interest rates, wind turbines contributed more energy across all months than other energy resources. The energy resource distribution for 0, 2,4 and 6 per cent annual real interest rates have a similar pattern, but PV contributed a majority of the energy.

Practical implications

This study has used annual real interest and inflation rates dynamic behavior to determine optimal HRES for remote communities. Hence, its analysis will equip decision-makers with the necessary information for accurate planning.

Originality/value

The results of this study can be used to plan and design HRES infrastructure for off-grid communities around the world.

Keywords

- Energy production
- Optimization
- Wind-PV
- Cash flow
- HOMER
- Hybrid renewable energy

- [Net present cost](#)

Citation

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