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Potential and economic viability of standalone hybrid systems for a rural community of Sokoto, North-west Nigeria

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Abstract

An assessment of the potential and economic viability of standalone hybrid systems for an off-grid rural community of Sokoto, North-west Nigeria was conducted. A specific electric load profile was developed to suite the community consisting 200 homes, a school and a community health center. The data obtained from the Nigeria Meteorological Department, Oshodi, Lagos (daily mean wind speeds, and daily global solar radiation for 24 years from

1987 to 2010) were used. An assessment of the design that will optimally meet the daily load demand with a loss of load probability (LOLP) of 0.01 was performed, considering 3 stand-alone applications of photovoltaic (PV), wind and diesel, and 3 hybrid designs of wind-PV, wind-diesel, and solar-diesel. The diesel standalone system (DSS) was taken as the basis of comparison as the experimental location has no connection to a distribution network. The HOMER® software optimizing tool was engaged following the feasibility analysis with the RETScreen software. The wind standalone system (WSS) was found to be the optimal means of producing renewable electricity in terms of life cycle cost as well as levelised cost of producing energy at \$0.15/(kW\$h). This is competitive with grid electricity, which is presently at a cost of approximately \$0.09/(kW\$h) and 410% better than the conventional DSS at a levelised cost of energy (LCOE) of \$0.62/kWh. The WSS is proposed for communities around the study site.

Keywords

photovoltaic (PV) powerwind powersolarwind hybridcost per kilowatt-hourclean energy
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