

Technico-Economical Sizing of Stand Alone Hybrid System for Rural Electrification in an Algerian Territory—a Case Study

Fouzia BRIHMAT, Said MEKHTOUB

Abstract : The Tindouf region in Algeria enjoys an average windspeed of 4.3 m/s at 10 m elevation and an average daily solar radiation of 5.9 kWh/m²/d. Within this perspective, a remote rural village in Tindouf region within ten homes can readily be expected to have more than enough potential for its load demand to be supplied with a stand-alone hybrid renewable energy system. For this purpose, a wind-pv-diesel hybrid power system has been designed. The study found a wind-pv-diesel hybrid power system with 74% renewable energy penetration (26% wind and 48% solar PV) to be the feasible system with cost of energy of 0.433 US\$/kWh. The proposed system was comprised of one wind turbine of 3 kW, 3.5kW of PV panels, and one diesel generating set of 5.5 kW rated power. The system was able to meet the energy requirements (AC primary load of 9.49 MWh/y) of the village with 289 kWh/y energy in excess. The annual contributions of wind, solar pv and the diesel generating set were 3 234, 5 958, and 3 274 kWh, respectively. The proposed hybrid power system resulted in avoiding addition of 16.26 t/y of CO₂ gas in to the local atmosphere of the village and conservation of 6176.15 liters of fossil fuel annually.

Keywords : Wind-pv-diesel hybrid system, Homer, optimum system sizing, Net Present Cost, Algeria